CALIFORNIA HIGH-SPEED TRAIN

DRAFT

Biological Assessment

Merced to Fresno Section

November 2011

CALIFORNIA
High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROJECT

Draft Biological Assessment

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California High-Speed Rail Authority and Federal Railroad Administration

November 2011

Table of Contents

ES1.0 Executive Summary 1
ES1.1 Proposed Project 1
ES1.2 Technical Studies 1
ES1.2.1 Literature Analysis 1
ES1.2.2 Field Surveys 2
ES1.2.3 GIS Analysis 2
ES1.3 Study Results 3
ES1.3.1 Wildlife Habitat Types that may Support Federally Listed Species 3
ES1.3.2 Federally Listed Plant and Wildlife Species and Critical Habitat 3
ES1.3.3 Summary of Findings, Conclusions, and Determinations 4
1.0 Introduction 1-1
1.1 Purpose of the Document 1-1
1.2 Proposed Action 1-2
1.2.1 Overview 1-2
1.2.2 Purpose and Need 1-3
1.3 Consultation History 1-5
1.3.1 Federal/State Endangered Species Act Consultation Summary 1-5
1.3.2 Federal Fisheries Consultation Summary 1-5
2.0 Project Description 2-1
2.1 Project Description Alternatives 2-1
2.2 Project Elements 2-4
2.2.1 Trainsets 2-4
2.2.2 Rail Line 2-4
2.2.3 Train Stations 2-9
2.2.4 Electrical System 2-9
2.2.5 Operation and Maintenance Systems 2-11
2.2.6 Additional Construction Footprint Areas 2-13
2.3 Location of Project Elements 2-13
2.4 Construction Methods 2-13
2.4.1 Pre-Construction Activities 2-14
2.4.2 Major Construction Activities 2-14
2.4.3 Construction Utility Requirements and Waste Disposal 2-22
2.4.4 Construction Materials and Equipment 2-23
2.5 Construction Schedule 2-23
2.6 Operations and Maintenance 2-23
2.6.1 Train Service 2-23
2.6.2 Lighting 2-24
2.6.3 Maintenance and Inspection Activities 2-24
2.7 Conservation Measures to Be Incorporated into Project Design 2-24
2.7.1 Avoidance Minimization Measures 2-25
2.7.2 Compensatory Mitigation for Effects on Federally Listed Species 2-30
2.7.3 Project Design Features 2-32
3.0 Action Area 3-1
3.1 Definitions 3-1
3.2 Environmental Setting 3-2
3.2.1 Project Location 3-3
3.2.2 Topography 3-7
3.2.3 Climate 3-7
3.2.4 Hydrology 3-7
3.2.5 Vegetation Communities and Wildlife Habitat Types 3-7
3.2.6 Aquatic Habitats 3-18
3.2.7 Wildlife Movement Corridors 3-21
3.3 Interrelated and Interdependent Actions 3-23

3.3.1 HST System Summary....3-23
3.3.2 Interrelated Elements....3-25
3.4 Ongoing Activities Affecting Species or Habitat....3-26
3.4.1 Overview....3-26
3.4.2 Ongoing Activities in the Action Area....3-26
3.4.3 Regional Effects on Species and Habitat....3-28
3.4.4 Cumulative Effects....3-28
4.0 Species/Critical Habitat Considered....4-1
4.1 Study Methods....4-1
4.1.1 Pre-Survey Desktop Review....4-1
4.1.2 Wetland Delineation Methods....4-8
4.1.3 Focused Field Surveys....4-8
4.1.4 Data Processing and Analysis....4-10
4.2 Special-Status Species Occurrence Potential....4-11
4.2.1 No Potential....4-11
4.2.2 Future Potential....4-11
4.2.3 Unlikely Potential....4-11
4.2.4 Low Potential....4-11
4.2.5 Moderate Potential....4-11
4.2.6 High Potential....4-17
4.2.7 Occurs....4-17
4.3 Federally Listed Plant and Wildlife Species....4-17
4.3.1 Plants....4-17
4.3.2 Wildlife....4-18
4.3.3 Anadromous Fish....4-18
4.3.4 Critical Habitat....4-18
4.4 Species/Critical Habitat Potentially Occurring in the Action Area....4-18
4.4.1 Colusa Grass....4-18
4.4.2 San Joaquin Valley Orcutt Grass....4-19
4.4.3 Critical Habitat for San Joaquin Valley Orcutt Grass....4-20
4.4.4 Hairy Orcutt Grass....4-21
4.4.5 Greene's Tuctoria....4-22
4.4.6 Critical Habitat for Greene's Tuctoria....4-23
4.4.7 Succulent Owl's-Clover....4-23
4.4.8 Critical Habitat for Succulent Owl's-Clover....4-24
4.4.9 Conservancy Fairy Shrimp....4-25
4.4.10 Critical Habitat for Conservancy Fairy Shrimp....4-26
4.4.11 Vernal Pool Fairy Shrimp....4-26
4.4.12 Critical Habitat for Vernal Pool Fairy Shrimp....4-27
4.4.13 Vernal Pool Tadpole Shrimp....4-28
4.4.14 Critical Habitat for Vernal Pool Tadpole Shrimp....4-29
4.4.15 Valley Elderberry Longhorn Beetle....4-29
4.4.16 Central Valley Steelhead Distinct Population Segment....4-30
4.4.17 Central Valley Spring-run Chinook Salmon....4-34
4.4.18 California Tiger Salamander....4-35
4.4.19 San Joaquin Kit Fox....4-38
5.0 Effects Analysis....5-1
5.1 Effects on Colusa Grass....5-3
5.1.1 Mechanism and Explanation of Possible Effects....5-3
5.1.2 Conservation Measures....5-5
5.1.3 Net Project Effects on the Species....5-6
5.2 Effects on San Joaquin Valley Orcutt Grass....5-6
5.2.1 Mechanism and Explanation of Possible Effects....5-6
5.2.2 Conservation Measures....5-6
5.2.3 Net Project Effects on the Species....5-7

5.3 Effects on San Joaquin Valley Orcutt Grass Critical Habitat 5-7
5.3.1 Mechanism / Explanation of Possible Effects..... 5-7
5.3.2 Conservation Measures 5-7
5.3.3 Net Project Effects on Critical Habitat 5-8
5.4 Effects on Hairy Orcutt Grass..... 5-8
5.4.1 Mechanism and Explanation of Possible Effects 5-8
5.4.2 Conservation Measures 5-8
5.4.3 Net Project Effects on the Species..... 5-9
5.5 Effects on Greene's Tuctoria..... 5-9
5.5.1 Mechanism and Explanation of Possible Effects 5-9
5.5.2 Conservation Measures 5-9
5.5.3 Net Project Effects on the Species.....5-10
5.6 Effects on Greene's Tuctoria Critical Habitat.....5-10
5.6.1 Mechanism / Explanation of Possible Effects.....5-10
5.6.2 Conservation Measures 5-10
5.6.3 Net Project Effects on Critical Habitat 5-11
5.7 Effects on Succulent Owl's-clover.....5-11
5.7.1 Mechanism and Explanation of Possible Effects 5-11
5.7.2 Conservation Measures 5-11
5.7.3 Net Project Effects on the Species.....5-12
5.8 Effects on Succulent Owl's-clover Critical Habitat.....5-12
5.8.1 Mechanism/Explanation of Possible Effects.....5-12
5.8.2 Conservation Measures 5-12
5.8.3 Net Project Effects on Critical Habitat 5-13
5.9 Effects on Conservancy Fairy Shrimp.....5-13
5.9.1 Mechanism and Explanation of Possible Effects 5-13
5.9.2 Conservation Measures 5-15
5.9.3 Net Project Effects on the Species.....5-15
5.10 Effects on Conservancy Fairy Shrimp Critical Habitat.....5-16
5.10.1 Mechanism / Explanation of Possible Effects.....5-16
5.10.2 Net Project Effects on the Critical Habitat.....5-16
5.11 Effects on Vernal Pool Fairy Shrimp.....5-16
5.11.1 Mechanism and Explanation of Possible Effects.....5-16
5.11.2 Conservation Measures 5-17
5.11.3 Net Project Effects on the Species.....5-17
5.12 Effects on Vernal Pool Fairy Shrimp Critical Habitat.....5-18
5.12.1 Mechanism / Explanation of Possible Effects.....5-18
5.12.2 Conservation Measures 5-18
5.12.3 Net Project Effects on Critical Habitat 5-18
5.13 Effects on Vernal Pool Tadpole Shrimp 5-18
5.13.1 Mechanism and Explanation of Possible Effects.....5-18
5.13.2 Conservation Measures 5-19
5.13.3 Net Project Effects on the Species.....5-19
5.14 Effects on Vernal Pool Tadpole Shrimp Critical Habitat 5-20
5.14.1 Mechanism/Explanation of Possible Effects.....5-20
5.14.2 Net Project Effects on the Critical Habitat.....5-20
5.15 Effects on Valley Elderberry Longhorn Beetle 5-20
5.15.1 Mechanism and Explanation of Possible Effects.....5-20
5.16 Effects on Central Valley Steelhead 5-24
5.16.1 Mechanism and Explanation of Possible Effects.....5-24
5.16.2 Net Project Effects on the Species.....5-30
5.17 Effects on Spring-run Chinook Salmon.....5-31
5.17.1 Mechanism and Explanation of Possible Effects.....5-31
5.17.2 Conservation Measures 5-32
5.17.3 Net Project Effects on the Species.....5-33

5.18 Effects on Essential Fish Habitat 5-34
5.18.1 Mechanism/Explanation of Possible Effects.....5-35
5.18.2 Net Project Effects on Essential Fish Habitat.....5-35
5.18.3 Project Design Features to Minimize Effects on Special-status Fish Species and EFH 5-35
5.19 Effects on California Tiger Salamander 5-36
5.19.1 Mechanism and Explanation of Possible Effects.....5-37
5.19.2 Conservation Measures 5-38
5.20 Effects on San Joaquin Kit Fox.....5-39
5.20.1 Mechanism and Explanation of Possible Effects.....5-40
5.20.2 Conservation Measures 5-42
5.20.3 Net Project Effects on the Species.....5-44
5.21 Effects from Interrelated Actions.....5-44
5.22 Cumulative Effects.....5-45
6.0 Conclusion and Determination of Effects for Federally Listed Species and Their Designated Critical Habitat 6-1
6.1Conclusions..... 6-1
6.2Effects from Interrelated and Interdependent Actions..... 6-2
6.3Cumulative Effects..... 6-2
6.4Determination 6-3
7.0 References 7-1
8.0 Preparer Qualifications.....8-1

List of Figures

2-1 HST System California 2-2
2-2 Merced to Fresno HST Project – Alternatives Carried Forward for Further Study (Three Alternative Routes) 2-3
2-3 At-Grade Profile 2-5
2-4 Retained-Fill Typical Cross Section 2-5
2-5 Retained-Cut Typical Cross Section 2-5
2-6 Elevated Profile 2-6
2-7 Straddle Bent Typical Cross Section 2-7
2-8 Replacing Local At-Grade Crossings with New Overcrossings above HST Guideway and Existing Railroad Trackway 2-8
2-9 Adding Local Roadway Overcrossings above HST Guideway 2-8
2-10 Typical Cross Section of Roadway Grade-Separated Beneath HST Guideway..... 2-8
2-11 Diagram of a Wye Formation..... 2-9
2-12 Typical HMF Layout 2-12
2-13 San Joaquin River Crossing Profile and Elevation Plan.....2-17
2-14 San Joaquin River Crossing – Typical Sections 2-19
3-1 Environmental Setting: Soils, Watersheds, and Elevation Profile 3-3
3-2a Locations of Habitat Types along Project Alignment..... 3-7
3-2b Locations of Habitat Types along Project Alignment..... 3-8
3-2c Locations of Habitat Types along Project Alignment..... 3-9
3-2d Locations of Habitat Types along Project Alignment.....3-10
3-2e Locations of Habitat Types along Project Alignment.....3-11
3-2f Locations of Habitat Types along Project Alignment.....3-12
3-3 Wildlife Movement Corridors.....3-20

3-4 Statewide HST System (Phase 1 and 2) from Programmatic EIS 3-22
4-1 CNDDB Federally Listed Plant Species 4-28
4-2 CNDDB Federally Listed Wildlife Species 4-29
4-3 Observed Elderberry Bush Locations 4-57
4-4 Central Valley Steelhead Critical Habitat 4-59
4-5 Spring-run Chinook Restoration Area 4-62
5-1 San Joaquin River Hydrological Connectivity 5-25

List of Tables

ES-1 Federally Listed Species with the Potential to Occur in the Action Area ES-3
ES-2 Effects Determination for Federally Listed Plant Species within the Limit of Direct Effect ES-4
ES-3 Effects Determination for Federally Listed Wildlife Species within the Limit of Direct Effect ES-5
3-1 Acreage of Vegetation Communities within the Action Area 3-6
4-1 Federally Listed Species with the Potential to Occur in the Action Area 4-39
4-2 Federally Listed Species with the Potential to Occur in the Action Area 4-43
5-1 Potential Effects on Federally Listed Species in the Action Area 5-2
5-2 Summary of Compensatory Mitigation Ratios for Impacts on Suitable Habitat for the Valley Elderberry Longhorn Beetle 5-23
5-3 Listed Species with Potential to Occur in other Interrelated and Interdependent Sections 5-43
5-4 Major Foreseeable Projects 5-44
6-1 Determination of Effects for Federally Listed Species and their Designated Critical Habitat 6-3

List of Appendices

A HST Alternatives

B Suitable Habitat for Branchiopods and California Tiger Salamander

C Suitable Habitat for Valley Elderberry Longhorn Beetle

D Suitable Habitat for San Joaquin Kit Fox

E USFWS Official Species List

F Regulatory Correspondence

Acronyms and Abbreviations

°F	degrees Fahrenheit
AC	asphaltic concrete
Authority	California High-Speed Rail Authority
BA	Biological Assessment
BMP	best management practice
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Conservancy fairy shrimp
CHU	critical habitat unit
CIDH	cast-in-drilled-hole
CIP	cast-in-place
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CRAM	California Rapid Assessment Methods
CTS	California tiger salamander
CVFPB	Central Valley Flood Protection Board
CVS	Central Valley steelhead
CWHRS	California Wildlife Habitat Relationship System
dBA	A-weighted decibels
ECA	Essential Connectivity Areas
EFH	essential fish habitat
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERA	Environmentally Restricted Areas
ESA	federal Endangered Species Act
ESU	Evolutionary Significant Unit
FE	Federally Endangered
FHWA	Federal Highway Administration

FP	Fully Protected (California Department of Fish and Game)
FRA	Federal Railroad Administration
FRCS	fall-run Chinook salmon
FT	Federally Threatened
GIS	geographic information system
GPS	global positioning system
HAS	Habitat Study Area
HMF	Heavy Maintenance Facility
HST	High Speed Train
JD	Jurisdictional Determination
kV	kilovolt
MA/LAA	May affect, Likely to adversely affect
mph	miles per hour
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
OCAP	operations criteria and plan
OCS	Overhead Catenary System
PCC	Portland cement concrete
PCE	primary constituent elements
quad	quadrangle
RSA	resource study area
RWQCB	Regional Water Quality Control Board
SC	Species of Special Concern (California Department of Fish and Game)
SE	Listed as endangered under the California Endangered Species Act
SEL	sound exposure level
SFHA	Special Flood Hazard Areas
SJKF	San Joaquin kit fox
SJRRP	Joaquin River Restoration Program

SR	Listed as rare under the California Endangered Species Act
SRCS	spring-run Chinook salmon
ST	Listed as threatened under the California Endangered Species Act
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TPSS	Traction Power Substations
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VELB	Valley Elderberry Longhorn Beetle
VPFS	vernal pool fairy shrimp
VPTS	vernal pool tadpole shrimp
WEF	Wildlife Exclusion Fence
WRCC	Western Region Climate Center
WST	western spadefoot toad

ES1.0 Executive Summary

The California High-Speed Rail Authority (Authority) and Federal Railroad Administration (FRA) propose to construct a new High-Speed Train (HST) system that, at final build, would connect the major population centers of the San Francisco Bay Area with the Los Angeles metropolitan region. This Biological Assessment (BA) has been prepared to evaluate all potential effects of the proposed Merced to Fresno Section of the California HST Project (hereafter referred to as the Merced to Fresno Section) on species listed as endangered or threatened, or proposed for listing as endangered or threatened, or that are candidates for listing as endangered or threatened under the federal Endangered Species Act (ESA). Potential effects on federally listed species are evaluated in accordance with the legal requirements set forth in Section 7 of the ESA (16 United States Code [U.S.C.] 1536). Criteria used to determine which federal resources were considered for this BA, and potential effects on these resources from the Merced to Fresno Section, are presented. In addition, this BA proposes measures to avoid or minimize takes of species protected under the ESA. The listed species and designated critical habitat discussed within this BA are regulated by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS). Both USFWS and NMFS-listed species and critical habitat are addressed in this one combined document.

ES1.1 Proposed Project

The HST system would be an electrically powered, steel-wheel-on-steel-rail system with state-of-the-art safety, signaling, and automated train-control systems. The trains would be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade-separated, dedicated track alignment.

The project discussed in this BA is the portion of the HST System from Merced to Fresno, which includes the following:

- Approximately 80 miles of dual track.
- Two railroad passenger stations, one each in the cities of Merced and Fresno.
- Approximately 42 road overcrossings and undercrossings.
- Associated railway support facilities, which include electrical stations, maintenance-of-way facility, and a potential heavy maintenance facility (HMF).

ES1.2 Technical Studies

ES1.2.1 Literature Analysis

A desktop review was performed to identify the locations of special aquatic resources, federally listed plant and wildlife species, wildlife movement/migration corridors and areas, and federally designated or proposed critical habitat units (CHUs) occurring within the Merced to Fresno Section limit of direct effect (see Section 3.1). Review material included resource databases from the USFWS, the California Natural Diversity Data Base (CNDDB), the California Native Plant Society (CNPS), and the California Wildlife Habitat Relationship System (CWHRS); USFWS recovery plans and conservation guidelines; and various habitat linkage reports.

A resource query area was defined by establishing a 10-mile buffer from the centerline of the proposed HST facilities (see Figures 4-1 and 4-2). This buffer was sized to minimize the potential of overlooking sensitive resources that may be affected by the Merced to Fresno Section. United States Geological Survey 7.5-minute series quadrangles that coincided with the resource query area were then evaluated for the presence of federally listed (or proposed) endangered or threatened species, and for the presence of designated or proposed critical habitat. Seventeen quadrangles directly intersected the Action Area (see Section 3.1) and were utilized within this evaluation area. Generally defined, the Action Area is the

area directly or indirectly affected by construction and operation of the Merced to Fresno Section. Three resource databases were queried for the presence of sensitive resources within the defined resource query area. These were USFWS Sacramento Office website, CNDDB, and CNPS. This initial, geographically broad query resulted in the identification of 25 federally listed species and 11 critical habitat designations associated with the Action Area. In addition to the species under jurisdiction by USFWS, two federally listed fish species—Central Valley steelhead and Central Valley spring-run Chinook salmon and designated critical habitat for Central Valley steelhead identified in the database queries will be addressed under a separate consultation with NMFS. No additional proposed federally listed species or proposed critical habitat were identified in the queries.

ES1.2.2 Field Surveys

This section provides a summary of methods used to survey for special-status plants. A more detailed survey approach is discussed in the *Merced to Fresno Section Draft Special-Status Plants Survey Report* (Authority and FRA 2011a).

To identify potentially suitable wildlife habitat for special-status wildlife species, key habitat constituents mapped during field surveys included topography and the presence or absence of vegetative cover, foraging habitat, and migration barriers (i.e., canals and roadways). Focused surveys were not conducted for wildlife species. Detailed information, including recommendations for focused surveys, is presented in the *Merced to Fresno Section Draft Biological Resources and Wetlands Technical Report* (Authority and FRA 2011b).

Special-status plant surveys were conducted in accordance with *CNPS Botanical Survey Guidelines* (CNPS 2001), *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996a), and *Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities* (CDFG 2009a).

Botanical surveys were floristic in nature, meaning that all observed plant species were identified to the level necessary to determine whether they are a special-status species or not. Species were identified and recorded according to nomenclature found in the *Jepson Manual of Higher Plants of California* (Hickman 1993). As recommended in the guidelines listed above (USFWS 1996a, CDFG 2009a), surveys for special-status plants were timed to coincide with the appropriate bloom period for each species when reproductive structures necessary for accurate identification of target species could be most readily identified.

Botanical surveys were conducted on accessible parcels in March, April, and May 2011. The *Merced to Fresno Section Draft Special-Status Plants Survey Report* (Authority and FRA 2011a) includes a complete discussion of study methods.

ES1.2.3 GIS Analysis

Aerial imagery was interpreted to determined plant community and cover types in inaccessible areas. The reconnaissance-level field surveys and mapping process is detailed in the *Merced to Fresno Section Draft Biological Resources and Wetlands Technical Report* (Authority and FRA 2011b). Terrestrial plant communities and cover types within the Habitat Study Area (HSA) were mapped using 1:4800 scale aerial photographs. All terrestrial plant community and cover type characterization and mapping was done from publicly accessible roads along or near the proposed HST alternatives. Habitat types, including natural communities of special concern, were noted and delineated on aerial photographs of the HSA. Data collected using aerial photographs during terrestrial and aquatic field surveys were then digitized and incorporated into a geographic information system (GIS) application for analysis.

ES1.3 Study Results

ES1.3.1 Wildlife Habitat Types that may Support Federally Listed Species

Wildlife habitat types were identified using CWHRS descriptions. Parcels whose agricultural use could not be determined to specific CWHRS wildlife habitat types (e.g., dryland grain crops, irrigated grain crops, irrigated hayfield, irrigated row and field crops) were designated under the umbrella category of cropland. Agricultural croplands are the largest recorded habitat type within the resource study area (RSA). RSAs were developed essentially to provide a geographic area sufficient to capture potential direct and indirect effects. Urban areas, including large cities such as Merced and Fresno and the smaller cities between, constitute the second greatest land use within the RSA. In urban areas, native vegetation is absent or highly disturbed, and typical vegetation consists of a variety of landscaped trees and other nonnative vegetation. CWHRS habitat types observed within the RSA included the following:

- Agricultural/cropland
- Alkali desert scrub
- Annual grassland
- Barren
- Fresh emergent wetland
- Lacustrine
- Pasture
- Riverine
- Urban
- Valley foothill riparian

ES1.3.2 Federally Listed Plant and Wildlife Species and Critical Habitat

Based on the results of desktop and field surveys, the Merced to Fresno Section Action Area contains habitat for 13 federally listed plant and wildlife species regulated by USFWS and NMFS (Table ES-1).

Table ES-1
Federally Listed Species with the Potential to Occur in the Action Area

Common Name	Scientific Name	Federal Status[b]
Colusa grass	*Neostapfia colusana*	FT
San Joaquin Valley Orcutt grass	*Orcuttia inaequalis*	FT
hairy Orcutt grass	*Orcuttia pilosa*	FE
Greene's tuctoria	*Tuctoria greenei*	FE
succulent owl's-clover	*Castilleja campestris* ssp. *succulenta*	FT
Conservancy fairy shrimp	*Branchinecta conservatio*	FE
vernal pool fairy shrimp	*Brachinecta lynchi*	FT
vernal pool tadpole shrimp	*Lepidurus packardi*	FE
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
Central Valley Steelhead	*Oncorhynchus mykiss*	FT
Central Valley spring-run Chinook salmon	*Oncorhynchus tshawytscha*	FT
California tiger salamander, Central Valley DPS[a]	*Ambystoma californiense*	FT
San Joaquin kit fox	*Vulpes macrotis mutica*	FE

[a] DPS = distinct population segment

[b] FT (Federally Threatened) = Listed as threatened under the ESA.
FE (Federally Endangered) = Listed as endangered under the ESA.

Critical Habitat

Critical habitat is designated within the limit of direct effect (see Section 3.1) for the following six species:

- San Joaquin Valley Orcutt grass (158 acres).
- Greene's tuctoria (12 acres).
- Succulent owl's-clover (12 acres).
- Conservancy fairy shrimp (12 acres).
- Vernal pool fairy shrimp (12 acres).
- Vernal pool tadpole shrimp (170 acres).

ES1.3.3 Summary of Findings, Conclusions, and Determinations

Throughout this BA, the minimum to maximum range of direct effects on listed species is presented as ranges of areas of suitable habitat among design options associated with each of three candidate HST alternatives. The final alignment of the Merced to Fresno Section will not be determined prior to the selection of the preferred alternative for the project-specific EIR/EIS.

No federally listed plant species were found during special-status plant surveys. Suitable habitat for the federally listed plants may exist in natural areas that were inaccessible to survey crews; construction activities may affect, likely to adversely affect these species within the Action Area. The effect determinations for federally listed plant species are listed in Table ES-2.

Table ES-2
Effects Determination for Federally Listed Plant Species
within the Limit of Direct Effect

Plant Species	Effect Determination
Colusa Grass	MA/LAA
San Joaquin Valley Orcutt grass	MA/LAA
hairy Orcutt grass	MA/LAA
Greene's tuctoria	MA/LAA
succulent owl's-clover	MA/LAA
MA/LAA = May affect, Likely to adversely affect	

Effects on federally listed wildlife species were calculated based on a number of factors, which include species range, specific habitat requirements, known species occurrences, and the overlap of the limit of direct effect with both range and suitable habitat. The Merced to Fresno Section may affect, likely to adversely affect all wildlife species evaluated. However, the extent of effects, as determined by affected suitable habitat, varies between species. Table ES-3 provides the effects determination and summarizes the range of potential impacts on suitable habitat for each species. This range includes those natural lands that were not accessible to surveyors, which may or may not actually support federally listed species but for which suitable habitat is present.

Table ES-3
Effects Determination for Federally Listed Wildlife Species within the Limit of Direct Effect

Species	Effect Determination [a]	Type of Effect	Potentially suitable habitat (acres) [b]	
			Min	Max
Vernal pool tadpole shrimp	MA/LAA	Direct/Indirect	7.52	57.89
Vernal pool fairy shrimp	MA/LAA	Direct/Indirect	9.64	66.23
Valley elderberry longhorn beetle	MA/LAA	Direct/Indirect	11.72	31.57
California tiger salamander Central population DPS	MA/LAA	Direct/Indirect	189.93	746.77
Central Valley Steelhead	MA/LAA	Direct/Indirect	8.21	20.56
Central Valley spring-run Chinook Salmon	MA/LAA	Direct/Indirect	8.21	20.56
Conservancy Fairy Shrimp	MA/LAA	Direct/Indirect	7.52	61.62
San Joaquin kit fox	MA/LAA	Direct/Indirect	490.13	1,936.20

[a] MA/LAA = May affect, Likely to adversely affect

[b] Based on species range overlapping with suitable habitat within the limit of direct effect.

Critical Habitat Effect Determination

Critical habitat for the following six species has been designated within the Merced to Fresno Section HST construction footprint in association with the BNSF Alternative.

- Vernal pool tadpole shrimp
- Vernal pool fairy shrimp
- Conservancy fairy shrimp
- Succulent owl's clover
- Greene's tuctoria
- San Joaquin Valley Orcutt grass

All species are vernal pool species with suitable habitat identified within the Merced to Fresno Section footprint that overlaps the six designated CHUs. Because primary constituent elements of designated critical habitat have been identified within the limit of direct effect, the Merced to Fresno Section may affect, likely to adversely affect critical habitat.

Effects from Interrelated and Interdependent Actions

The Merced to Fresno Section is not an interdependent project but is a part of a statewide HST system. In addition to the project activities that will be implemented as part of the Merced to Fresno Section, interrelated activities that will be implemented in other sections of Phase 1 may also affect the federally listed species affected by the proposed action, including the following: Conservancy fairy shrimp along three Phase 1 segments, vernal pool tadpole shrimp along three Phase 1 segments, vernal pool fairy shrimp along three Phase 1 segments, valley elderberry longhorn beetle along four Phase 1 segments, Central Valley spring run Chinook salmon and Central Valley steelhead along two Merced to Fresno Section segments only, California tiger salamander along four Phase 1 segments, and San Joaquin kit fox along four Phase 1 segments.

Effects from the interrelated activities include many possible effects during construction and operation of the HST Project in these other segments. These effects include habitat loss, fragmentation, mortality during construction, and indirect effects from surface runoff and incremental single-event noise.

The adverse effects on the federally listed species from the interrelated sections of the HST System have not all been formally studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar in nature and magnitude to those in the Merced to Fresno Section. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be partially mitigated by implementing strategies similar to those described in this BA. Furthermore, these HST sections would be required to consult with the USFWS and NMFS under Section 7 of the ESA.

Cumulative Effects

Under Section 7 consultation, cumulative effects analyses are for actions likely to adversely affect listed resources, including any future state or private activities, not involving federal activities that are reasonably certain to occur within the Action Area 1,000 feet on either side of the construction footprint. The combination of the HST Project with other proposed projects in the San Joaquin Valley could result in cumulative effects on federally listed species. Cumulative projects in the region include transportation, residential, agricultural, commercial, and industrial projects. These projects are located in the Action Area, including the general plan updates to the City of Chowchilla and the City of Madera, and the San Joaquin River Restoration Program.

In summary, cumulative effects from these projects will contribute to the overall loss or degradation of wildlife resources. Disturbances will be direct and indirect, temporary and permanent, and will include the following:

- Impairment to federally listed wildlife species populations, dynamics, behavior, and ability to carry out species lifecycle.
- Impairment of wildlife movement and migration corridors, including effects on species' genetic variation, population gene flow, and ability for species to migrate to areas that are required to carry out the species' important life history events (including breeding).
- Adverse effects on the various functions and values provided by federally listed plant and wildlife species' habitats.
- Potential adverse modification of federally listed wildlife species' habitats.

The successful implementation of the general avoidance and minimization measures discussed in Section 2.7 of this BA, along with any specific avoidance and minimization discussed for each federally listed plant and wildlife species, will considerably reduce the nature and magnitude of cumulative effects on federally listed plant and wildlife species. Additionally, the Merced to Fresno will comply with federal, state, and local regulations through USFWS and NMFS consultation and permitting, which will result in further development of specific avoidance and minimization measures, best management practices (BMPs), and compensatory mitigation options to be implemented. Other cumulative projects will be required to comply with similar regulatory requirements (e.g., federal, state, and local government laws and regulations) that protect federally listed wildlife species and wildlife movement and migration corridors. Therefore, cumulative effects will be mitigated through the appropriate regulatory process for each project.

1.0 Introduction

This Biological Assessment (BA) is prepared and presented to initiate consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) for the Merced to Fresno Section of the California High-Speed Train (HST) System, in compliance with Section 7(a)(2) of the federal Endangered Species Act (ESA), as amended (16 United States Code [U.S.C.] §§ 1531 *et seq*) and its implementing regulations (50 Code of Federal Regulations [CFR] § 402.01 *et seq*).

1.1 Purpose of the Document

The primary purpose of the BA is to document Federal Railroad Administration (FRA) conclusions and the rationale to support those conclusions regarding the effects of the proposed action on federally listed species. This BA also serves to initiate consultation on essential fish habitat (EFH) for Pacific salmon (*Oncorhynchus* spp.) with NMFS, as required by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801), as amended. The following discussion summarizes the goal of the ESA, the duties of the federal action agency under Section 7, the purpose of the consultation, the informational requirements to initiate consultation, and the requirements of the Magnuson-Stevens Act.

In 16 U.S.C. Section 1531, the ESA sets forth the goal of conserving threatened and endangered species (listed species) and the ecosystems upon which they depend. Section 7 of the ESA, entitled "interagency cooperation," establishes the process whereby federal action agencies, their designees (e.g., state transportation agencies), and the USFWS and/or the NMFS (jointly referred to as the Services) work together to ensure that proposed actions are not likely to jeopardize the continued existence of species that are listed or proposed for listing as threatened or endangered under the ESA. The Services also work to ensure that proposed actions are not likely to adversely affect the designated critical habitats for those species.

The implementing procedures of ESA are set forth at 50 CFR Part 402. A federal action agency may take action directly, through one of its own proposed projects, or indirectly, through partial or complete funding for a nonfederal project or by issuing a permit for a nonfederal project. These conditions can cause an action to be subject to a Section 7 consultation under the ESA.

When a federal agency takes action subject to the ESA, it must comply with Section 7(a)(2) of the ESA. Section 7(a)(2) states:

"Each federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an 'agency action') is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section. In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available."

Also, in accordance with Section 7(a)(2) of the ESA, federal agencies must consult with NMFS on activities that may affect a listed species. NMFS and the USFWS share responsibility for implementing the ESA. Generally, USFWS manages land and freshwater species, while NMFS manages marine and anadromous species.

In addition, pursuant to Section 305(b)(2) of the Magnuson-Stevens Act, federal agencies must consult with NMFS regarding any of their actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may affect, likely to adversely affect EFH (50 C.F.R. § 600.920). The Magnuson-Stevens Act requires cooperation among NMFS, fishery management councils, fishing

participants, federal and state agencies, and others in achieving EFH protection, conservation, and enhancement.

This BA is intended to satisfy information requirements identified at 50 CFR Section 402.14(c) that are necessary to initiate consultation with the Services. In this case, consultation is being initiated with both the USFWS and the NMFS. To initiate consultation, action agencies must provide the six types of information identified at 50 CFR Section 402.14(c). These include the following:

- A description of the action to be considered.
- A description of the specific area that may be affected by the action.
- A description of any listed species or critical habitat that may be affected by the action.
- A description of the manner in which the action may affect any listed species or critical habitat and an analysis of any cumulative effects.
- Relevant reports, including any environmental impact statement, environmental assessment, or biological assessment prepared.
- Any other relevant available information on the action, the affected listed species, or critical habitat.

This BA is intended to satisfy all information requirements identified at 50 CFR Section 402.14(c). Using this BA and other information (best scientific and commercial data available), the Services will develop their biological opinion (BO) as to the likelihood that the action agency's proposed activities jeopardize the continued existence of a listed species or adversely affect its designated critical habitat under the standards defined at 50 CFR Section 402.02.

1.2 Proposed Action

The proposed action is the construction and operation of the Merced to Fresno Section of a larger HST System that runs through much of the state of California. The need for this HST System is directly related to the expected growth in population and increases in intercity travel demand in California over the next 20 years and beyond. With growth in travel demand, the number of travel delays is expected to increase because of the growing congestion on California's highways and at its airports. This growing congestion is expected to cause the transportation system to become less reliable, which is expected to have negative effects on the economy, quality of life, and air quality in and around California's metropolitan areas. The intercity highway system, commercial airports, and conventional passenger rail serving the intercity travel market are currently operating at or near capacity and will require large public investments for maintenance and expansion to meet existing demand and future growth. The purpose of the HST System is to provide a new mode of high-speed intercity travel that links the major metropolitan areas of the state; interfaces with international airports, mass transit, and highways; and provides added capacity to meet increases in intercity travel demand in a manner sensitive to and protective of California's unique natural resources.

The HST System is to be funded in part by revenues from sales of a state bond approved by California voters. The project also has a federal component, with funds from the American Recovery and Reinvestment Act and other federal sources. This federal funding constitutes the federal nexus that requires consultation under Section 7 of the ESA.

1.2.1 Overview

Per the USFWS' request on March 1, 2011, FRA designated the California High-Speed Rail Authority (Authority) as the nonfederal representative for this Section 7 consultation, in addition to its current role to manage the construction and operation of the HST system. Together, the Authority and FRA propose to construct, operate, and maintain an electric-powered steel-wheel-on-steel-rail HST system that will be

over 800 miles long and capable of speeds in excess of 220 miles per hour (mph) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems.

The Authority's statutory mandate is to plan, build, and operate an HST system that coordinates with California's existing transportation network, particularly intercity rail and bus lines, commuter rail lines, urban rail transit lines, highways, and airports. The Authority and FRA prepared a first-tier, Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) that evaluated the ability of an HST system to meet the existing and future capacity demands on California's intercity transportation system (Authority and FRA 2005). That environmental analysis found that an HST system would meet the need for a safe and reliable mode of travel that would link the major metropolitan areas of the state and deliver predictable, consistent travel times sustainable over time. Although highway and air transportation improvements would reduce travel times and congestion, these alternative modal improvements would have greater potential for significant environmental impacts than the HST System, would increase energy use and dependence on petroleum, and would increase suburban sprawl. As a result of this analysis, as well as a second first-tier, Program EIR/EIS and Revised EIR/EIS for the Bay Area to Central Valley region (Authority and FRA 2008, 2010), the Authority and FRA chose to proceed with the HST System and are preparing project-specific EIR/EIS for the individual sections of the HST System.

These individual sections of the system are separate from each other and can function on their own without further construction of an adjoining section. Each section is designed to have independent utility and logical termini and does not rely on other sections for operations to commence at a local level. Once construction is complete, these discrete individual sections will be components of the larger HST System. The Merced to Fresno Section is one of these individual sections. The proposed action is not interdependent.

1.2.2 Purpose and Need

The purpose of the HST System is to provide a new mode of high-speed intercity travel that would link major metropolitan areas of the state; interface with international airports, mass transit, and highways; and provide added capacity to meet increases in intercity travel demand in California in a manner sensitive to and protective of California's unique natural resources. The purposes of the HST System are best summarized in the project objectives and policies adopted by the Authority. These are to:

- Provide intercity travel capacity to supplement critically over-used interstate highways and commercial airports.
- Meet future intercity travel demand that will be unmet by present transportation systems and increase capacity for intercity mobility.
- Maximize intermodal transportation opportunities by locating stations to connect with local transit, airports, and highways.
- Improve the intercity travel experience for Californians by providing comfortable, safe, frequent, and reliable high-speed travel.
- Provide a sustainable reduction in travel time between major urban centers.
- Increase the efficiency of the intercity transportation system.
- Preserve environmental quality and protect California's sensitive environmental resources by reducing emissions and vehicle miles traveled for intercity trips.
- Maximize the use of existing transportation corridors and rights-of-way, to the extent feasible.
- Develop a practical and economically viable transportation system that can be implemented in phases by 2020 and that would generate revenues in excess of the costs of operation and maintenance.

The Authority has noted several important aspects of need for an HST System. The capacity of California's intercity transportation system is insufficient to meet existing and future demand. The current and projected future congestion of the intercity transportation system will continue to result in deteriorating air quality, reduced reliability, and increased travel times. The intercity transportation system has not kept pace with the tremendous increase in population and tourism in the state. The interstate highway system, commercial airports, and conventional passenger rail system serving the intercity travel market are currently operating at or near capacity and will require large public investments for maintenance and expansion to meet existing demand and future growth over the next 20 years and beyond. Moreover, the ability to expand many major highways and key airports is uncertain; some needed expansions may be impractical or may be constrained by physical, political, and other factors.

Simply stated, the need for improvements to intercity travel within California relates to the following issues:

- Future growth in demand for intercity travel.
- Capacity constraints that will result in increasing congestion and travel delays.
- The unreliability of travel resulting from congestion and delays, weather conditions, accidents, and other factors that affect the quality of life and economic well-being of residents, businesses, and tourism in California.
- The increasing frequency of accidents on intercity highways and passenger rail lines in congested corridors of travel.
- Reduced mobility as a result of increasing demand on limited modal connections between major airports, transit systems, and passenger rail in the state.
- Poor and deteriorating air quality and pressure on natural resources as a result of expanded highways and airports.

The Merced to Fresno Section of the HST System reflects these statements of need. The San Joaquin Valley has experienced substantial urban growth over the past two decades. As a result, the regional transportation system, particularly SR 99, has experienced a substantial increase in congestion. In the winter, driving and air service are further hampered by frequent periods of heavy fog. With the future population growth projected for the San Joaquin Valley, travel demand is expected to exceed the capacity of the existing transportation system. As noted in the Program EIR/EIS, the population of Merced County, a fast-growing county adjacent to the Merced to Fresno Section, is projected to increase by 80.8 percent from 2005 to 2030. Over this same period, the populations of Fresno and Kern counties are projected to increase by 47.8 and 65.5 percent, respectively.

The HST System would provide a new, rapid transportation link between the major cities of the San Joaquin Valley, helping to relieve congestion on the existing transportation system. The Merced to Fresno Section of the HST System would have stations in the cities of Merced and Fresno, the two major cities in the San Joaquin Valley. For example, the travel time on the HST System between Merced and Fresno would be less than the current travel time between these two cities by automobile or Amtrak. The HST System would also improve intermodal connections between the San Joaquin Valley and major metropolitan areas by facilitating a fast, reliable connection to Fresno, which hosts the main commercial airport in the region.

In addition to providing a new high-speed link between the major cities of the San Joaquin Valley, the Merced to Fresno Section would be critical to the planned phased development of the entire HST System. The High-Speed Passenger Train Bond Act directs that the Initial Operating Segment of the System will be San Francisco to Los Angeles, with the potential to open regional segments before construction completion along this north-south backbone of the system. The Merced to Fresno Section is a key to the successful completion of the Initial Operating Segment for the following reasons:

- Because of its topography, low density of urban development, and large spans of agricultural lands, this section offers the greatest opportunity to reach maximum authorized speeds, which would allow the train to make up time from other sections with restricted speeds.
- This section provides the best conditions for the necessary testing of HST rolling stock and infrastructure before operation due to fewer constraints from existing development and flatter terrain.
- This section offers a central location along the Initial Operating Segment for the Heavy Maintenance Facility (HMF) needed for a statewide HST System.
- This section has the least cost per mile for construction, so construction could begin earlier in the project bonding timeframe.

1.3 Consultation History

This section summarizes the history of informal consultation with the USFWS and NMFS that the Authority and/or the FRA have conducted to date.

1.3.1 Federal/State Endangered Species Act Consultation Summary

Consultation with the USFWS has been ongoing to discuss issues related to habitat assessment and protocol-level survey areas and methodology, wildlife corridors and passage design, conservation measures, mitigation banks, and future meeting schedules. USFWS and Authority biologists met on September 23 and November 5, 2009, and on February 10 and June 9, 2010. Initial meetings with California Department of Fish and Game (CDFG) discussed methodology for studies. Authority biologists subsequently met with CDFG on June 7, 2010, to discuss listed species, streambed alteration, survey timelines, and mitigation strategies.

On March 14, 2011, the FRA sent a letter to USFWS and NMFS advising that the Authority has been designated as the FRA's nonfederal representative for the purposes of conducting informal Section 7 consultation on FRA activities associated with the California HST System.

1.3.2 Federal Fisheries Consultation Summary

The Authority requested technical assistance from NMFS on September 23, 2009, regarding potential effects from the Merced to Fresno Section on special-status anadromous fishes pursuant to Section 7 of the ESA, as well as effects on EFH designated under the Magnuson-Stevens Act.

On January 5, 2010, the Authority met with NMFS to discuss the Merced to Fresno Section and agreed that additional information on the project should be gathered prior to determining whether proposed actions could potentially affect special-status anadromous fish. However, given the current understanding of the types and extent of potential effects, it was initially determined that three fish species may need to be analyzed for potential effects: Central Valley steelhead (CVS) (*Oncorhynchus mykiss*), Central Valley spring-run Chinook salmon (SRCS) (*Oncorhynchus tshawytscha*), and Central Valley fall/late fall-run Chinook salmon (FRCS).

On November 17, 2010, the Authority submitted a letter to NMFS that provided a description of the Merced to Fresno Section and requested a list of species under NMFS jurisdiction that may be affected by the project or confirmation that no such species would be affected and that further consultation with NMFS is not required.

On February 11, 2011, a species list was received advising that CVS may occur in or downstream of the Merced to Fresno Section. In addition, the letter indicated that SRCS will be introduced to the San Joaquin River no later than December 31, 2012, and that the project may affect essential fish habitat (EFH) for SRCS.

On June 14, 2011, an agency coordination meeting took place that included representatives from USFWS, NMFS, CDFG and the U.S. Environmental Protection Agency (EPA), with the primary purpose of discussing the line of communication, timeframe, and approach for this BA.

On September 2, 2011, an agency coordination meeting took place to brief USFW and NMFS on the content of the *Merced to Fresno Section Draft Biological Resources and Wetlands Technical Report* (Authority and FRA 2011b), the BA approach, the summary of direct effects determination, and the overall schedule. Both the USFWS and the NMFS species were addressed and shared with USFWS and NMFS coordinating biologists.

On October 27, 2011, an agency coordination meeting took place to provide an overview and the findings of the BA. The agencies were given an opportunity to provide technical guidance on the approach and content of the BA. Both USFWS and NMFS provided input. On the same day, NMFS also visited with the Authority biologists to address specific issues regarding the construction scenario across the San Joaquin River.

On October 31, 2011, an agency coordination meeting took place at NMFS to discuss and address specific issues regarding the construction scenario across the San Joaquin River.

2.0 Project Description

The proposed action is to construct and operate a rail line to support an intercity HST from Merced to Fresno (Figure 2-1). The Merced to Fresno Section is one of nine sections that were identified in the Program EIR/EISs (Authority and FRA 2005, 2008, 2010a). In this document, the State of California proposes to build an HST System to connect the major population centers of the San Francisco Bay Area with the Los Angeles metropolitan region. The HST System is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology with state-of-the-art safety, signaling, and automated train-control systems. The trains would be capable of operating at speeds of up to 220 mph over a fully grade-separated, dedicated track alignment.

This project description details the project elements (Section 2.2), including the trainsets, rail line, stations, electrical systems, and the operation and maintenance systems; the location of the project elements (Section 2.3); the construction methods (Section 2.4); the construction schedule (phasing and timeline) (Section 2.5); the operation and maintenance activities (Section 2.6); and the proposed conservation measures to be incorporated into the project design (Section 2.7). As with all projects of this magnitude and complexity, changes to the design are anticipated to occur throughout the development of the HST System.

2.1 Project Description Alternatives

The *Merced to Fresno Section Draft Project EIR/EIS* (Authority and FRA 2011e) identifies alternatives in order to avoid potential impacts on societal, economic or natural resources, and evaluates a No Project Alternative (as required by the California Environmental Quality Act [CEQA] and the National Environmental Policy Act [NEPA]). The *Merced to Fresno Section Draft Program EIR/EIS* examines three alternatives (Figure 2-2) for rail alignments, stations, and associated facilities such as electrical and maintenance stations, and road and wildlife crossings. Two of these alternatives (UPRR/SR 99 and BNSF alternatives) were selected by the Authority and FRA at the conclusion of the Tier 1 EIR/EIS processes for the HST System in 2005 (*Final Statewide Program EIR/EIS*) (Authority and FRA 2005), 2008 (*Bay Area to Central Valley HST Revised Final Program EIR/EIS*) (Authority and FRA 2008), and 2010 (*Bay Area to Central Valley HST Revised Final Program EIR*) (Authority and FRA 2010a). An additional alternative (Hybrid Alternative) was developed based on public input during the scoping process. A preferred alternative for the Merced to Fresno Section EIR/EIS has not been identified. A summary of the three project alternatives (including design options, wye design options, and stations) is provided in Appendix A.

Because a preferred alternative has not been identified, the project description in this BA contains all three project alternatives currently under consideration in the Merced to Fresno Section EIR/EIS. Specifically, in order to describe and evaluate the alternative alignments, stations, and facilities, this BA presents the effects on listed species as a range from minimum to maximum values of areas related to the amount of suitable habitat disturbed by each of three alternatives.

Regardless of the preferred alternative ultimately selected, the project alternatives are geographically similar and would have similar effects on listed species. The primary differences between alternatives would be the location and quantity of habitat disturbed. Additional information, including identification of the preferred alternative, may be available prior to the completion of consultation but is not available at this time. The Effects Analysis (Section 5) presents the range of effects that may occur based on the various alternatives discussed in this section.

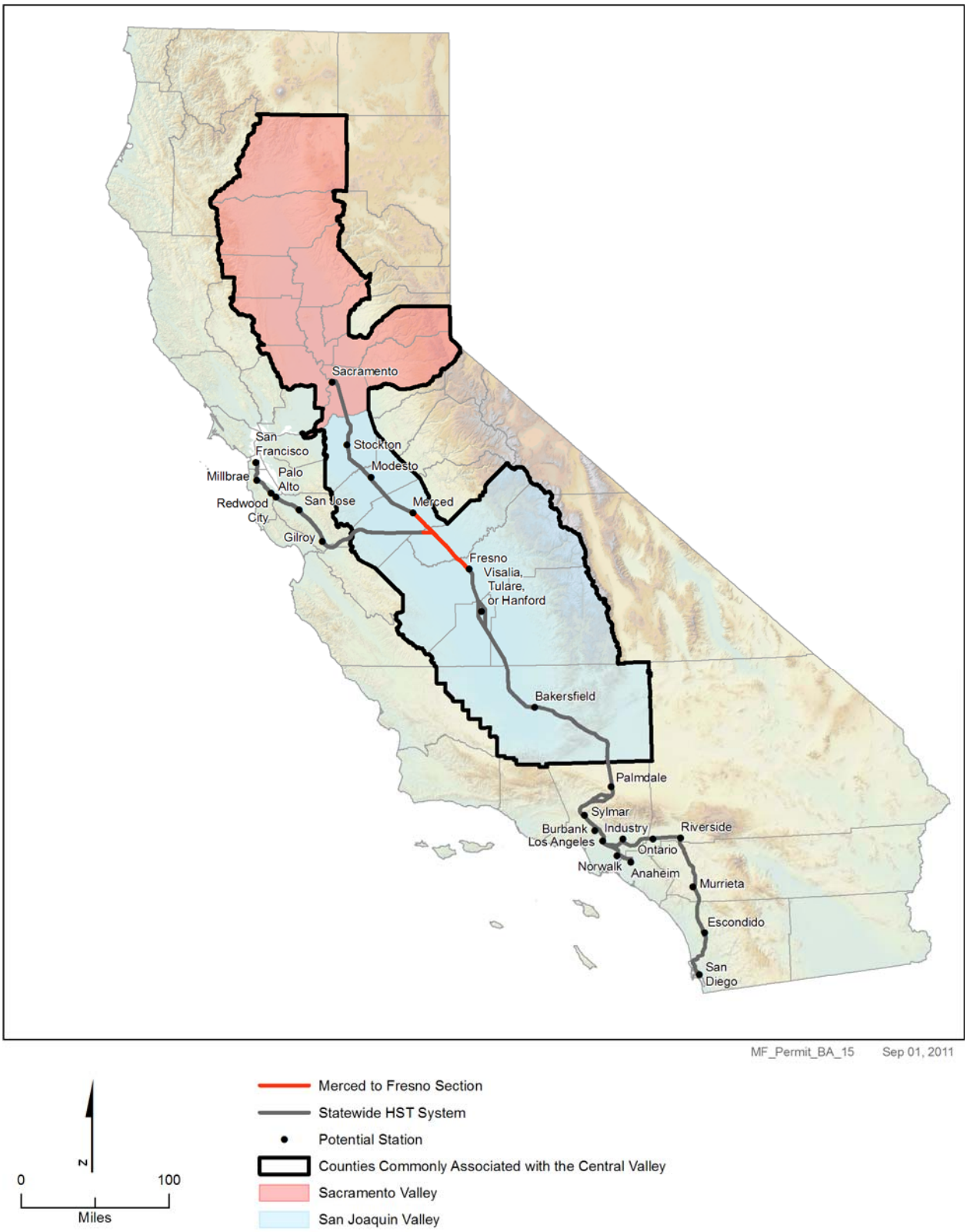


Figure 2-1
HST System California

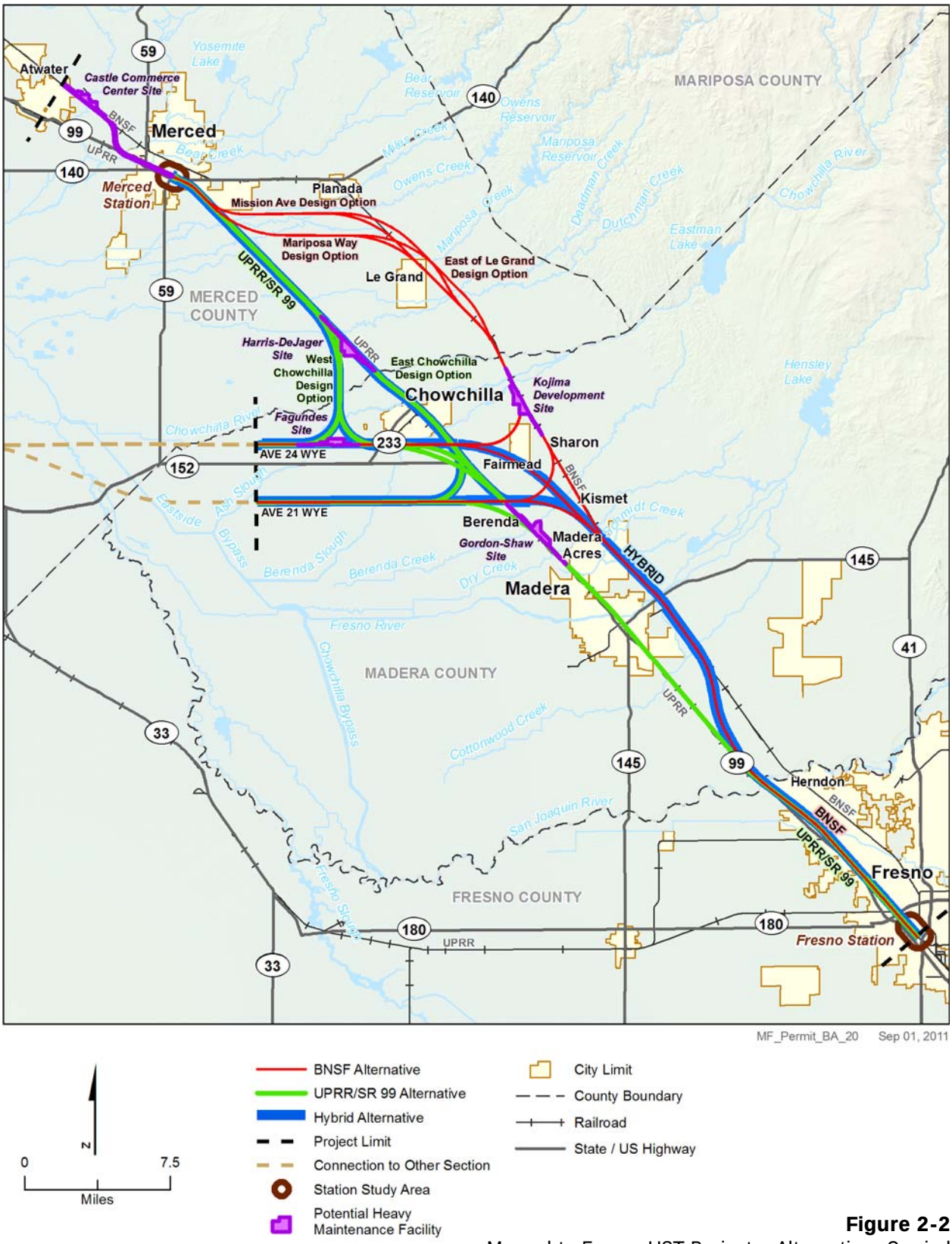


Figure 2-2
Merced to Fresno HST Project – Alternatives Carried Forward for Further Study (Three Alternative Routes)

2.2 Project Elements

This section discusses the physical elements of the Merced to Fresno Section. These include the trainsets that may be used, at-grade track and elevated track, road crossings, HST stations (the Merced Station and the Fresno Station), the electrical system and associated facilities (including substations, switching stations, and paralleling stations) that power the train, and control and maintenance facilities (the HMF, the maintenance-of-way facility, and the access control systems).

2.2.1 Trainsets

The HST System would be designed for the operation of trainsets ranging from 8 to 16 cars, 660 to 1,320 feet in length, designed to operate at a top speed of 220 mph. The current design preference is for a single-level train.

2.2.2 Rail Line

The Merced to Fresno Section of the California HST Project would consist of a fully dedicated rail line, constructed from continuous welded steel rail. The Merced to Fresno Section would use four different track profiles: low, near-the-ground tracks are at-grade; higher tracks are elevated or on retained earth; and below-grade tracks are in a retained cut. Types of bridges that might be built include full channel spans, large box culverts, or, for some larger river crossings, piers within the ordinary high-water channel. The various track profiles are described below.

2.2.2.1 At-Grade Profile

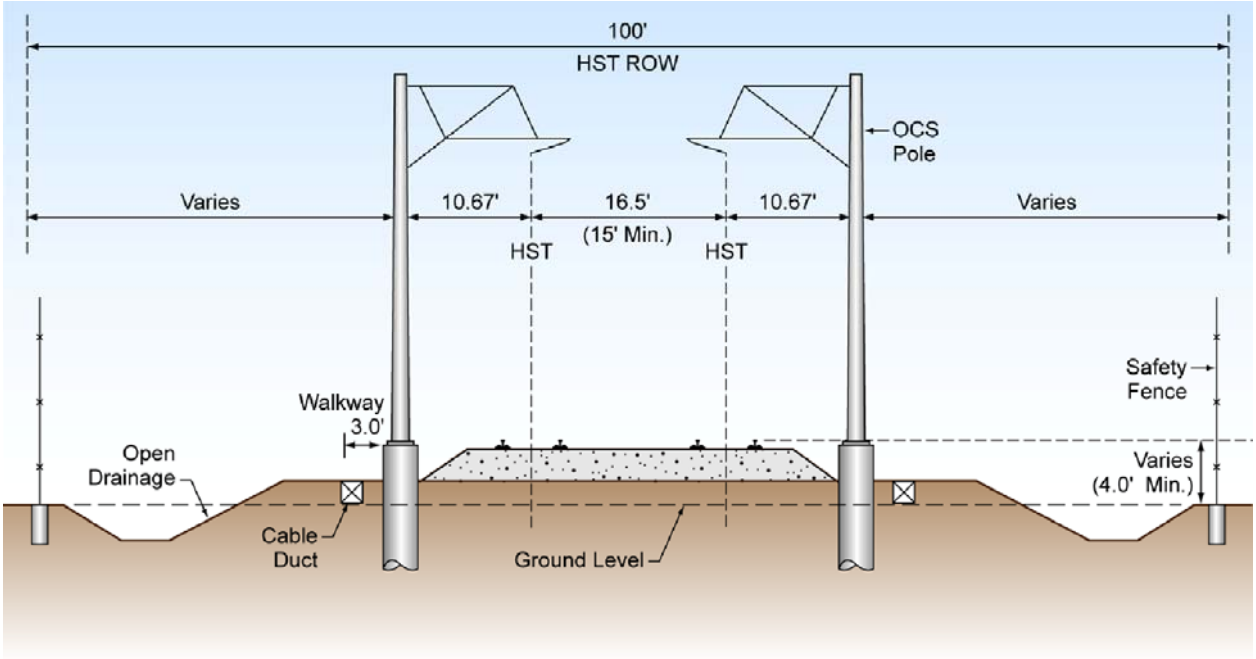
At-grade track profiles (Figure 2-3) are best suited in areas where the ground is relatively flat, as in the Central Valley, and in rural areas where interference with local roadways is less. Where the rail line is at-grade, the track would be built on compacted soil and ballast material (a thick bed of angular rock) to prevent subsidence or changes in the track surface from soil movement. For at-grade track, the top of the rail would be constructed at a minimum of 4.5 feet above the 100-year floodplain or higher when transitioning to an elevated structure. The height of the at-grade profile may vary to accommodate slight changes in topography, provide clearance for storm water culverts and structures in order to allow water flow, and sometimes wildlife movement.

2.2.2.2 Retained-Fill Profile

Retained-fill profiles (Figure 2-4) are used when it is necessary to narrow the right-of-way within a constrained corridor to minimize property acquisition or to transition between an at-grade and elevated profile. For retained-fill track, the guideway would be raised off the existing ground on a retained-fill platform made of reinforced concrete walls, much like a freeway ramp. Short retaining walls would provide the same effect and would protect the adjacent properties from a slope extending beyond the rail guideway. Retained-fill profile can be high enough to allow road undercrossings. The use of retained-fill would be evaluated on a case-by-case basis.

2.2.2.3 Retained-Cut Profile

Retained-cut profiles (Figure 2-5) are used when the rail alignment crosses under existing roads or highways that are at-grade. This profile type is only used for short distances in highly urbanized and constrained situations. In some cases, it is less disruptive to the existing traffic network to depress the rail profile under these crossing roadways. Retaining walls would typically be needed to protect the adjacent properties from a cut slope extending beyond the rail guideway. Retained-cut profiles are also used for roads or highways when it is more desirable to depress the roadway underneath an at-grade HST alignment might be at-grade on either side, the width of the water channel could require a bridge at the same level, which would be built in the same way as the elevated profile.



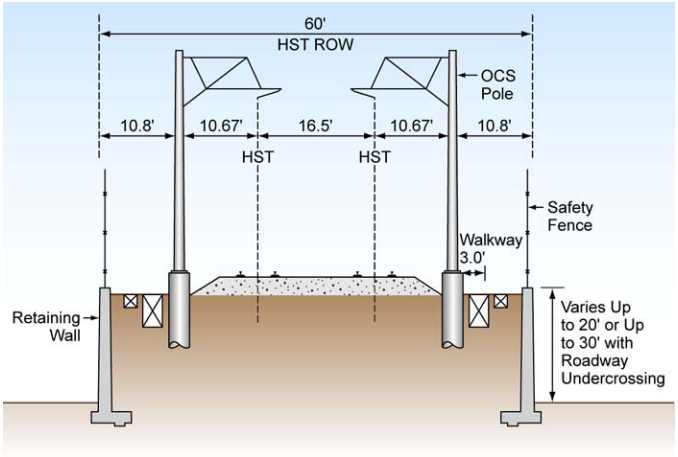


Figure 2-3
At-Grade Profile

Figure 2-4
Retained-Fill Typical Cross Section

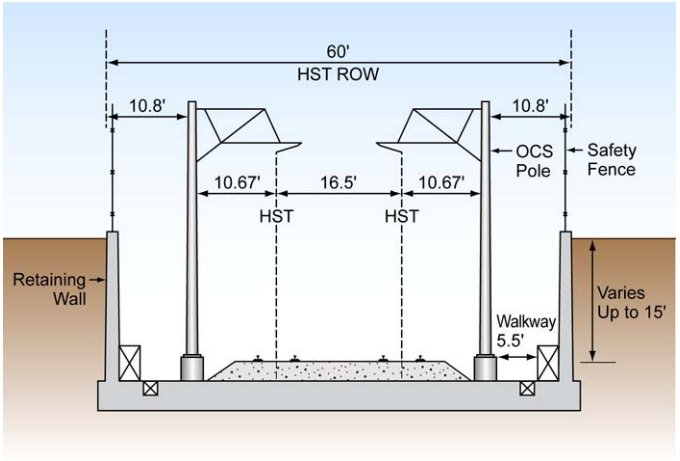


Figure 2-5
Retained-Cut Typical Cross Section

CALIFORNIA High-Speed Rail Authority
U.S. Department of Transportation Federal Railroad Administration

2.2.2.4 Elevated Track

Elevated profiles (Figure 2-6) can be used in urban areas where extensive road networks must be maintained. An elevated profile must have a minimum clearance of approximately 16.5 feet over roadways and 23.5 feet over railroads. Pier supports would typically be approximately 10 feet in diameter at the ground. Such structures could also be used to cross water bodies; even though the trackway might be at-grade on either side, the width of the water channel could require a bridge at the same level, which would be built in the same way as an elevated profile. Elevated crossings at selected streambeds can maintain permeability and connectivity. These crossings within habitat linkages include single-span or multispan bridges at natural watercourses. They may serve to connect the two adjacent sides of the HST project for free-ranging mammals.

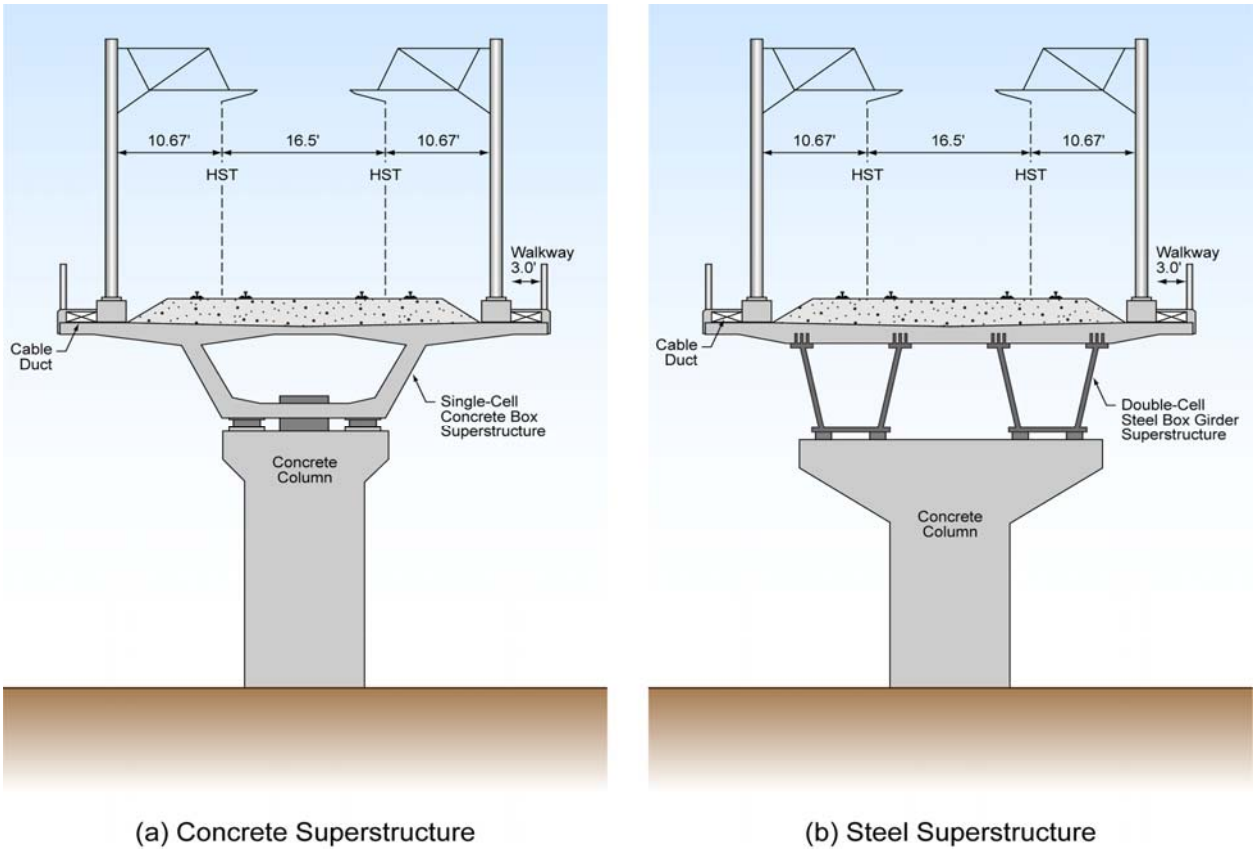


Figure 2-6
Elevated Profile

<u>Straddle Bents</u>

When the HST elevated profile crosses over a roadway or a railway on a very large skew (degree of difference from the perpendicular), a straddle bent ensures that the piers are outside the roadway or railway right-of-way.

A straddle bent (Figure 2-7) is a pier structure that spans (or “straddles”) the functional/operational right-of-way limit of a roadway, highway, or railway. Typical roadway and highway crossings that have a smaller skew angle (i.e., the crossing is nearly perpendicular) generally use intermediate piers in medians and span the functional right-of-way. However, for large-skew-angle crossing conditions, median piers would result in excessively long spans that are not feasible. Straddle bents that clear the right-of-way can be spaced as needed (typically 110 feet apart) to provide feasible span lengths for bridge crossings at large-skew angles.

2.2.2.5 Road Crossings

The Merced to Fresno Section consists of a fully grade-separated and access-controlled guideway in order to maintain local traffic and agricultural access. The following section describes possible scenarios for HST grade separations, as illustrated on Figures 2-8 through 2-10:

- **Roadway overcrossings –** There are many roadway and state route facilities that currently cross at-grade with or over the UPRR and BNSF railroad tracks. Figure 2-8 illustrates how a roadway would be grade-separated over both the HST and the railroad under these situations.
- **Local road overcrossings –** Similar conditions occur when an at-grade HST alignment crosses rural roads adjacent to farmland. Figure 2-9 is an example of a typical roadway overcrossing of the HST tracks; these overcrossings would generally occur approximately every 2 miles to provide continued mobility for local residents and farm operations.

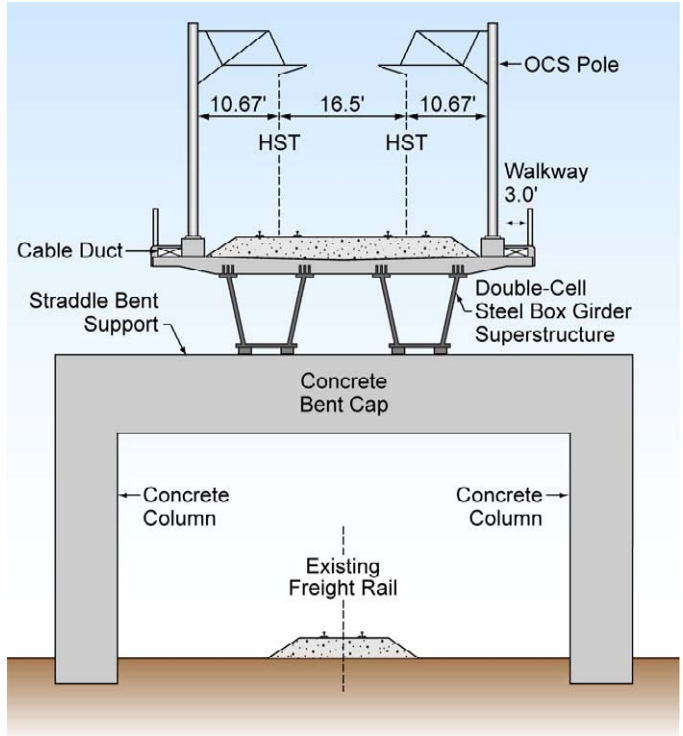


Figure 2-7
Straddle Bent Typical Cross Section

- **Elevated HST road crossings –** In urban areas, it may be more feasible to raise the HST as shown previously in Figures 2-6 and 2-7. This is especially relevant in downtown urban areas where use of an elevated HST guideway would minimize effects on the existing roadway system.
- **Roadway undercrossings –** The Merced to Fresno Section would require an undercrossing for both northbound and southbound directions of the HST guideway to travel over SR 145 in Madera. Figure 2-10 illustrates how a roadway would be grade-separated below the HST guideway.

2.2.2.6 Railroad Wye

Another component of HST tracks is how the tracks are configured to change directions. The transition to a wye would require splitting two tracks into four tracks crossing over one another before the wye legs can diverge in opposite directions to allow bidirectional travel. Based on HST design criteria, this transition would require approximately 2 miles, with an estimated 120-foot-wide right-of-way for the transition before the tracks have fully diverged from each other. Figure 2-11 provides a diagram showing how the wye would transition the HST from the east-west alignment to the north-south direction. As shown, some of the tracks must cross over the opposite northbound or southbound track.

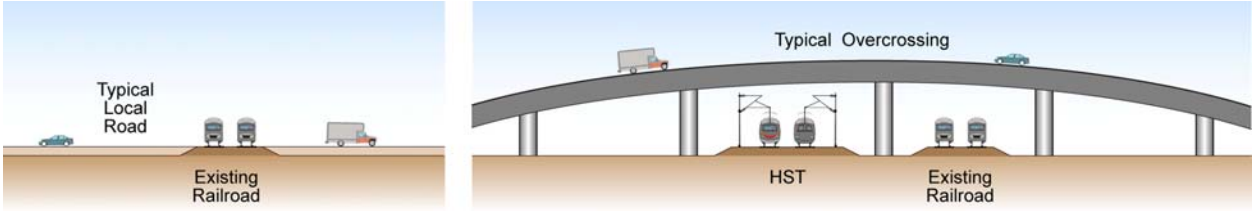


Figure 2-8
Replacing Local At-Grade Crossings with New Overcrossings above HST Guideway and Existing Railroad Trackway

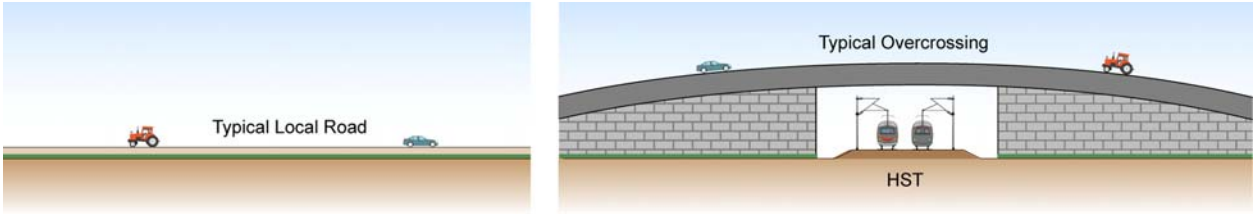


Figure 2-9
Adding Local Roadway Overcrossings above HST Guideway

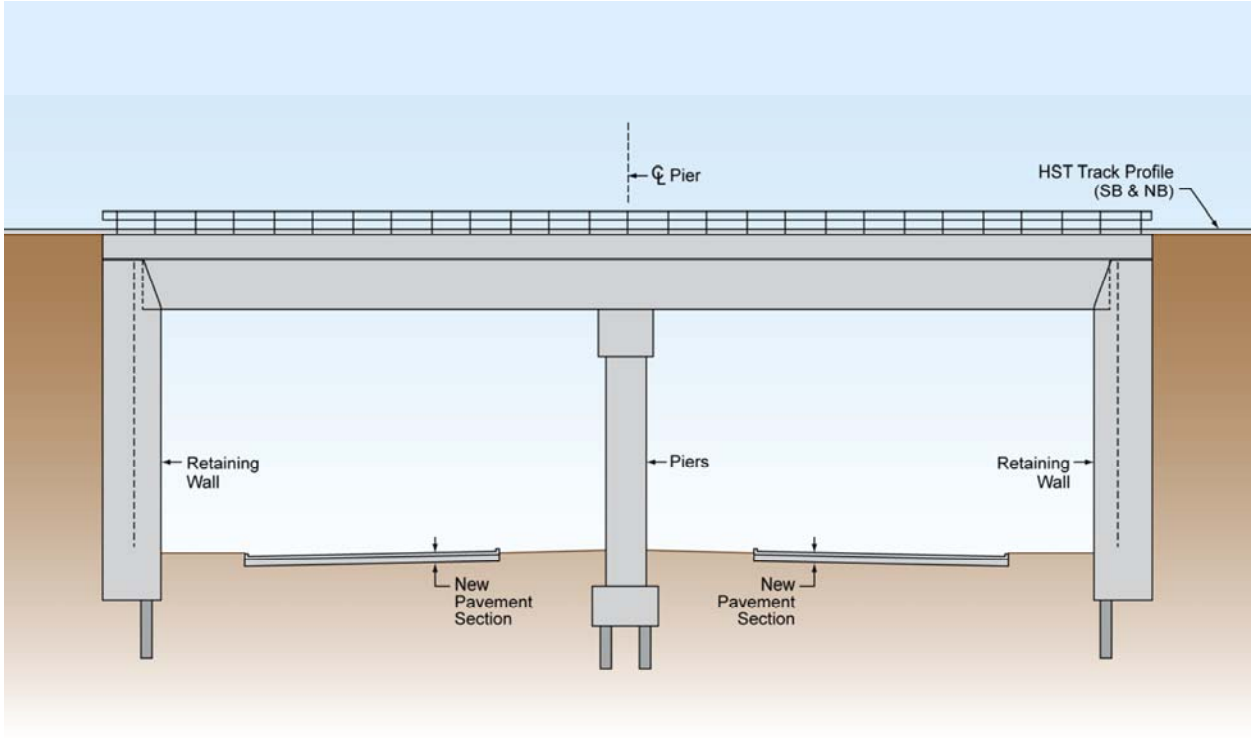


Figure 2-10
Typical Cross Section of Roadway Grade-Separated Beneath HST Guideway

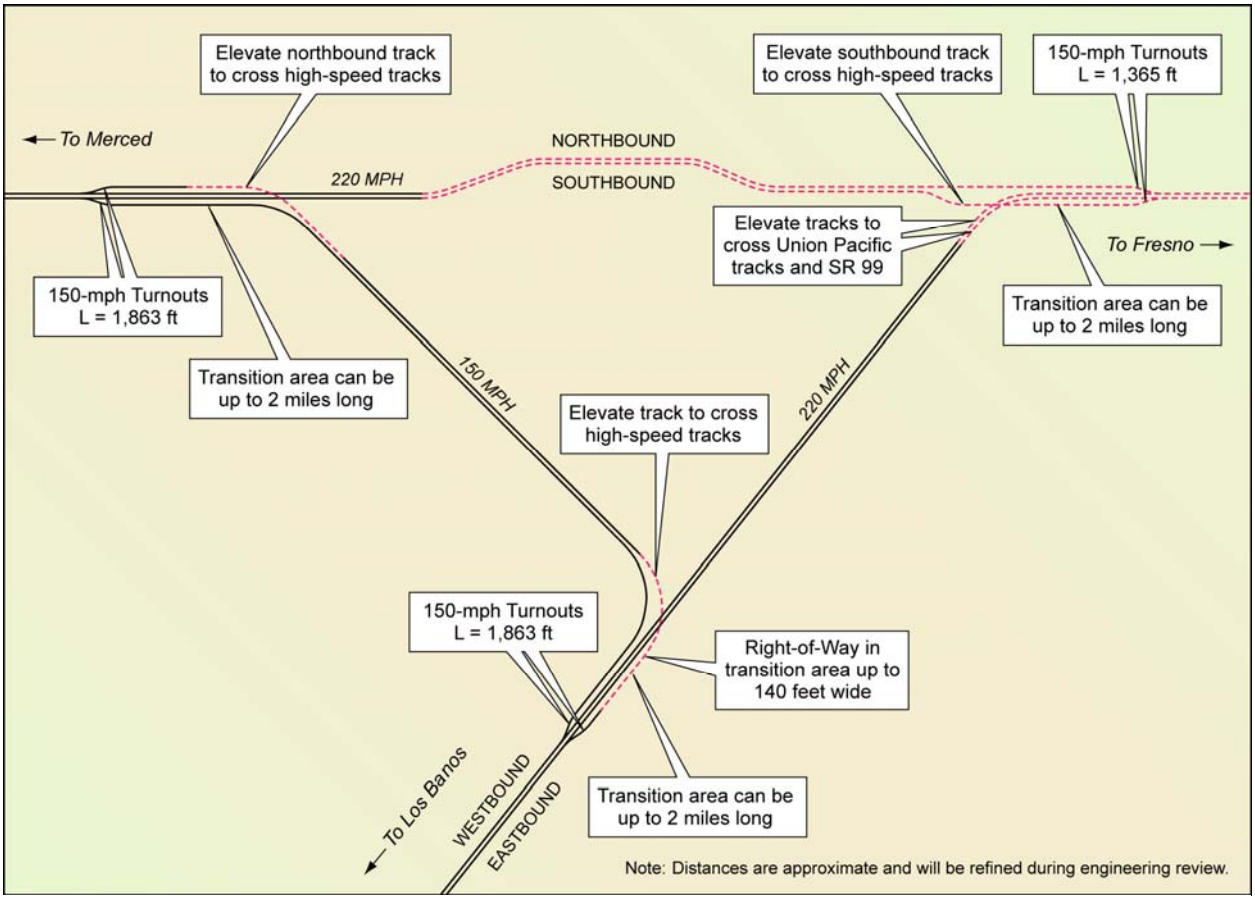


Figure 2-11
Diagram of a Wye Formation

2.2.3 Train Stations

Stations would be sited and designed to allow for connection to local transit, airports, and highways; to maximize the use of existing transportation corridors and rights-of-way; and to develop a practical and economically viable transportation system. All stations would contain the following elements:

- Station buildings of 40,000 to 60,000 square feet that are two to three stories high and contain passenger boarding platforms, ticketing, waiting areas, passenger amenities, employee areas, and baggage and freight handling areas.
- Parking structures of 5 to 8 acres in Merced and Fresno.
- Waiting areas and queuing space for taxis and shuttle buses.
- Pedestrian connections.

2.2.4 Electrical System

California's electricity grid would power the HST System. The HST System is expected to require less than 1% of the state's future electricity demand. In 2008, a study performed by Navigant Consulting, Inc. found that, while the HST System would be supplied with energy from the California grid and it is not feasible to physically control the flow of electricity from particular sources (Navigant Consulting 2008), it would be feasible for the Authority to obtain the quantity of power required for the HST System from

100% clean, renewable energy sources through a variety of mechanisms, such as paying a clean energy premium for the electricity consumed.

The Merced to Fresno Section 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 project corridor. These power substations are needed to even out the power feed to the HST System. A description of the Merced to Fresno Section electrical system is provided below.

2.2.4.1 Traction Power Distribution

Overhead Catenary System

The Overhead Catenary System (OCS) would consist of a series of mast poles approximately 23.5 feet higher than the top of rail, with contact wires suspended from the mast poles between 17 to 19 feet from top of rail. The train would have an arm, called a pantograph, to maintain contact with this wire to provide power to the train. The mast poles would be spaced approximately every 200 feet along straight portions of the track down to every 70 feet in tight-turn track areas. The OCS would be connected to the substations described below, required at approximately 30-mile intervals. Statewide, the power supply would consist of a 2-by-25-kilovolt (kV) overhead contact system for all electrified portions of the system.

Traction Power Substations

Based on the HST System's estimated power needs, Traction Power Substations (TPSSs) would each need to be approximately 32,000 square feet (200 feet by 160 feet) and located at approximately 30-mile intervals.

TPSSs would have to accommodate the power supply stations and would require a substantial buffer area around them for safety purposes. The TPSS could be screened from view with a wall or fence. Each TPSS site would have a 20-foot-wide access road (or easement) from the street access point to the protective fence perimeter at each parcel location. Each site would require one 2-acre parcel. Each substation would include an approximately 450-square-foot control room.

Switching and Paralleling Stations

Switching and paralleling stations work together to balance the electrical load between tracks, and to switch power off or on to either track in the event of an emergency. Switching stations would be required at approximately 15-mile intervals, midway between the TPSSs. These stations would need to be approximately 9,600 square feet (120 feet by 80 feet). Paralleling stations would be required at approximately 5-mile intervals between the switching stations and the TPSSs. The paralleling stations would need to be approximately 8,000 square feet (100 feet by 80 feet). Each station would include an approximately 450-square-foot (18 feet by 25 feet) control room. TPSS, switching stations, and paralleling stations are included in each alternative design as appropriate.

Back-up and Emergency Power Supply Sources

During normal system operations, power would be provided by the local utility service and/or from the TPSS. Should the flow of power be interrupted, the system would automatically switch to a back-up power source, through use of an emergency standby generator, an uninterruptable power supply, and/or a DC battery system.

For the Merced to Fresno Section, permanent emergency standby generators are anticipated to be located at passenger stations and at the HMF, and terminal layup/storage and maintenance facilities. These standby generators are required to be tested (typically once a month for a short duration) in accordance with National Fire Protection Association (NFPA) 110/111 to ensure their readiness for back-up and emergency use. If needed, portable generators could also be transported to other trackside facilities to reduce the impact on system operations.

Signaling and Train Control Elements

Signaling and train control elements include small signal huts/bungalows within the right-of-way that house signal relay and microprocessor components, cabling to the field hardware and track, signals, and switch machines on the track. These would be located in the vicinity of track switches, and would be grouped with other power, maintenance, station, and similar HST facilities where possible.

2.2.5 Operation and Maintenance Systems

California's HST System includes three types of maintenance facilities. Each section would have maintenance-of-way facilities. A number of overnight layover and servicing facilities would be distributed throughout the HST System. In addition, the HST System would have a single HMF. A description of each maintenance facility is provided below.

2.2.5.1 Maintenance-of-Way Facilities

Maintenance-of-way facilities would provide for equipment, materials, and replacement parts storage, and support quarters and staging areas for the HST System subdivision maintenance personnel. Each subdivision would cover about 150 miles; the maintenance-of-way facility would be centrally located in the subdivision, no more than 75 miles in each direction.

The maintenance-of-way facility would sit on a linear site adjacent to the HST tracks with a maximum width of two tracks, and would be approximately 0.75 mile long for a total size of 26 acres. One maintenance-of-way facility would be necessary in the Merced to Fresno Section. This facility might be located within the HMF if such a facility were reasonably close to Merced. Additionally, for lengths of mainline track that are relatively distant from stations and/or maintenance-of-way facilities, a refuge track would be sited to provide temporary storage of work trains as they perform maintenance in the vicinity of the track. The track would be approximately 1,600 feet long, would not have electric power, and would be connected to the main line. Access by road for work crews would be required, along with enough space to park work crew vans while working from the site and to drive the length of the track. The track and access area would be within the fenced and secure area of the HST line. In the Merced to Fresno Section, no such refuge track would be required.

2.2.5.2 Heavy Maintenance Facility

An HST rail heavy vehicle maintenance and layover facility, otherwise known as the HMF, may be located in the Merced to Fresno Section. Figure 2-2 provides the location of the project, including potential HMF site locations. This facility would require 154 acres with space for all activities associated with train fleet assembly, disassembly, and complete rehabilitation; all on-board components of the trainsets; and overnight layover accommodations and servicing facilities. The site would include a maintenance shop, Operations Control Center building, one TPSS, other support facilities, and a train interior cleaning platform. Figure 2-12 shows a typical HMF layout. The property boundaries for each HMF site would be larger than the acreage needed for the actual facility, due to the unique site characteristics and constraints of each location.

The HMF would have two functions. First, it would support train arrival, assembly, testing, and commissioning to operations. Later, it would become the state's system-wide heavy maintenance workshop. The HMF is likely to support the following functions:

- **Assembly, Testing, and Commissioning:** During the pre-revenue service period, the HMF would be used for the assembly, testing, acceptance, and commissioning of the HST System's new trains. Implementation of the testing, acceptance, and commissioning activities would require a mainline test track between 80 and 105 miles in length, connected directly to the HMF. This would also accommodate the equipment decommissioning or retirement of equipment from the system to make way for the future generations of trains.

- **Train Storage:** Some trains would be stored at the HMF prior to the start of revenue service.

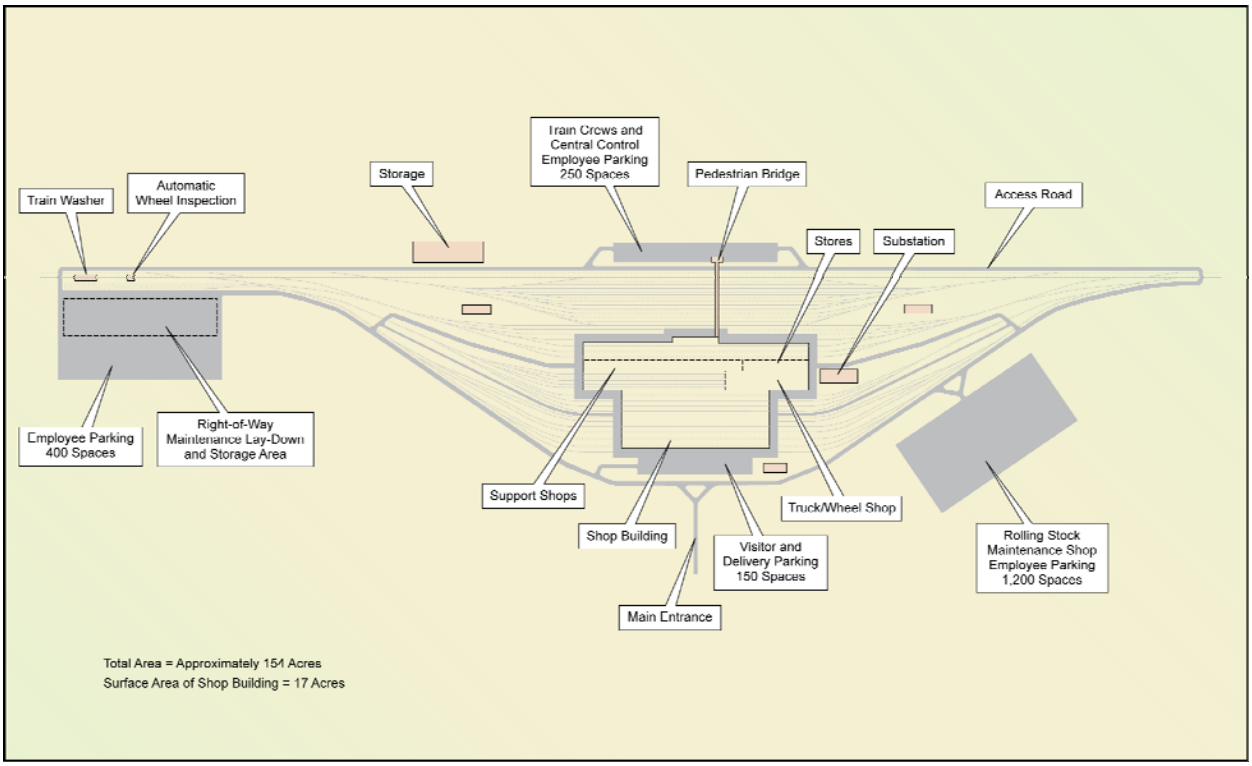


Figure 2-12
Typical HMF Layout

- **Service Monitoring:** Service monitoring would include daily train testing and diagnostics of certain safety sensitive apparatus on the train in addition to automatic on-board and on-ground monitoring devices.
- **Examinations in Service:** Examinations would include inspections, tests, verifications, and "quick" replacement of certain train components on the train. Examples include inspection and maintenance tasks associated with the train's running gear, bogies, underbody elements, and pantographs.
- **Inspection:** Periodic inspections would be part of the planned preventive maintenance program requiring specialized equipment and facilities. Examples include examination of interior fittings and all train parts, passenger environment, in-depth inspection of axles and underbody components critical to train safety, and/or wheel condition diagnostics and re-profiling (wheel truing).
- **Rolling Stock Modifications and Accident Repair:** Rolling stock modifications and accident repair would include major design modifications for improving safety, reliability, and passenger comfort.
- **Overhaul:** Part of planned lifecycle maintenance program, overhauls require a specialized heavy maintenance shop with specific heavy-duty equipment. Activities would include the complete overhaul of train components. Overhauls would be completed on each trainset every 7 to 10 years (30 days per trainset) and mid-life overhauls would be performed on each trainset every 15 to 20 years (45 days per trainset).

A single, gated entry would control access to the HMF. A two-way, 24-foot-wide circulation road would follow the facility's interior perimeter and a 50-foot-wide asphalt apron would surround the main shop building to provide emergency vehicles access to the structure.

About 1,200 to 1,500 employees could be accommodated during peak shifts, including overlapping personnel departures and arrivals. The HMF would require parking for approximately 1,200 vehicles based on an estimate of 80% automobile share, and assuming 20% of employees would use public transportation or ride-share. In addition, up to 150 parking spaces near the facility would be available for management and administrative personnel, visitors, deliveries, and parking. Some crew, rolling stock preparation personnel, and train yard employees would park their vehicles near the yard tracks. Thus, the plan would include spaces for approximately 50 crew, 50 rolling stock preparation personnel, and 150 yard support employees at full build-out. A pedestrian bridge over the train yard tracks would connect the employee parking lot to the main shop building.

2.2.5.3 Operations Control Center

The HMF could house the Operations Control Center on the second floor, and would provide space for employee parking, pedestrian access/egress, and appropriate bathroom and lunchroom facilities. Housing the Operations Control Center in the HMF would minimize costs and impacts because it would not increase the HMF's footprint or require a separate building. If not housed on the HMF site, the Operations Control Center would be housed in an office building where adequate and reliable electronic data connections could be provided for up to 200 employees.

2.2.6 Additional Construction Footprint Areas

The construction footprint for the Merced to Fresno Section would consist of staging, laydown, and casting yards for fabrication of the bridge spans for the elevated portions of the alignment. Where feasible, construction staging areas for storage of equipment and materials would be located in areas that ultimately are to be occupied by permanent HST facilities. Additional staging areas may be sited based on the contractors needs. If the contractor needs to establish a temporary staging area near the San Joaquin River, the staging area would be located at least 50 feet from the channel in order to minimize impacts on the riparian corridor. The contractor would establish temporary staging areas in conformance with ESA.

If the pre-cast span method is used to build the concrete bridge spans associated with elevated sections, casting yards of approximately 50 acres would be required. Where feasible, casting yards may be situated in the same footprint as permanent HST structures (e.g., station sites, the HMF).

The HST right-of-way would be fenced and access controlled. The HST right-of-way access road inside of the fenced-in area (to provide access for construction activities) would be paved with asphalt or, at a minimum, gravel coated with a polymer-based binder to reduce dust. This construction access road would be approximately 24 feet wide.

Some disposal of earth unsuitable for reuse in construction (e.g., expansive clays and organic materials) is anticipated. Because the project area is predominantly flat and does not contain geographic barriers, extensive excavation and material removal is not anticipated. The small amounts of material unsuitable for reuse would be hauled off site to a permitted landfill or sold as fill for another project.

2.3 Location of Project Elements

The Merced to Fresno Section HST alignment would traverse the urban downtown areas in the cities of Merced and Fresno. In these urban areas, it would be generally adjacent to SR 99 and the UPRR, as illustrated on Figure 2-2. Refer to Appendix A for a detailed description of the location of the three project alternatives.

2.4 Construction Methods

Contractors may begin construction activities at any point along the HST alignment, and they may operate in more than one location (spread) at a time. A discussion of the construction methods steps is provided below.

2.4.1 Pre-Construction Activities

During final design, the Authority and its contractor will conduct a number of pre-construction activities to determine how best stage and manage the actual construction. These activities include the following:

- Conducting geotechnical investigations which would focus on defining precise geology, groundwater, seismic, and environmental conditions along the alignment. The results of this work would guide final design and construction methods for foundations, underground structures, tunnels, stations, grade crossings, aerial structures, systems, and substations.
- Identifying staging areas and pre-casting yards which would be needed for the casting, storage, and preparation of pre-cast concrete segments, temporary spoil storage, workshops, and the temporary storage of delivered construction materials. Field offices and/or temporary job-site trailers would also be located at the staging areas. As much as practical, construction staging would use the same areas that will ultimately be occupied by permanent HST facilities. For example, staging areas would be placed at the future locations of the HST maintenance yards in Fresno and Merced. Additional staging areas would be located at various points along the HST right-of-way. These staging areas would be spaced roughly evenly between Merced and Fresno, and chosen for their easy access to the local road network and highways. As described below, if the contractor needs to establish a temporary staging area near the San Joaquin River, the staging area would be located at least 50 feet from the riparian corridor in order to minimize impacts on the riparian corridor.
- Initiating site preparation and demolition, such as clearing, grubbing, and grading, followed by the mobilization of equipment and materials. Demolition would require strict controls to ensure that adjacent buildings or infrastructure are not damaged or otherwise affected by the demolition efforts.
- Relocating utilities, where the contractor would work the utility companies to relocate or protect in place high-risk utilities as overhead tension wires, pressurized transmission mains, oil lines, fiber optics, and communications prior to construction.
- Implementing temporary, long-term, and permanent road closures to re-route or detour traffic away from construction activities. Handrails, fences, and walkways would be provided for the safety of pedestrians and bicyclists.
- Locating temporary batch plants, which would be required to produce Portland cement concrete (PCC) or asphaltic concrete (AC) needed for roads, bridges, aerial structures, retaining walls, and other large structures. The facilities generally consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; aboveground storage tanks; and designated areas for sand gravel truck unloading, concrete truck loading, and concrete truck washout. The contractor would be responsible for implementing procedures for reducing air emissions, mitigating noise impacts, and reducing the discharge of potential pollutants into storage drains or watercourses from the use of equipment, materials, and waste products. Conducting other studies and investigations, as needed, such as local business surveys to identify business usage, delivery, shipping patterns, and critical times of the day or year for business activities.

This information would help develop construction requirements and work-site traffic control plans, and will identify potential alternative routes, cultural resource investigations, and historic property surveys.

2.4.2 Major Construction Activities

Major construction activities anticipated for the Merced to Fresno Section include earthwork; bridge and aerial construction; road crossing construction; at-grade construction; construction of elevated structures; construction of elevated structures at the San Joaquin River, railroad systems construction; and station construction. The following sections summarize these activities.

Earthwork

Earth support is an important factor in constructing deep excavations that will be encountered on several alignment sections. It is anticipated that the following excavation support systems may be used along the route. There are three general excavation support categories, which are described below.

- Open-Cut Slope: Open-cut slope is used in areas where sufficient room is available to open-cut the area and slope the sides back to meet the adjacent existing ground. The slopes are designed similar to any cut slope, taking into account the natural repose angle of adjacent ground material and global stability.

- Temporary: Temporary excavation support structures are designed and installed to support vertical or near vertical faces of the excavation in areas where room to open-cut does not exist. This structure does not contribute to the final load carrying capacity of the tunnel or trench structure and is either abandoned in place or dismantled as the excavation is being backfilled. Generally, it consists of soldier piles and lagging, sheet piles, slurry walls, secant piles, or tangent piles.

- Permanent: Permanent structures are designed and installed to support vertical or near vertical faces of the excavation in areas where room to open-cut does not exist. This structure forms part of the permanent final structure. Generally, it consists of slurry walls, secant piles, or tangent pile walls.

Bridge and Aerial Structure Construction

Similar to existing high-speed rail systems around the world, it is anticipated that the elevated guideways will be designed and built using pre-fabricated elements such as single-cell pre-cast-prestressed concrete box span-by-span segmental girder construction. Where needed, other structural types will be considered and used, including steel plate and box girders, steel trusses, and cable-supported structures.

- Foundations: A typical aerial structure foundation pile cap is supported by an average of four large-diameter piles with diameters ranging from 5 to 9 feet. Commonly referred to as drilled shafts, they are holes drilled to the design depth and filled with reinforced concrete. Depth of piles depends on geotechnical site conditions. Pile construction can be achieved by using rotary drilling rigs, and either bentonite or synthetic slurry along with temporary steel pipe casings may be used to stabilize pile shaft excavation. The estimated pile production rate varies with the diameter and depth of the drilled hole, with an estimate of 3 to 4 days per pile for installation of the larger diameter elements. Additional pile installation methods available to the contractor include bored piles, rotary drilling cast-in-place piles, driven piles, and a combination of pile jetting and driving.

- Upon completing the piles, pile caps can be constructed using conventional methods. For pile caps constructed near existing structures such as railway, bridges, and underground drainage culverts, temporary sheet piling can be used to minimize disturbances to adjacent structures. It is anticipated that sheet piling installation and extraction can be achieved using vibratory pile driving equipment where impact driving would affect adjacent facilities or sensitive resources.

- Substructure: Aerial structures with pier heights ranging from 20 to 90 feet may be constructed using conventional slip form and scaffolding methods. A self-climbing formwork system may be used to construct piers and portal beams over 90 feet high. The self-climbing formwork system is equipped with a winched lifting device, which is raised up along the column by hydraulic means with a structural frame mounted on top of the previous pour. In general, a 3-day cycle for each 12 feet of pour height can be achieved. The final size and spacing of the piers depends on the type of superstructure and spans they are supporting.

- Superstructure: It will be necessary to consider the loadings, stresses, and deflections encountered during the various intermediate construction stages, including changes in statical scheme, sequence of tendon installation, maturity of concrete at loading, and load effects from erection equipment. As a result, the final design will depend on the contractor's means and methods of construction and can include several different methods, such as a span-by-span, incrementally launched, progressive

cantilever, balanced cantilever, etc. Where structures are to be constructed over areas containing sensitive resources, top down methods will be used to minimize impacts on those resources.

Road Crossing Construction

Road crossings of existing railroads, roads, and the HST System would be constructed on the line of the existing road or offline at some locations. When constructed online, the existing road would be closed or temporarily diverted. When constructed offline, the existing road would be maintained in use until the new crossing is completed.

Construction of At-Grade Sections

Contractors would begin construction of at-grade sections by excavating or leveling the ground surface. They would typically grade and excavate up to 3 feet prior to building up the rail bed, although excavations of up to 6 feet could be necessary where highly compressible soils, such as peat or soft clay, are present and cannot be remedied by other means due to construction or cost constraints. Following initial grading, contractors would move earth for use in the rail bed, construct the trackbed using scrapers to expand cuts, and then deposit material to build up the rail bed. They may also use materials to build embankments for nearby overpasses. Contractors would obtain borrow materials from existing, permitted borrow pits and quarries, and complete construction of the rail bed using ballast material from existing permitted quarries.

Construction of Elevated Structures

Contractors may implement various methods of construction for the elevated portions of the Merced to Fresno Section, using cast-in-place (CIP) or pre-cast concrete and structural steel in various combinations. Installation methods along with equipment required to install the elements of a structure will vary depending on the method. Under the pre-fabricated method, the contractor would produce the various pre-fabricated elements offsite, while concurrently constructing the substructure required to support them at the various locations. Once the substructure is complete, the pre-fabricated elements would be transported to the job site for installation whether they are retaining wall components, part of a column/pier, or the super-structure. Contractors may produce large pre-fabricated bridge segments at a temporary, purpose-built facility, known as a fabrication/casting yard. To provide enough onsite concrete, portable concrete batch plants would be used during construction of the alignment sections. Portable batch plants have a footprint of approximately 2,500 to 3,000 square feet, and would be strategically located so that concrete hauls to the construction site do not exceed 40 minutes to minimize impacts on the quality of the concrete due to extended travel time once mixed.

Once completed, the contractors would move each pre-fabricated element on a special wheeled transporter to the job site for installation. Depending on the type of pre-fabricated element, the transporters may travel atop the already-completed portion of the viaduct and then feed a segment to a special gantry crane (which would also sit atop the already completed viaduct) that hoists and positions the segment. The contractors would then place the segments on piers constructed prior to arrival of the segments at the site.

The Authority currently prefers the pre-cast span-by-span segmental method over more conventional methods of viaduct construction because it appears to be less expensive, faster, and results in less schedule uncertainty. However, they are considering using other methods for all or part of the viaducts, including the CIP method, box girders, erection of specially designed steel structures, American Association of State Highway and Transportation Officials girders, pre-cast segmental balanced cantilevers, and pre-cast segmental span-by-span.

Construction of Elevated Structures at the San Joaquin River

The HST track would be elevated from approximately 1,000 to 1,500 feet north of the north bank of the San Joaquin River to just north of Veterans Boulevard, a distance of between 9,000 to 12,000 feet. The soffit, or lowest portion of the structure, spanning over the waterway would be a minimum of 10 to

15 feet above the top bank on both sides of the river, providing ample clearance for passage of flood flows and wildlife. The section of the elevated structure or guideway that crosses the San Joaquin River is anticipated to be supported on foundations consisting of cast-in-drilled-hole (CIDH) with CIP concrete column extensions, as illustrated on Figures 2-13 and 2-14.

Where required, the construction of foundations within the active waterway will use construction methods such as installation of sheet pile cofferdams to isolate the activity from the live stream in order to avoid or minimize the potential for impacts on anadromous fish within the Action Area (see Section 3.1). In addition, both temporary and permanent steel casings for CIDH pile construction and piling for falsework would use vibratory pile hammers for installation.

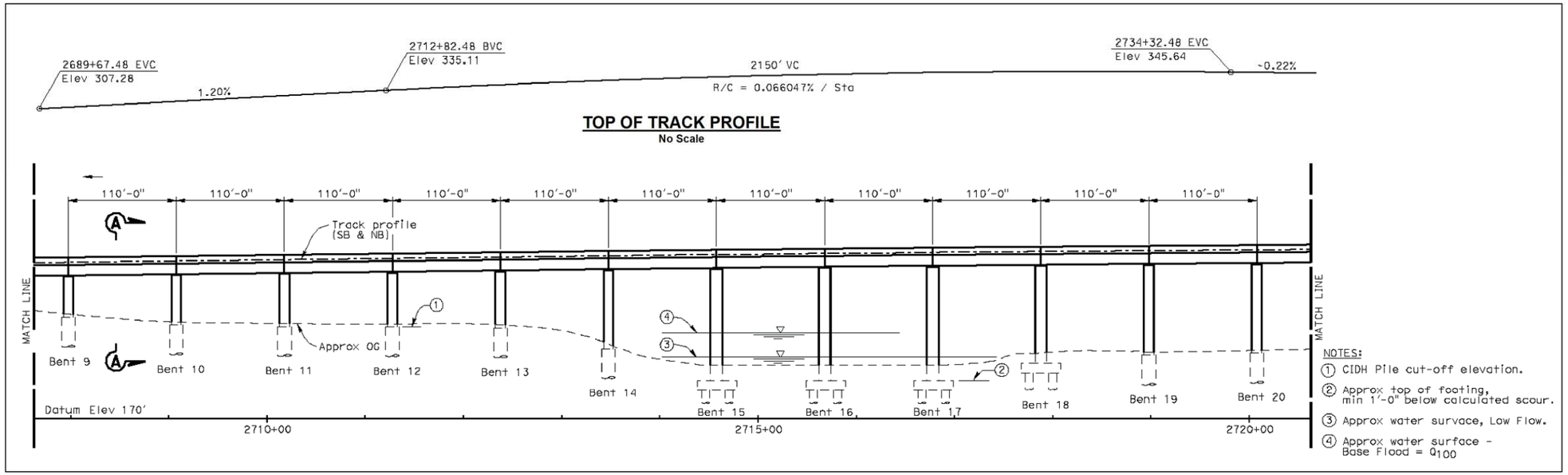
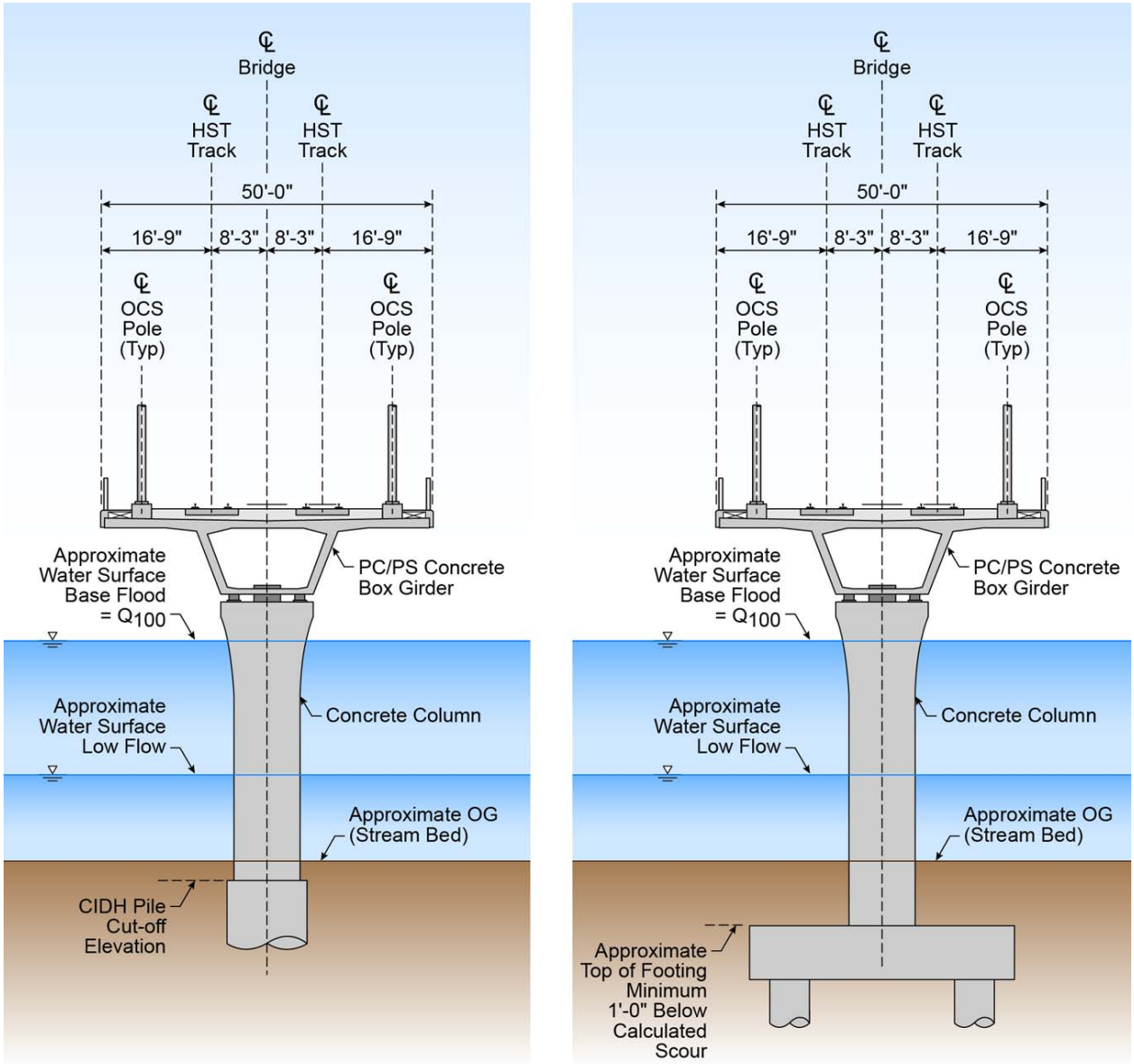


Figure 2-13
San Joaquin River Crossing Profile and Elevation Plan



(a) PC/PS Concrete Box Girder on CIDH Pile

(b) PC/PS Concrete Box Girder on CIDH Pile Footing

Figure 2-14
San Joaquin River Crossing – Typical Sections

The number of foundation elements would be directly related to the span arrangement necessary to meet the requirements for bridge hydraulics. The Merced to Fresno Section is upstream of the California Department of Transportation's SR 99 bridge structure; therefore, the hydraulic effect of the placement of new piers within the flow on downstream structures and the geomorphology of the channel will be considered and issues addressed, as appropriate, during the design of the final configuration of the structure and foundation elements.

Railroad Systems Construction

The railroad systems are to include trackwork, traction electrification, signaling, and communications. After completion of earthwork and structures, trackwork is the first rail system to be constructed, and it must be in place to start traction electrification and railroad signalizing installation.

Trackwork construction generally requires the welding of transportable lengths of steel running onto longer lengths (approximately 0.25 mile), which are placed in position on crossties or track slabs and field-welded into continuous lengths.

Tie and ballast track construction typically requires that crossties and ballast be distributed along the trackbed by truck or tractor. In sensitive areas such as where the HST is parallel to or near streams, rivers, or wetlands, and in areas of limited accessibility, this operation may be accomplished by using the established right-of-way with material delivery via the constructed rail line.

An alternative to ballasted track construction is using a slab track system. Slab track construction techniques include using slipped form paving machines, top down construction, grouted pre-cast panels set on a poured slab, or conventional paving machines. Slab track may be built directly on tunnel inverts, at grade over prepared subgrade, or on aerial structures.

Traction electrification equipment to be installed includes TPSSs and the OCS. TPSSs are typically fabricated and tested in a factory, then delivered by tractor-trailer to a prepared site adjacent to the alignment. It is assumed that TPSSs are to be located every 30 miles along the alignment. The OCS is assembled in place over each track and includes poles, brackets, insulators, conductors, and other hardware.

Signaling equipment to be installed includes wayside cabinets and bungalows, wayside signals (at interlocking), switch machines, insulated joints, impedance bounds, and connecting cables. The equipment will support automatic train protection, automatic train control, and positive train control to control train separation, routing at interlocking, and speed.

Station Construction

As HST stations for the Merced to Fresno Section would be newly constructed, existing train operations, including station capacity and passenger levels of service, would be maintained during construction. The typical construction sequence would be:

- Demolition and Site Preparation: The contractor would be required to perform street improvement work, site clearing and earthwork, drainage work, and utility relocations. Additionally, substations and maintenance facilities are assumed to be newly constructed structures. For platform improvements or additional platform construction, the contractor may be required to realign existing track.
- Structural Shell and Mechanical/Electrical Rough-Ins: For these activities, the contractor would construct foundations and erect the structural frame for the new station, enclose the new building, and/or construct new platforms and connect the structure to site utilities. Additionally, the contractor would rough-in electrical and mechanical systems and install specialty items such as elevators, escalators, and ticketing equipment.
- Finishes and Tenant Improvements: The contractor would install electrical and mechanical equipment, communications and security equipment, finishes, and signage. Additionally, the contractor may install other tenant improvements if requested.

2.4.3 Construction Utility Requirements and Waste Disposal

Contractors would need to use water for construction activities such as demolition of surface and subsurface features, dust control, soil compaction, landscape restoration, concrete work, general cleanup,

hygiene, and drinking. If no water sources exist near the site, then contractors would use tanker trucks, storage tanks, and water towers to provide water to the site.

Contractors would temporarily store excavated materials produced by construction activities in designated areas at or near the construction site. Wherever possible, they would return excavated soil to its original location to be used as backfill, and dispose waste materials associated with construction in local landfills permitted to take these types of materials. Material unsuitable for reuse would to be hauled offsite to a permitted location in conformance with ESA.

2.4.4 Construction Materials and Equipment

Materials required for construction include steel rails, building materials for the maintenance facilities, control buildings, and power supply facilities, as well as concrete, reinforcing steel, ballast, cement, aggregates, specialized train system components, fuel, and water. Materials would be delivered and stored at the Merced to Fresno Section project site for use. Various construction equipment would be used and staged at the site, including but not limited to cranes, pile drivers, dump trucks, bulldozers, and bucket loaders.

In procuring fill materials to build the grade-separated alignment, the Authority would attempt to identify available material from existing quarries as close to the construction site as practicable. For temporary fill material to be used within the San Joaquin River, the contractor would be required to use native material similar to that within the Action Area. In procuring fill materials to build the grade-separated alignment, the contractor would source the materials in conformance with ESA and the California Department of Transportation's standard specifications.

2.5 Construction Schedule

This section describes the Merced to Fresno Section construction schedule. The specific construction phases and durations are presented below.

Mobilization and Site Preparation (8 to 12 months): Relocate utilities and clear and grub right-of-way (demolition); establish detours and haul routes; erect safety devices and mobilize special construction equipment; prepare construction yards; stockpile materials; and establish PCC segment casting yards.

Heavy Construction (30 to 36 months): Construct viaducts, grade separations, highway realignments, surface streets, and major facilities (maintenance, stations, etc.).

Medium Construction (6 to 9 months): Lay tracks; construct drainage facilities; and conduct backfilling operations and street paving.

Light Construction (12 to 18 months): Install and test systems (train control systems, OCS, communication system), traffic signals, street lighting, striping; close detours; and conduct site cleanup.

2.6 Operations and Maintenance

This section describes operations and maintenance for train service, lighting, and maintenance and inspection activities.

2.6.1 Train Service

Three categories of trains would be operated (Parsons Brinkerhoff 2008). Express trains would run between major stations (e.g., San Francisco, Los Angeles, and San Diego). An express train could make the trip between San Francisco and Los Angeles in 2 hours and 40 minutes. Express trains would not stop at and would travel through the two HST stations in the Merced to Fresno Section on dedicated through-tracks. Limited-stop trains would provide service to some intermediate stations, as well as to the major

stations. All-stop trains would make all stops between the two terminus stations. Trains will be spaced at least 3 minutes apart.

2.6.2 Lighting

In general, the right-of-way would not be lighted except at stations and associated maintenance and electrical facilities. Station lighting would be designed to provide safety for arriving and departing passengers within urban areas. Maintenance and electrical facilities would have permanent lighting for both interior and exterior areas, as needed to support operations, including those requiring lighting 24 hours per day. Typically, exterior lights would be mounted on tall masts, towers, or poles, and flood the area with sodium or mercury-vapor light. The lights would be angled toward the ground to limit reflectance on the surrounding community.

2.6.3 Maintenance and Inspection Activities

During operation of the HST System, programmed inspection and maintenance would be performed to verify that the project components are functioning as required. A maintenance-of-way program would be instituted to schedule inspection and maintenance activities. The maintenance-of-way program has two types of activities: preventative maintenance and corrective maintenance (Parsons Brinkerhoff 2008). Preventative maintenance would maintain the quality of the system and aid in defining a maintenance cycle for each project component type. Corrective maintenance would establish the level of performance of the infrastructure for both safety and comfort. Corrective maintenance is anticipated to be performed within the rail line right-of-way during off-peak hours of operation, or at power supply system facilities. Corrective maintenance would consist of light maintenance (not affecting operations and speed), heavy maintenance (affecting operations), or major renewals (full or partial interruption of traffic).

Regular maintenance for the HST would include the following activities:

- Inspection and repair of the rail line, the power supply system, and the maintenance facilities.
- Annual vegetation control, re-grading, and ballast application.
- Culvert replacement along road crossings and debris clearance from the rail lines, as necessary.
- Regular inspection of foundation elements at river crossings, such as the San Joaquin River Crossing, are expected to occur on a bi-annual basis for exposed elements (accessible on foot or by light vehicle) and on a 5-year cycle for the inspection of components which are underwater and require a dive team for the process.

Long-term maintenance may include intermittent activities, such as replacing short lengths of rail or ballast.

2.7 Conservation Measures to Be Incorporated into Project Design

To minimize and avoid the effects of the Merced to Fresno Section on federally listed species, a number of conservation measures would be implemented. These measures are intended to reduce direct and indirect effects on listed species from project construction and operation (including maintenance activities). Compliance with applicable environmental regulations would further mitigate potential impacts on biological resources and wetlands, and the BO issued at the end of this consultation process would result in additional project-specific avoidance and minimization measures.

The Authority and FRA would require the use of best management practices (BMPs) and avoidance and minimization measures to reduce or avoid adverse effects on federally listed species. Compensatory mitigation would be provided where effects on protected species and habitats cannot be avoided. General avoidance, minimization, and compensatory mitigation measures for potential adverse effects on federally

listed species are listed below. Species-specific conservation measures are described in more detail in Section 5.

2.7.1 Avoidance Minimization Measures

This section describes the following avoidance and minimization measures to minimize and avoid project effects on federally listed species:

- Construction work window restrictions.
- Pre-construction surveys.
- Contractor education and environmental training.
- Biological monitoring during construction activities.
- Avoidance of Environmentally Sensitive Areas, wildlife exclusion fencing, and non-disturbance zones.
- Mitigation for obstructed wildlife movement zones.
- Relocation of federally listed wildlife species.
- Restoration of temporarily disturbed areas, cleaning of construction equipment.
- Dewatering/water diversion.
- Avoidance of special-status species entrapment.

- San Joaquin River Plan and Final Design.

2.7.1.1 Construction Work Window Restrictions

Due to the number of federally listed species potentially affected by the Merced to Fresno Section and the conflicting potential construction work windows for each species or their habitat, construction work window restrictions would be determined through agency consultation. Since construction work window restrictions may not reduce effects on all federally listed wildlife species, additional measures may be required, as determined by the natural resource regulatory agencies. These measures may include provision of non-disturbance zones, additional site- or species-specific biological monitoring, or approved passive or active species relocation.

Construction work window restrictions for special aquatic resources would be implemented to reduce potential direct and indirect effects of construction activities on federally listed species within those habitats. Construction activities in special aquatic resources (e.g., vernal pools, seasonal wetlands, seasonal riverine areas, riparian areas) would be restricted during the rainy season (October 15 to April 15) or would be conducted when the resource is dry (i.e., lacks flowing or standing water). In the event that construction work window restrictions cannot be met, the use of dewatering, water diversions, or additional BMPs would be employed as determined through consultation with the U.S. Army Corps of Engineers (USACE), USFWS, NMFS, CDFG, and the Regional Water Quality Control Board (RWQCB) to enable the subject activity. Additional mitigation measures may be necessary to reduce or lessen the nature and magnitude of significant adverse effects when construction work window restrictions are not feasible (e.g., nesting bird surveys, non-disturbance exclusion zones, resource and species monitoring).

Construction work window restrictions for the San Joaquin River and other waterway crossings would include the following:

- Work within the wetted perimeter of the river channel is assumed to occur between June 15 and October 15 to minimize impacts on aquatic species and other aquatic resources.

- Where the Central Valley Flood Protection Board (CVFPB) has defined the limits of a designated floodway, work within those limits will be typically restricted between April 15 to October 31 for flood protection issues, unless otherwise authorized by the CVFPB.

- Material and equipment storage within close proximity to the river channel areas will be limited to the restricted period from April 15 to October 31. Equipment may enter into the restricted river channel areas but will be removed daily and stored outside of the areas subject to flooding.

2.7.1.2 Pre-Construction Surveys

Prior to the start of construction, a qualified biologist(s) would conduct preconstruction survey(s) for special-status species (wildlife and plants) and special aquatic resources. Pre-construction surveys would be conducted: (1) in general accordance with the appropriate technical guidance documents approved by the USACE, USFWS, CDFG, and the California Native Plant Society (CNPS); and (2) in accordance with standard professional practice.

Based on the results of the pre-construction surveys, additional mitigation measures may be implemented including those discussed below.

2.7.1.3 Contractor Education and Environmental Training

Personnel who work onsite would attend a contractor education and environmental training session. The environmental training would cover general and specific biological and legal information on federally listed species and their habitats. The training sessions would be given by the site biological monitor before the initiation of construction activities and repeated, as needed. Daily updates and synopsis of the training would be performed during the daily safety ("tailgate") meeting. HST maintenance crews will be required to attend a contractor education and environmental training annually.

2.7.1.4 Biological Monitoring During Construction Activities

A qualified USFWS-approved biological monitor would be present onsite during key construction activities, including during ground-disturbance activities and for all construction activities conducted within or adjacent to identified Environmentally Sensitive Areas, Environmentally Restricted Areas (ERA), Wildlife Exclusion Fence (WEF) zones, or non-disturbance zones to oversee permit compliance and monitoring efforts. The onsite biologists would advise the contractor on methods that may minimize or avoid impacts on federally listed species.

2.7.1.5 Environmentally Sensitive Areas, Wildlife Exclusion Fencing, and Non-disturbance Zones

Fencing would be used to establish non-disturbance exclusion zones to restrict construction equipment and personnel from entering Environmentally Sensitive Areas or restrict wildlife species from entering the construction areas. Environmentally Sensitive Areas and ERAs would include sensitive habitats that may support federally listed species and areas within limits of indirect effect for federally listed species, as identified by the regulatory agencies in their permit documents. The non-disturbance zones would be determined through consultation and permitting with the various natural resources regulatory agencies.

Two types of fencing would be used for these purposes. Environmentally Sensitive Area fencing would be located and depicted on the project plans and delineated in the field by the biological monitor. The contractor would ensure that all Environmentally Sensitive Areas and ERAs are off-limits to construction personnel and equipment. Species-appropriate WEF would be installed along the outer perimeter of Environmentally Sensitive Area fencing.

2.7.1.6 Mitigation for Obstructed Wildlife Movement

The installation of Environmentally Sensitive Area fencing and WEF around sensitive resource areas could lead to as much as 7 miles of linear obstruction to wildlife movement and migration in natural habitat areas for 2 to 5 consecutive years. To mitigate the impacts of Environmentally Sensitive Areas, ERA fencing, and WEF on federally listed wildlife species and their movement/migration corridors, artificial dens would be installed along the outer perimeter of the fencing. To mitigate the effects of project operations on wildlife movement and migration corridors, the following measures would be implemented:

- Design plans would be further refined to identify optimal wildlife undercrossing land details within the referenced linkages.

- Artificial dens would be installed at dedicated wildlife crossing structures to prevent predation by larger predators at wildlife undercrossing and to provide escape cover for wildlife (e.g., San Joaquin kit fox [*Vulpes macrotis mutica*]).

2.7.1.7 Relocation of Federally Listed Wildlife Species

Federally listed wildlife species detected within the limit of direct effect (see Section 3.1) during construction would be relocated by the biological monitor in accordance with agency guidance, as approved by the appropriate natural resources agencies, when necessary, or in accordance with standard practice.

2.7.1.8 Restoration of Temporarily Disturbed Areas

Temporarily disturbed biological communities or habitats that could support federally listed species and special aquatic resources would be restored to pre-project conditions. Restoration activities would include, but not be limited to, the following: grading landform contours to approximate pre-disturbance conditions, removal of invasive plant species, and revegetating temporarily disturbed areas using native plant species to the extent possible, and using certified weed-free straw and mulch.

A site restoration plan would be prepared to identify appropriate restoration activities, establish a monitoring schedule, describe the materials that should be used, identify timing of the work, identify monitoring requirements and success criteria, and recommend contingency measures.

2.7.1.9 Cleaning of Construction Equipment

During construction, equipment would be washed before entering the work area. Mud and foreign plant materials would be removed from construction equipment when working in native plant communities, near sensitive biological communities, or in areas where special-status plant species have been identified.

2.7.1.10 Dewatering and Water Diversion

If construction occurs where open or flowing water is present, a strategy approved by the resource agencies (e.g., USACE, RWQCB, NMFS) would be used to dewater or divert water from the immediate work area. It is possible that diversion of the San Joaquin River at the work area would be required to place temporary falsework and to construct the new bridge. A discussion of a possible strategy used to divert water from the work is described below.

Where foundations require a single large-diameter CIDH pile support or concrete footing supported on multiple CIDH piles, a cofferdam will need to be constructed. The cofferdam for the large-diameter CIDH may come in the form of a permanent steel casing up to just above the waterline, while a sheet-pile type cofferdam may be used in order for the pile footing to be constructed below the invert of the channel. Access to the pile/footing locations would be either by temporary work trestle or by bridge supported on driven piling. A temporary embankment/work pad(s) constructed of clean, local cobble and gravel substrate material approved both by the USACE and NMFS would be used to divert the San Joaquin River's flow and maintain dry work area conditions. Flows would be diverted either into temporary culvert pipes that pass through the embankment/work pad(s) or to a channel opening provided between the end of the temporary embankment and the north bank of the river.

The temporary work pad(s) would be used to support drilling equipment for the construction of the CIDH piles, which would have either temporary or permanent steel casing placed to support the walls of each hole during drilling. Below the CIDH foundation, a slurry displacement method would be used to control groundwater intrusion into the pile excavation; drilling fluids would be controlled using special equipment and BMPs for these activities.

In order to avoid and/or minimize potential effects that could result from these activities, the following measures would be implemented:

- Develop and Implement a Stormwater Pollution Prevention Plan. Temporary construction BMPs would be implemented in accordance with the Merced to Fresno Section plans and specifications as well as the approved Stormwater Pollution Prevention Plan (SWPPP). BMPs may include, but would not be limited to, silt fences, fiber rolls, straw bales, sandbag barriers, check dams, and sediment basins.

- Pile Driving Underwater Sound Pressure Measures. The following measures would be implemented to avoid and minimize potential adverse effects that could otherwise result from in-water pile-driving activities:

    - The contractor will develop a plan for pile-driving activities in water to minimize impacts on fish and will allow sufficient time in the schedule for coordination with regulatory agencies. Measures will be implemented to minimize underwater sound pressure to levels below thresholds for peak pressure and accumulated sound exposure levels (SEL). Threshold levels established by NMFS (NMFS 2009a) that will not be exceeded are:

        - Peak pressure = 206 dB
        - Accumulated SEL = 183 dB

    - Underwater sound monitoring will be performed during pile-driving activities. A qualified biologist/natural resource specialist will be present during such work to monitor construction activities and compliance with terms and conditions of permits.

    - Sheet piling will be driven by vibratory or nonimpact methods (hydraulic) that result in sound pressures below threshold levels to the extent feasible.

    - Pile driving will be conducted only during daylight hours and initially will be used at low energy levels and reduced impact frequency. Applied energy and frequency will be gradually increased until necessary full force and frequency are achieved.

- Implement Fish Rescue Plan Inside Cofferdam. Installation of the cofferdam and dewatering of the site during construction could result in fish stranding. The contractor will develop and implement a Fish Rescue Plan acceptable to CDFG, USFWS, and NMFS. The contractor will ensure that a qualified fisheries biologist with a current CDFG collection permit conducts the fish rescue and relocation efforts behind the cofferdam. The fish rescue effort would be implemented during the dewatering of the areas behind the cofferdam(s) and would involve capture and return of those fish to suitable habitat within adjacent waterways. A fisheries biologist will be present on-site during initial pumping (dewatering) to ensure compliance with the plan.

    - The contractor will monitor the progress of dewatering and allow for the fish rescue to occur prior to completely closing the cofferdam and again when water depths reach approximately 2 feet. USFWS, NMFS, and CDFG will be notified at least 48 hours prior to the start of fish rescue efforts. Information on the species, number, and sizes of fish collected would be recorded during the fish rescue and provided in a letter report to be submitted within 30 days after the fish rescue to USFWS, NMFS, and CDFG.

    - The Fish Rescue Plan will contain methods for minimizing the risk of stress and mortality due to capture and handling of fish removed from the construction site and returned to adjacent waterways.

    - Implementation of the Fish Rescue Plan would minimize potential adverse effects on listed fish species (if present) associated with fish stranding during dewatering activities related to the construction activities.

2.7.1.11 Avoidance of Federally Listed Species Entrapment

At the end of each work day, all excavated, steep-walled holes or trenches that are more than 2 feet deep would be covered using plywood or similar materials or provided with escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they would be thoroughly inspected for trapped animals. All culverts or similar enclosed structures with a diameter of 4 inches or greater that are stored at a construction site would be inspected for common and special-status wildlife species before the pipe is subsequently used or moved.

2.7.1.12 San Joaquin River Plan and Final Design

The San Joaquin River Plan and Final Design will incorporate a series of checkpoints. Please refer to the series of bullets below. The Authority and FRA will coordinate with NMFS, USFWS, CDFG, CVFPB and USACE to provide cross-sectional and profile data of the proposed SJR crossing as further refinement of the planning and design process continues. The checkpoints will include specific product deliverables and data that could then be used to conduct hydraulic modeling to demonstrate how bridge design might influence in-river processes such as scour. These analyses will address velocity, turbidity, fluvial processes including sediment scour and deposition. These checkpoints will be developed in concert with the resource agencies to obligate the design build contractor and processes to work with NMFS systematically in the design of the crossing. The anticipated design build phases are itemized below. The first four action items are a part of the preliminary design process, and then final design completion following NMFS concurrence.

The checkpoints are presented below:

- Establish Design Hydrology (peak design flow rate):
    - Collect, review and summarize available hydrology
    - Consult with CVFPB and USACE
    - Develop original hydrology, if required
- Obtain Existing Conditions Field Data (can start concurrent with Task 1):
    - Aerial and field reconnaissance – field plans
    - Channel cross-section survey and processing
    - Geotechnical sampling, testing and data report
- Establish Existing Conditions Hydraulics (HEC-RAS model)
    - Develop HEC-RAS model for each crossing
    - Calibrate or validate the model
    - Establish design water surface elevation and freeboard
    - Consult with CVFPB and USACE
- Demonstrate Minimal Hydraulic Impacts from Design
    - Incremental flood rise
    - Freeboard
    - Setbacks and levee clearance
    - Environmental Questionnaire
    - Scour and channel Stability; considerations for changes in geomorphology
- Final Design incorporating design modifications consistent with findings during the preliminary design process.

The Authority will closely coordinate with the Design Build Team, NMFS, USFWS and other appropriate agencies to design and place the required bridge support pier(s) within the San Joaquin River corridor. A requirement of the design and placement will include compatibility with the intent of the San Joaquin River Restoration Program and the habitat needs of Central Valley steelhead and Central Valley spring-run Chinook salmon. The HST crossing shall be designed with the planned increase in river flows and to maintain or effectively minimize any appreciable changes in scour, sediment transport and deposition, or changes in geomorphic processes that could alter habitat conditions in a manner that would impede the reestablishment of these species. The Authority, in partnership with the Design Build Team, will design and conduct a hydraulics/hydrology analysis with appropriate modeling tools and incorporate site-specific

data, including the needed geotechnical investigations to ensure the design, sizing, location, and construction techniques are compatible with habitat conditions that support salmonoid utilization of the San Joaquin River within the area impacted by the proposed HST crossing.

The Authority will coordinate with NMFS, the Bureau of Reclamation, and the U.S. Army Corps of Engineers on the study design methods, hydraulic and geomorphology criteria, and follow-up post construction monitoring to ensure crossing location biological integrity is maintained for habitat primary constituent elements and the compatibility with the goals of the San Joaquin River Restoration Program for the reintroduction of spring-run Chinook salmon and Central Valley steelhead.

Depending on the results of the hydraulic and hydrologic analyses, the Authority and the Design Build Team may be required to implement design changes to avoid and minimize adverse affects to aquatic habitat, where appropriate. Any design changes would be evaluated and considered in consultation with NMFS, CDFG, the Bureau of Reclamation, and the U.S. Army Corps of Engineers. Possible design changes that could be evaluated and considered include:

- Minor reconfiguration of piers and pier foundations to minimize hydraulic forces and associated potential for scour;
- Providing additional armoring along the bed and banks to minimize scour; and/or
- Major reconfiguration of bridge span arrangement and support pier design to minimize pier placement in the wetted portion of the San Joaquin River channel.

The Authority, along with the Design Build Team, will present a detailed San Joaquin River Crossing Plan that considers the hydraulic and hydrology analyses to NMFS that addresses the issues presented above prior to any site preparation or mobilization of work at the San Joaquin River.

2.7.1.13 Project Area Speed Limits

In order to minimize dust production, a speed limit of 20 mph would be enforced during project construction for all vehicles operating in temporary and permanent construction areas within the limit of direct effect.

2.7.2 Compensatory Mitigation for Effects on Federally Listed Species

Compensatory mitigation is proposed for the Merced to Fresno Section for adverse effects on wetlands and/or natural habitats that have the ability to support federally listed species. Compensatory mitigation usually occurs in advance of, or concurrent with, the impacts on be mitigated, but may occur after such impacts.

Compensatory mitigation for direct effects would occur at locations determined through consultation with the USFWS and NMFS. Compensatory mitigation would be accomplished by creation, restoration, enhancement, or preservation of lands through a combination of the following:

- Purchase of credits from an agency-approved mitigation bank.
- Fee-title acquisition of a Service-approved property.
- Purchase or establishment of a conservation easement with an endowment for long-term management of the conservation values.
- In-lieu fee, contribution determined through negotiation and consultation with USFWS.
- Funding the implementation of the Conservation Project to restore or enhance habitat

The amount of compensatory mitigation proposed would be based on a mitigation ratio determined by the amount of disturbance to federally listed species and their associated habitats. Typical compensatory mitigation ratios gathered from previous BOs and guidelines are discussed below. Specific compensatory mitigation ratios would be determined through the consultation process.

Compensation for direct effects on disturbed habitats (e.g., agricultural or urban land uses) will be provided at a ratio ranging between 0.1:1 and 0.5:1. Mitigation for direct effects on these land uses will be mitigated out-of-kind, through the preservation, enhancement, or creation of suitable natural lands for the San Joaquin kit fox (SJKF).

Furthermore, impacts on agricultural lands protected under the Williamson Land Act (prime farmland, farmland of state importance, unique farmland, and farmland of local importance) are proposed for preservation at a ratio no less than 1:1 in the Agricultural Lands section of the *Merced to Fresno Section Draft Project EIR/EIS* (Authority and FRA 2011e). Preservation of agricultural lands will maintain foraging and dispersal habitat for SJKF in existing agricultural production.

Compensatory mitigation ratios for federally listed wildlife species for which guidelines do not currently exist are suggested below and elaborated upon in Section 5. However, the actual ratios used for the Merced to Fresno Section may be higher or lower, depending on the results of the agency consultation.

2.7.2.1 Conservancy Fairy Shrimp, Vernal Pool Tadpole Shrimp, Longhorn Fairy Shrimp, and Vernal Pool Fairy Shrimp

The compensatory mitigation ratios for these species are based on whether the proposed mitigation is preservation or creation and on whether it occurs at an approved conservation bank or at a nonbank location. The compensatory mitigation ratios may range from 1:1 to 3:1 based on the guidance proposed in the *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* (USFWS 1996b).

2.7.2.2 Valley Elderberry Longhorn Beetle

The compensatory mitigation ratios for this species may vary, depending on the presence of exit holes, from 1:1 to 8:1, and may include the planting of additional associated native plants and the transplanting of permanently affected elderberry shrubs during the dormancy period, as described within the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (VELB) (*Desmocerus californicus dimorphus*) (USFWS 1999a).

2.7.2.3 California Tiger Salamander

The compensatory mitigation ratios for this species will be based on the duration of direct effects on habitats that support the species. Permanent direct effects on aquatic or upland habitat may be mitigated at a ratio of 3:1. Direct effects on aquatic or upland habitat that are temporary in duration may be mitigated at a ratio of 1.1:1.

2.7.2.4 San Joaquin Kit Fox

The compensatory mitigation ratios for effects on this species are based on the quantity and duration of effects and the type of habitat being affected (natural or disturbed). Permanent direct effects on natural areas may be mitigated at a ratio of 3:1, and permanent direct effects on disturbed areas may be mitigated at a ratio of 1.1:1. Temporary direct effects on disturbed areas may be mitigated at a ratio of 1.1:1, and temporary direct effects on natural areas may be mitigated at a ratio of 1.5:1 (USFWS 2007).

Compensatory mitigation for various resources may overlap. For instance, compensatory mitigation for wetlands and waters of the U.S. may overlap with compensatory mitigation for federally listed species,

such as vernal pools. In some instances, compensation for one species will also compensate for effects on another species.

A compensatory mitigation plan will be prepared and implemented. This plan will identify the compensatory mitigation locations, monitoring requirements, success criteria, and reporting requirements. The plan will be submitted to the appropriate natural resource regulatory agencies for review and approval.

In addition to compensatory mitigation for the SJKF, there are measures that address effects of the conversion of agriculture. Compensatory mitigation for farmland includes preservation of agriculture, which would provide some protection for connectivity on the adjacent landscape of the HST Project, as agricultural lands provide unimpeded landscape conditions for SJKF movement and dispersal. Agricultural lands that qualify are those protected by the Williamson Act, and they are proposed for preservation at a 1:1 ratio.

Currently, the agricultural impacts, and associated mitigation, on Williamson Land Act lands are estimated to be approximately 2,500 acres. Preservation of agricultural lands would maintain foraging and dispersal habitat for the SJKF in existing agricultural production.

2.7.3 Project Design Features

It is important to recognize that the Merced to Fresno Section includes project design features to effectively manage runoff and discharges. These project design features would contribute to the minimization of pollutant discharge to adjacent uplands, wetlands, and the San Joaquin River crossing. For example, the bridge structures would control the stormwater and discharge of the structure with BMPs required to meet 401 requirements. The structure at the San Joaquin River would meet all current environmental requirements. These project design features apply to habitat protection that coincide with federally listed species and are described in more detail below. Project design features that manage runoff would have mitigating effects from polluted or high-energy discharges that could damage habitat for listed species and other biota.

2.7.3.1 Project Design Features for Stormwater Management and Treatment

During the detailed design phase, the design-build team will evaluate each receiving stormwater system's capacity to accommodate project runoff. As necessary, this phase would include the following:

- Design onsite stormwater management measures, such as detention or selected upgrades to the receiving system, to provide adequate capacity.
- Design and construct onsite stormwater management facilities to capture runoff and provide treatment prior to discharge for pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways.
- Consider the use of constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated systems (biofilters) such as vegetated swales and grass filter strips.
- Use portions of the HMF site for onsite infiltration of runoff, if feasible, or for stormwater detention, if not. Incorporate vegetated setbacks from streams such as Canal Creek and Berenda Creek.

2.7.3.2 Project Design Features for Flood Protection

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

- In Special Flood Hazard Areas (SFHA), raise the track at least 4 feet above the 100-year flood elevation.
- Minimize development within the floodplain as appropriate. Avoid placement of facilities in the floodplain (e.g., at the Castle Commerce Center HMF site and the Gordon-Shaw HMF) or raise the ground with fill above the base-flood elevation.

Design of the crossings would maintain a floodwater surface elevation of no greater than 0.1 foot above current levels (zero rise within designated floodways). The following design considerations would minimize the effects of pier placement in the floodways:

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

2.7.3.3 Construction Stormwater Pollution Prevention Plan

The State Water Resources Control Board (SWRCB) Construction General Permit (2009-0009 DWQ) (SWRCB 2009) establishes three erosion risk levels that are based on site erosion and receiving-water risk factors. A preliminary analysis indicates that most of the project would fall under Erosion Risk Level 1, the lowest risk level. The portion of the project vicinity draining to the San Joaquin River would fall under Erosion Risk Level 2. Erosion Risk Level 2 measures also would be carried out anywhere in the project vicinity where construction activities are conducted within or immediately adjacent to sensitive environmental areas such as streams, wetlands, and vernal pools.

The Construction General Permit requires preparation and implementation of a SWPPP, which would provide BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for affected stream crossings. These BMPs could include measures to provide permeable surfaces where feasible and to retain and treat stormwater onsite. Other BMPs include strategies to manage the overall amount and quality of stormwater runoff. Typical BMPs include:

- Practices to minimize the contact of construction materials, equipment, and maintenance supplies with stormwater.
- Limiting fueling and other activities using hazardous materials to areas distant from surface water, providing drip pans under equipment, and daily checks for vehicle condition.
- Practices to reduce erosion of exposed soil, including soil stabilization, watering for dust control, perimeter silt fences, placement of rice straw bales, and sediment basins.

- Practices to maintain water quality including silt fences, stabilized construction entrances, grass buffer strips, ponding areas, organic mulch layers, inlet protection, and Baker tanks and sediment traps to settle sediment.
- Practices to capture and provide proper offsite disposal of concrete washwater, including isolation of runoff from fresh concrete during curing to prevent it from reaching the local drainage system, and possible treatment with dry ice or other acceptable means to reduce the alkaline character of the runoff (high pH) that typically results from new concrete.
- Development of a spill prevention and emergency response plan to handle potential fuel or other spills.
- Use of diversion ditches to intercept offsite surface runoff.
- Where feasible, avoidance of areas that may have substantial erosion risk, including areas with erosive soils and steep slopes.
- Where feasible, limit construction to dry periods when flows in water bodies are low or absent.

2.7.3.4 Central Valley Regional Water Quality Board, Order No. 5-00-175, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters

This order is a permit that covers construction dewatering discharges and some other listed discharges that do not contain significant quantities of pollutants, and that either (1) are 4 months or less in duration, or (2) have an average dry-weather discharge that does not exceed 0.25 million gallons per day.

The CVFPB regulates specific river, creek, and slough crossings for flood protection. These crossings must meet the provisions of Title 23 of the California Code of Regulations. Title 23 requires that new crossings maintain hydraulic capacity through such measures as in-line piers, adequate streambank height (freeboard), and measures to protect against streambank and channel erosion. Section 208.10 requires that improvements, including crossings, be constructed in a manner that does not reduce the channel's capacity or functionality, nor that of any federal flood control project. The CVFPB reviews encroachment permit applications for approval of a new channel crossing or other channel modification. For a crossing proposed for a federal flood control project, the CVFPB coordinates review of the application with the USACE and other agencies, as necessary. Under Section 408 of the Rivers and Harbors Act, the USACE must approve any proposed modification that involves a federal flood control project. A Section 408 permit would be required if construction modifies a federal levee. A Section 208.10 permit would be required where the project encroaches on a federal facility but does not modify it.

2.7.3.5 Maintain Pre-Project Hydrology

Avoid increasing existing peak stormwater flows from the project site. This would be accomplished by emphasizing onsite retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation, supplemented by detention, where required. Additional flow control measures could be implemented where local regulations or drainage requirements dictate.

2.7.3.6 Industrial Stormwater Pollution Prevention Plan

The stormwater general permit (97-03-DWQ) requires preparation of a SWPPP and a monitoring plan for industrial facilities, including vehicle maintenance facilities associated with transportation operations. The permit includes performance standards for pollution control.

3.0 Action Area

This section defines the terms used in this BA, summarizes and describes the vegetation communities and wildlife habitat types, and identifies some of the common land use practices observed during field surveys. This section establishes the environmental baseline by detailing the existing physical and biological conditions found within the Action Area. The vegetation communities and wildlife habitat types are described below.

3.1 Definitions

Three distinct terms are used within this BA and in supporting documents to describe the areas studied and affected by the Merced to Fresno Section: (1) the limit of direct effect, (2) the Action Area, and (3) the resource study area (RSA). These areas are defined and distinguished as follows, from the least inclusive to the most inclusive:

- The limit of direct effect is the area that is physically affected by the construction activities associated with the Merced to Fresno Section (including temporary disturbance) and the location of permanent project components. The limit of direct effect consists of the limits of cut and fill plus all access roads and areas required for operating, storing, and refueling construction equipment. More details regarding the limit of direct effect and project activities are explained in Section 2 (Project Description).

- The Action Area is defined as all areas to be affected by the federal action. The purpose of identifying this area is to provide a boundary around those areas in which the effects of the action will be felt. For this BA, the Action Area is the area directly or indirectly affected by the Merced to Fresno Section. It encompasses the limit of direct effect and all areas where indirect and other effects within the proposed action may occur to federally listed species. As defined by the ESA, indirect effects are those effects that are caused by, or will result from, the proposed construction activities and are later in time or farther removed in distance, but are still reasonably certain to occur. Indirect effects include, but are not limited to, changes to downstream water quality, air quality, noise, or light disturbance. Interrelated actions are defined as “actions that are part of a larger action and depend upon the larger action for their justification,” while interdependent actions are defined as “actions having no independent utility apart from the proposed action” (50 CFR Section 402.02).

- The RSAs for the various biological resources (plants, wetlands, and wildlife) are areas that incorporate the Action Area that biologists studied in the field surveys. The RSAs extends along the entire HST alignment from Merced to Fresno. RSAs also define the limits for indirect effects on a resource basis. The three defined RSAs are as follows:

  - Botanical RSA: The Botanical RSA is the study area for botanical resources, including federally listed plants, sensitive natural communities, and elderberry shrubs. The Botanical RSA consists of the limit of direct effect plus a 100-foot area that was incorporated to address potential indirect effects on plants. The Action Area for federally listed plants and valley elderberry longhorn beetle is equivalent to the Botanical RSA.

  - Wetland RSA: The Wetland RSA is the study area for wetlands and other waters of the U.S. and the species that are dependent on them (e.g., vernal pool species). The Wetland RSA consists of the limit of direct effect plus a 250-foot area that was incorporated to address potential indirect affects to wetlands, including seasonal wetlands and vernal pools. The Action Area for federally listed invertebrates associated with vernal pools is equivalent to the Wetland RSA.

  - Wildlife RSA: The Wildlife RSA is the study area for wildlife habitat assessments. The Wildlife RSA is defined as the limit of direct effect plus a 1,000-foot area and is divided into three areas: a core Wildlife RSA, an auxiliary Wildlife RSA, and a supplemental Wildlife RSA. The supplemental 1.24-mile Wildlife RSA established for evaluation of California tiger salamander

(CTS) (*Ambystoma californiense*) upland dispersal habitat is defined below, but discussed in Section 4.

Indirect effects on plants could be caused by the adverse affects from local runoff/discharge, construction-related chemicals, dewatering, shifts in micro watershed flows, excessive dust, trampling, and increased competition with invasive plant species. These effects have the potential to adversely affect the phenology, physiology and competitiveness of plant population(s) over time without mitigation or BMPs to counter negative trends. These potential adverse affects could occur 100 feet from the edge of the construction footprint.

Indirect effects vernal for pool branchiopods outside the construction footprint could result in adverse affects from local runoff/discharge, construction-related chemicals, dewatering, shifts in micro watershed flows, excessive dust, trampling, and increased competition with invasive plant species. These potential adverse affects could occur 250 feet from the edge of the construction footprint. These potential actions would all adversely affect water quality of vernal pool habitat.

For SJKF, the indirect effects outside the construction footprint could result in adverse affects from excessive noise, motion, nighttime lighting, and startle effects, resulting in avoidance behavior and/or changes in the dispersal patterns. In addition excessive dust, construction-related chemicals, rodent control programs, trampling and increasing prevalence of invasive plant species could result in deterioration of remaining suitable kit fox habitat. These potential adverse affects could occur within 1,000 feet of the construction footprint. These potential actions could adversely affect kit fox denning habitat, foraging habitat, and prey density.

The three Wildlife RSAs are as follows:

- The core Wildlife RSA consists of the limit of direct effect plus a 250-foot area. The core Wildlife RSA addresses habitat that may be utilized by species with a relatively low mobility, such as vernal pool invertebrates. The core Wildlife RSA was physically surveyed, where permission to enter was granted.
- The auxiliary Wildlife RSA (which is measured laterally 750 feet from the edge of the core Wildlife RSA for a total limit of indirect effect of 1,000 feet) was surveyed based on field surveys or extrapolation of observations made from within the core Wildlife RSA, aerial photograph interpretation, and windshield surveys. The auxiliary Wildlife RSA addresses habitat adjacent to the core Wildlife RSA that may be utilized by wildlife species with relatively high mobility.
- The supplemental Wildlife RSA extends laterally from the limit of direct effect up to 1.24 miles to address CTS upland dispersal and identifies species-specific habitats based on aerial photograph interpretation, documented occurrences of the species, and field observations of federally listed species and their habitats.
    - An RSA was not originally defined for fish. However, an indirect effects limit was established and has been identified. This indirect effects limit for Central Valley steelhead and Central Valley spring run Chinook salmon is primarily predicated on indirect effects that could occur during construction activities. Since the San Joaquin River is completely spanned and the pier placement occupies a very small amount of square feet within the active river system, operation of the HST is not anticipated to affect fish habitat post-construction. The runoff or potential for discharge for sediment originating from the project during construction is anticipated to be controlled by BMPs, design features and mitigation measures; however, without these features, there is potential for discharge within the river during construction. A 400-foot area of indirect effect is considered sufficient to capture any sediment and its dispersal in the water column in the unlikely event that there is a discharge.

3.2 Environmental Setting

This section describes the general physical biological conditions in the combined Action Area for all federally listed species, with particular emphasis on the topography, climate, hydrology, vegetation

communities, and wildlife habitats present. Wildlife habitats are identified using California Wildlife Habitat Relationship System (CWHRS) descriptions. The wildlife movement corridors that are crucial for wildlife migration and distribution throughout the Action Area are also identified. Unless otherwise specified, the term Action Area as used in this document refers to the same area defined by the auxiliary Wildlife RSA.

3.2.1 Project Location

The Merced to Fresno Section is located within the San Joaquin Valley, which is the southern half of the Great Valley ecological subregion. The San Joaquin Valley trends northwest from the Tulare Basin at the southern end to the Sacramento–San Joaquin Delta at the northern end. 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 constitute the southern interior Coast Range ecoregion (Figure 3-1).

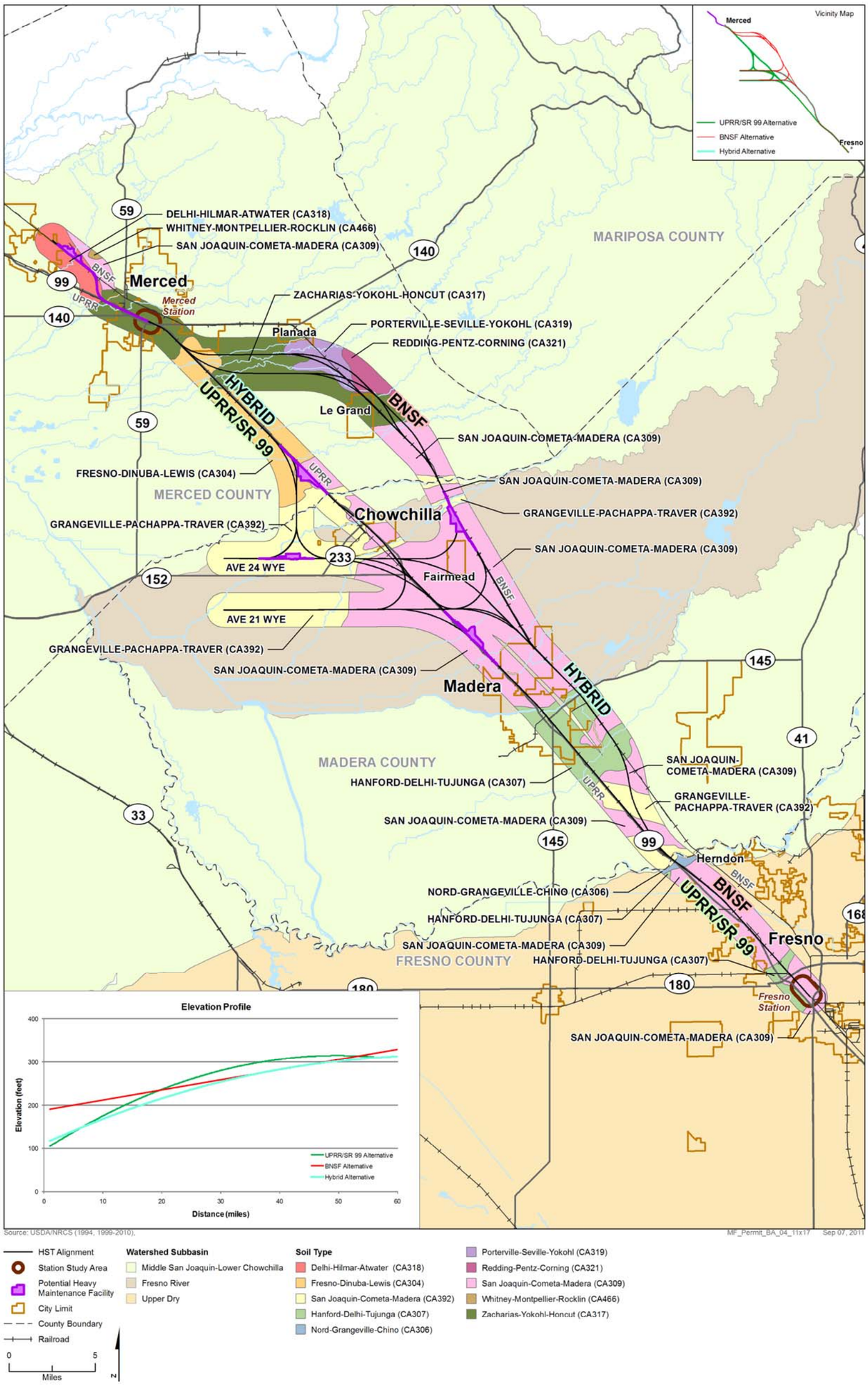


Figure 3-1
Environmental Setting: Soils, Watersheds, and Elevation Profile

3.2.2 Topography

Elevations above mean sea level in the Action Area range from 160 feet near Downtown Merced to 300 feet north of Downtown Fresno. The topography throughout the Action Area is generally flat with slopes ranging from 0% to 2%. Drainage generally flows to the west and southwest.

3.2.3 Climate

The San Joaquin Valley has an arid to semi-arid climate. Summers are generally hot and dry, whereas winters are generally cool and wet. Mean annual temperatures range from a low of 36 degrees Fahrenheit (°F) in December to a high of 98°F in July (WRCC 2010). The growing season (defined as a 50% probability of temperatures at or above 32°F) ranges from 261 days (March 3 to November 19) for Merced to 300 days (February 5 to December 1) for Fresno (NRCS 2002). Average annual precipitation is approximately 12.5 inches in the northern part of the Action Area near Merced, and approximately 11.0 inches in the southern part of the Action Area near Fresno (WRCC 2010). Approximately 80% of the annual rainfall in the Action Area occurs between November and March.

During the spring and summer, snowmelt from the Sierra Nevada provides the majority of the water for the San Joaquin Valley. Warm, moisture-laden air masses generated over the Pacific Ocean condense and cool as they are pushed upward over the Sierra Nevada, resulting in heavy precipitation on the western slopes. The resulting snow pack ranges from 20 to 80 inches as elevation increases from the lower foothills to the Sierran crest.

3.2.4 Hydrology

The Action Area lies in the southern portion of the San Joaquin River Basin. The San Joaquin River Basin extends from the Sacramento-San Joaquin Delta in the north to the northerly boundary of the Tulare Lake Basin in the south, and from the crest of the Sierra Nevada Range in the east to the crest of the Coast Ranges in the west. The basin encompasses about 13,500 square miles and includes large areas of high elevation along the western slope of the Sierra Nevada. As a result, the San Joaquin River experiences significant snowmelt runoff during the late spring and early summer. Flood flows typically occur between April and June.

The Merced to Fresno Section is located in three watershed subbasins: the Middle San Joaquin–Lower Chowchilla, Fresno River, and Upper Dry (Figure 3-1). Most of the Action Area is located to the north of the San Joaquin River in the Middle San Joaquin–Lower Chowchilla Watershed (Hydrologic Unit Code 18040001). The Action Area to the south of the San Joaquin River is located in the Tulare-Buena Vista Lakes Watershed (Hydrologic Unit Code 18030012). Prominent water features in the Action Area include Bear Creek, Miles Creek, Owens Creek, Duck Slough, Deadman Creek, Dutchman Creek, the Chowchilla River, Ash Slough, Berenda Slough, Berenda Creek, Dry Creek, the Fresno River, Cottonwood Creek, and the San Joaquin River. The natural hydrology of the region has been substantially altered by the construction of dams, storage reservoirs, diversion dams, canals, and groundwater pumping associated primarily with agricultural irrigation.

3.2.5 Vegetation Communities and Wildlife Habitat Types

Habitat and natural land status in the Action Area were classified where possible using the *California Wildlife Habitat Relationships System* (CDFG 2011), as summarized in Table 3-1. Agricultural lands are the largest recorded habitat type within the Action Area. Urban areas, including large cities such as Merced and Fresno and the several smaller cities between, constitute the second greatest land use within the Action Area. Figures 3-2a through f depict the locations of habitat types along the Merced to Fresno Section that are identified as potentially suitable for federally listed species addressed in this document (see Appendix B for suitable habitat for branchiopods and California tiger salamander, Appendix C for suitable habitat for valley elderberry longhorn beetle, and Appendix D for suitable habitat for San Joaquin kit fox).

Table 3-1
Acreage of Vegetation Communities within the Action Area

Habitat Type by CWHR Vegetation Community	Acreage		Percent Range
	Minimum	Maximum	
Developed	741.57	826.94	26.75% to 31.85%
Agricultural[a]	1,387.08	1,818.94	58.84% to 59.57%
California Annual Grassland	15.39	129.25	0.66% to 4.18%
Mixed Riparian	3.69	10.23	0.16% to 0.33%
Other Riparian	1.67	6.82	0.07% to 0.22%
Eucalyptus	0.00	0.78	0.00% to 0.03%
Ruderal	152.59	235.90	6.55% to 7.63%
Freshwater Marsh	0.00	0.03	0.00% to 0.00%
Seasonal Wetland/Vernal Pool	1.98	15.15	0.09% to 0.49%
Palustrine Forested Wetland	0.06	5.74	0.00% to 0.19%
Natural Watercourse	4.68	11.42	0.20% to 0.37%
Constructed Watercourse	18.46	27.48	0.79% to 0.89%
Inundated Non-wetlands	1.23	2.91	0.05% to 0.09%
Total Acres	**2,328.40**	**3,091.59**	**—**

[a] "Agricultural" includes Dryland Grain Crop, Deciduous Orchard, Evergreen Orchard, Irrigated Grain Crop, Irrigated Row and Field Crop, Irrigated Hayfield, Vineyard, and any other undetermined cropland.

3.2.5.1 Agricultural Lands

Agricultural lands account for approximately 75% of the land use in the Action Area. Orchards, vineyards, fallow fields, row crops and field crops constitute 66%, while dairies, pastures, and inactive agriculture constitute an additional 10%. Agricultural lands provide limited plant and wildlife habitat value relative to natural and seminatural habitats as a result of lower species diversity and uniform vegetation structure. Agricultural lands provide a landscape that allows San Joaquin kit fox to disperse throughout.

Additionally, wildlife species are often regarded as pests and many farmers will actively haze birds and poison animals to reduce crop damage and loss. Vegetation other than the managed crop generally comprises weedy species adapted to high levels of disturbance and is often actively managed with herbicides, mowing, and/or tilling. Sparse annual grasses and weedy forbs may be present within hay fields and along the crop edges; however, because these weeds decrease crop value, these undesirable plants are often eradicated.

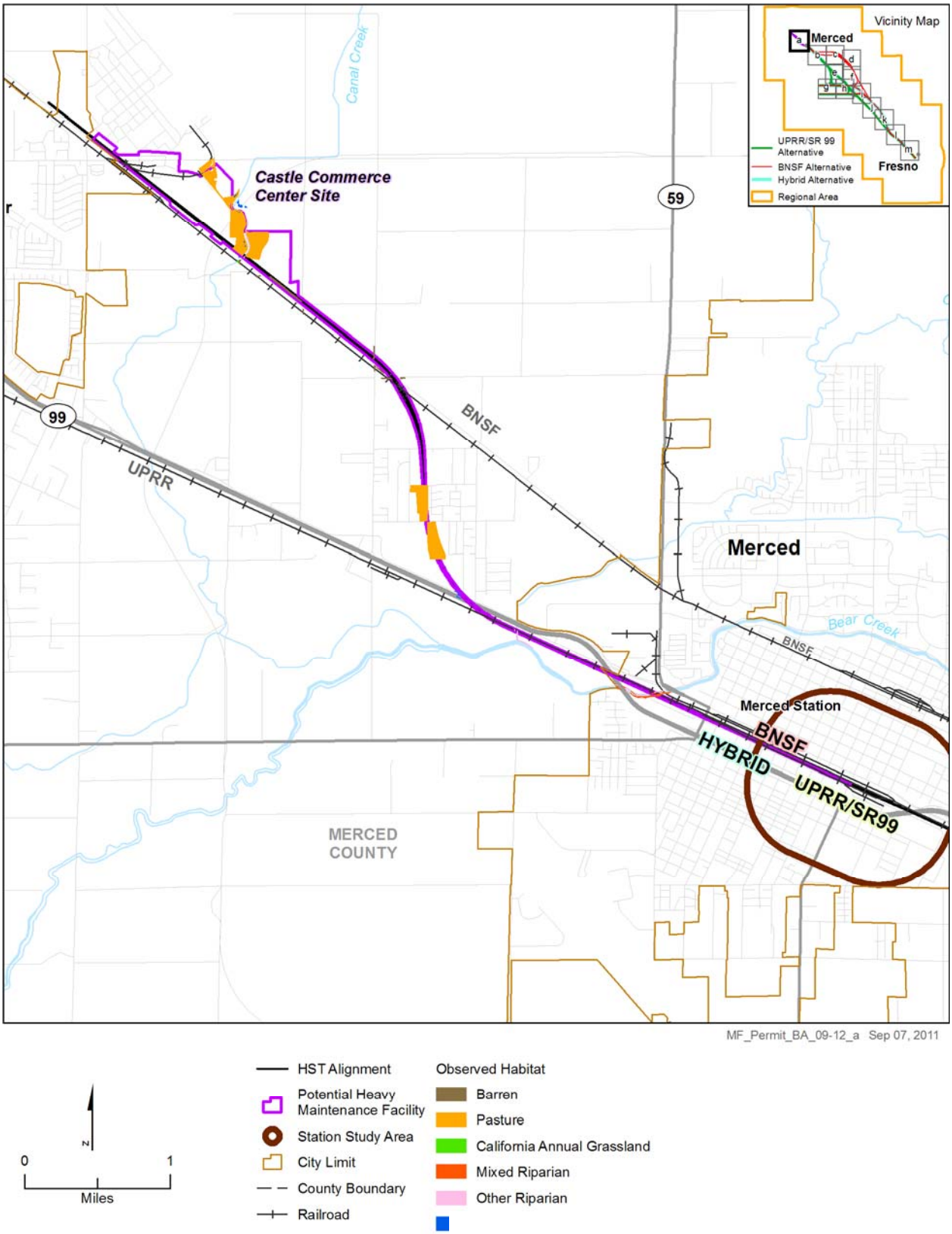


Figure 3-2a
Locations of Habitat Types along Project Alignment

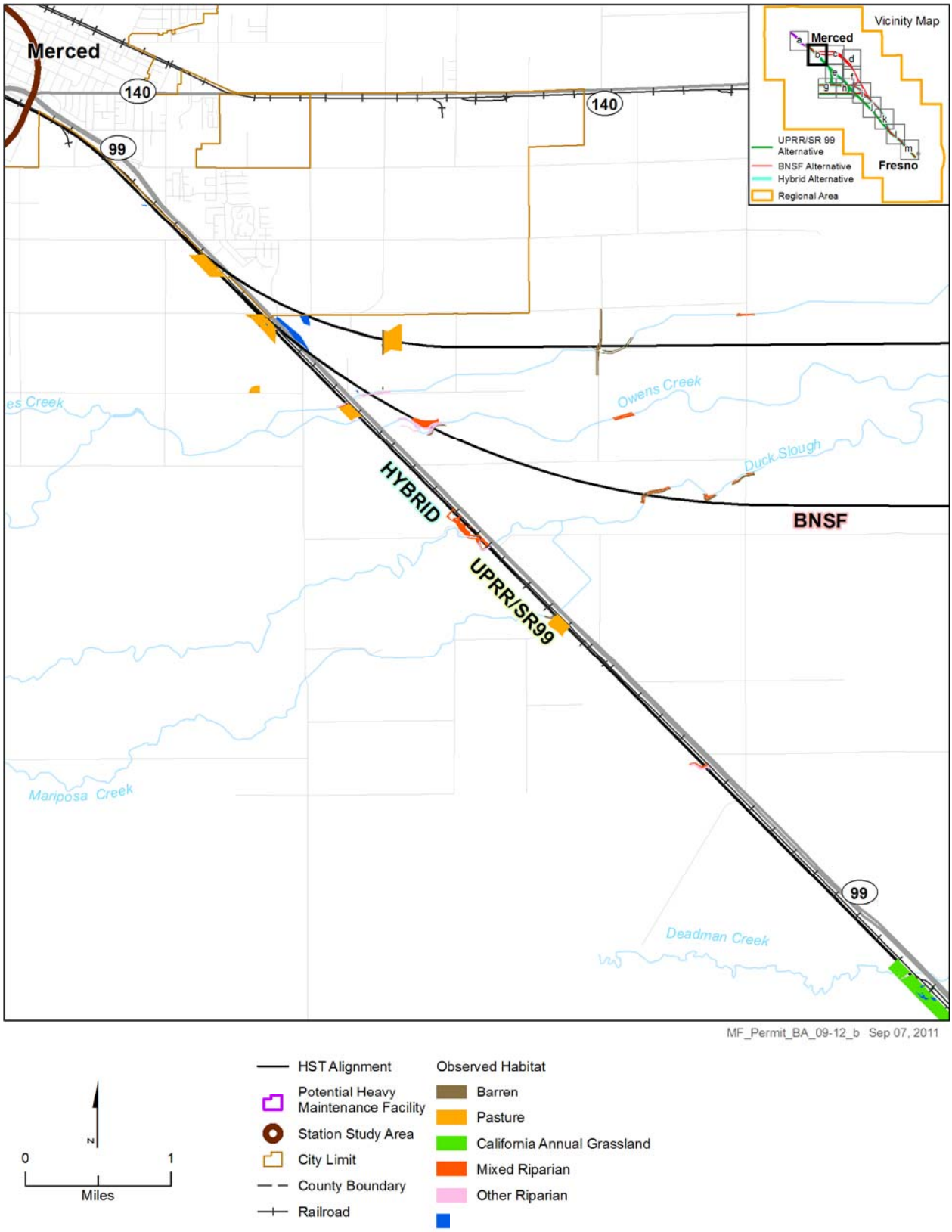


Figure 3-2b
Locations of Habitat Types along Project Alignment

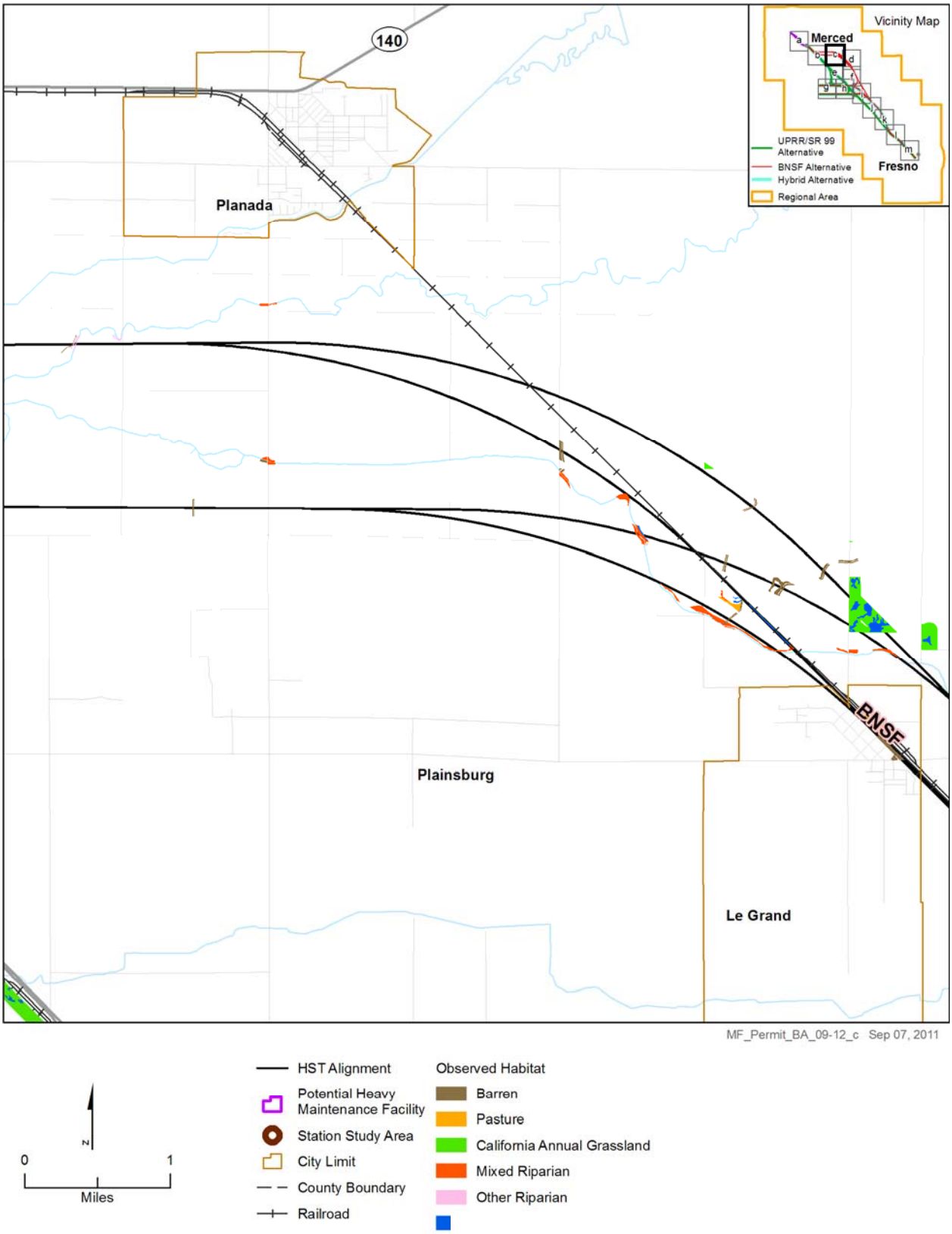


Figure 3-2c
Locations of Habitat Types along Project Alignment

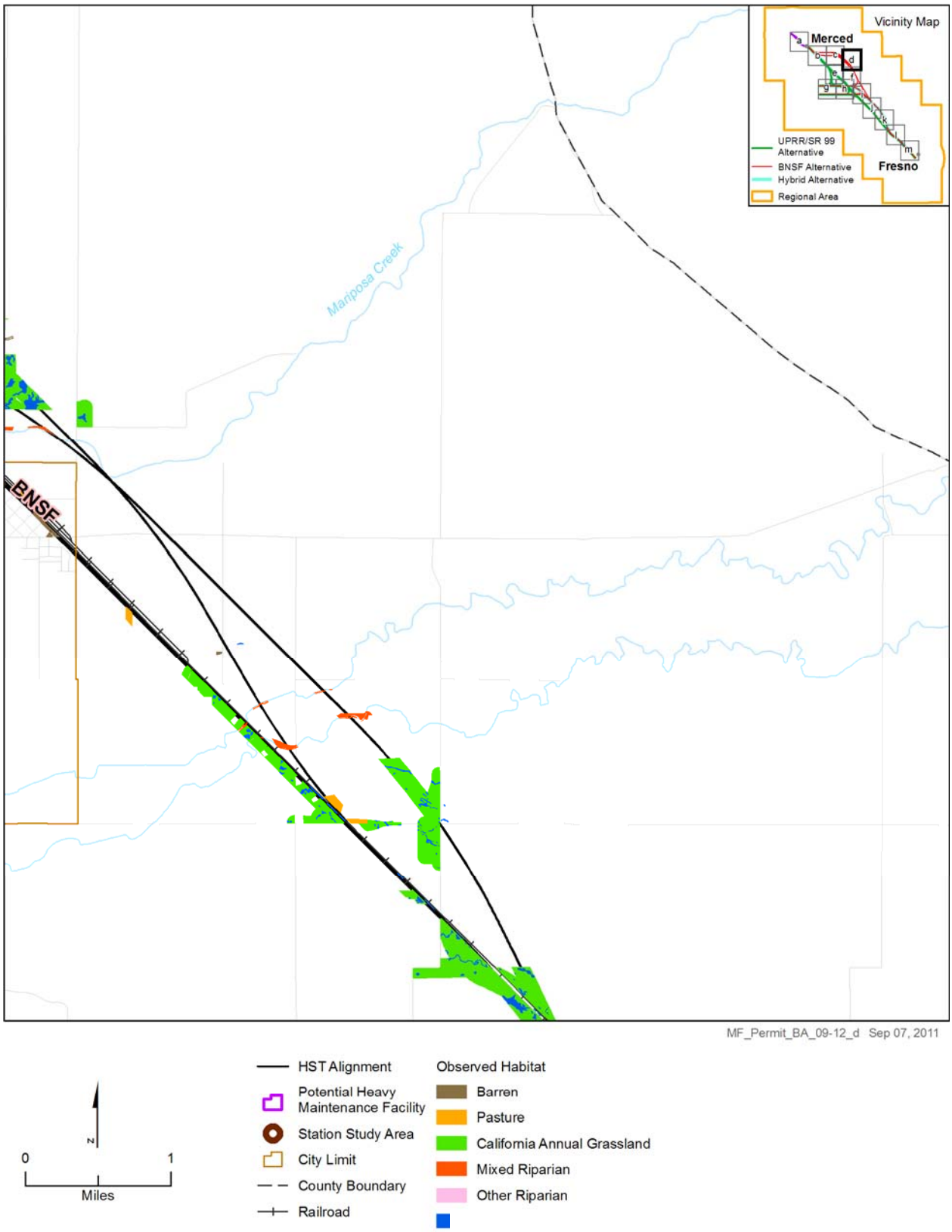


Figure 3-2d
Locations of Habitat Types along Project Alignment

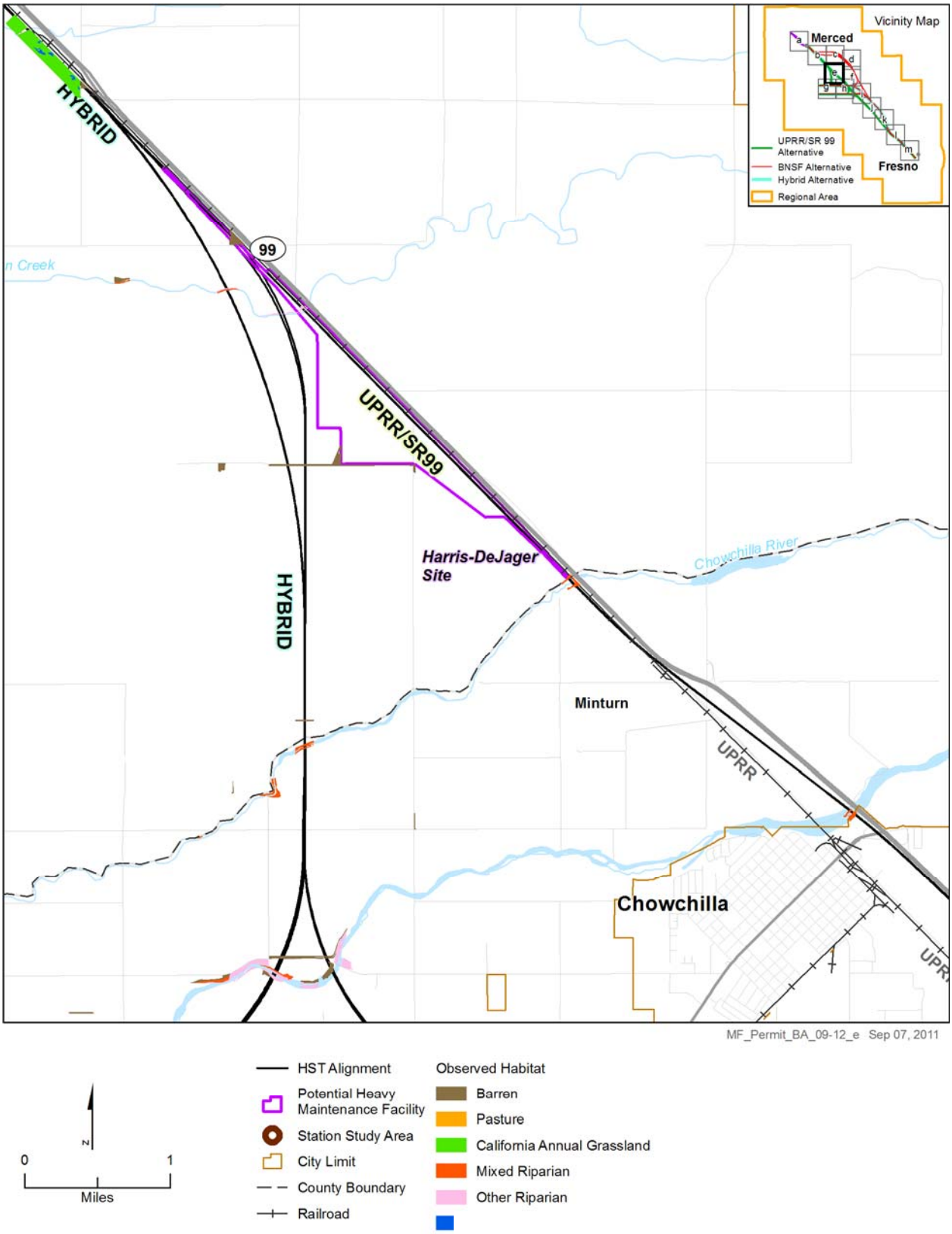


Figure 3-2e
Locations of Habitat Types along Project Alignment

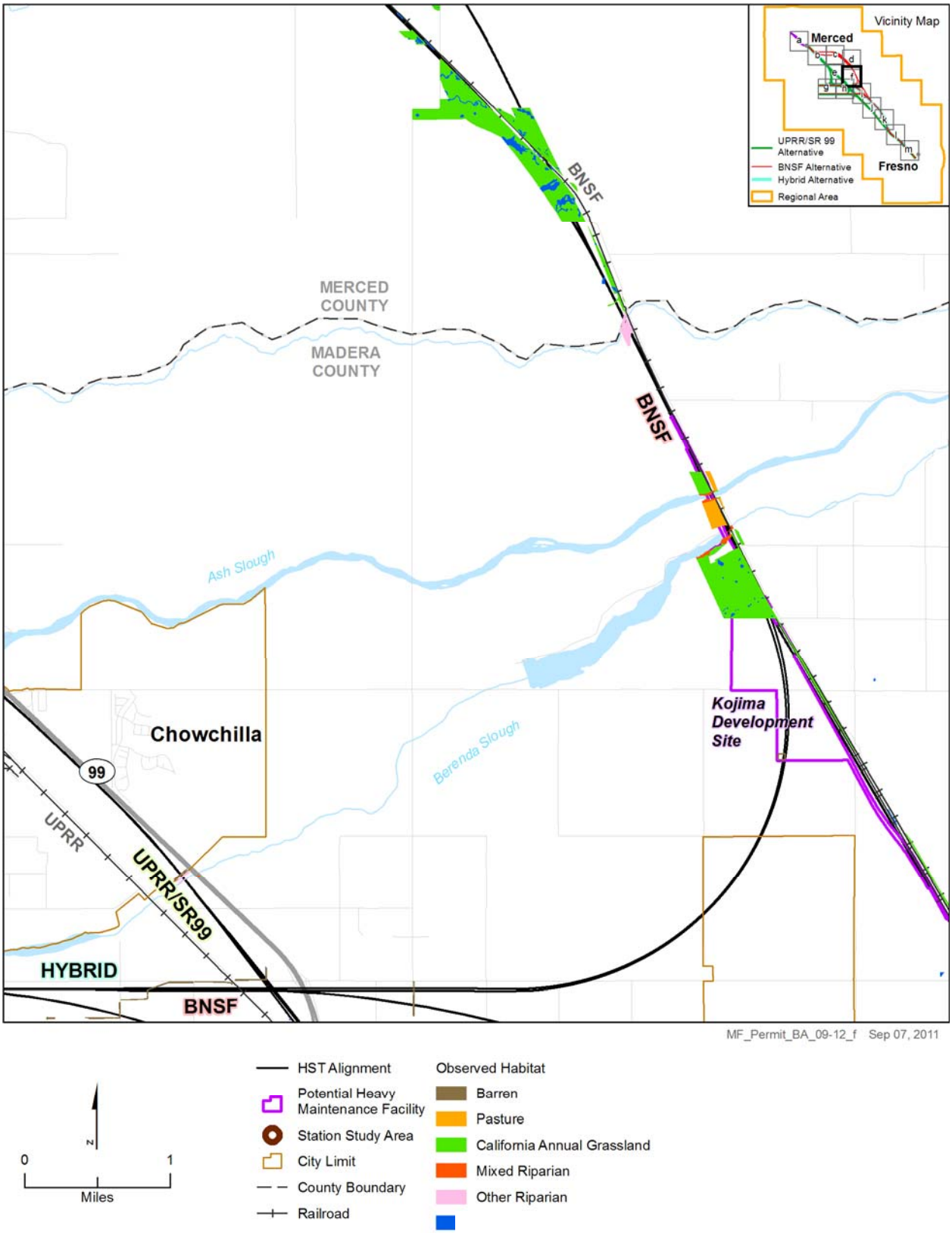


Figure 3-2f
Locations of Habitat Types along Project Alignment

Types of Agricultural Land in the Action Area

The following section describes the agricultural types identified in the Action Area.

Orchards

Almond trees (*Prunus dulcis*) are the most common orchard crop in the Action Area. Other deciduous orchard crops include pistachios (*Pistacia vera*), walnut trees (*Juglans regia*), fig trees (*Ficus* spp.), and pomegranate trees (*Punica* spp.). Evergreen orchards such as oranges and lemons (*Citrus* spp.) are also present. Orchards consist of monocultures of evenly spaced, generally low bushy trees that are similar in canopy size and tree height. Canopy cover ranges from open to dense depending on the age of the trees, with saplings and young trees having relatively open canopies and older trees providing more closed canopy cover. Depending on the management levels, the understory vegetation is either devoid of vegetation or comprised of various weedy annual grasses and forbs. Where herbaceous vegetation is present, it is often mowed, sprayed, or tilled to facilitate harvest and conserve water. Most of the orchards in the Action Area are flood-irrigated.

Vineyards

Vineyards include cultivated wine, table, and raisin grapes (*Vitis* spp.) grown in evenly spaced rows that are variable in canopy cover depending on the age and growth of the vines. The understory vegetation is variable depending on the management practices. In some vineyards, herbaceous vegetation is nearly absent, and in other areas, weedy annual grasses and forbs are common. Where herbaceous vegetation is present, it is often managed with herbicides, mowing, and/or tilling. Flood and drip methods are most commonly used to irrigate the vineyards in the Action Area.

Field Crops

Field crops consist of monocultures that are intensely managed and frequently harvested and replanted, often on a seasonal rotational basis. Field crops include dry land grain crops and irrigated hay crops. Dry land grain crops include non-irrigated annual grass crops such as wheat (*Triticum* spp.), barley (*Hordeum* spp.), and rye (*Secale cereale*). Other annual grasses and herbaceous weeds are frequently interspersed along the margins of dry crop fields. Common irrigated hay crops include species such as timothy (*Phleum pratense*), oats (*Avena* spp.), orchard grass (*Dactylis glomerata*), millet (*Panicum miliaceum*), red clover (*Trifolium pratense*), and alfalfa (*Medicago sativa*). Within the Action Area, these crops are planted as monocultures in large, predominantly flood-irrigated fields. Irrigated hay crops are common throughout the Action Area and are often associated with dairy farms as they are grown as silage.

Row Crops

Irrigated row crops in the San Joaquin Valley include sweet potatoes (*Ipomoea batatas*), cotton (*Gossypium herbaceum*), tomatoes (*Solanum lycopersicum*), lettuce (*Lactuca* spp.), beans (*Phaseolus vulgaris*), and garlic (*Allium sativum*). Most field and row crops in the Action Area are flood-irrigated, although sprinkler irrigation is used in some areas.

Irrigated grain crops include corn (*Zea mays*), safflower (*Carthamus tinctorius*), and milo (*Sorghum* spp.) grown as silage for dairy cows. Non-native annual grasses and herbaceous weeds are uncommon as a result of active cultivation, herbicide application, and shading from the mature corn stalks.

Fallow Fields

Fallow fields, as used in this BA, are defined as: (1) generally bare dirt agricultural fields that have been tilled but have no evidence of a currently planted crop; (2) old orchards and vineyards where the vines or trees have been cut and removed and the soil had recently been tilled; or (3) fields where irrigated hay, grain, or field crops had been recently harvested, but had no evidence of actively growing crops. Fallow fields are generally devoid of vegetation due to recent tilling and cultivation. Abandoned fields or recently

disked fields that showed no evidence of recent cultivation and were characterized by non-native annual grasses and other ruderal species were not considered fallow fields, but were mapped as either inactive agriculture or ruderal habitat as described below.

Dairies

Dairy farms within the Action Area are large industrial-scale farming operations that include barns and other farm buildings, feed lots, silage storage areas, and manure settling basins. These areas are generally devoid of herbaceous vegetation but may include trees.

Pastures

Pastures are generally enclosed within fences and comprised of a mixture of annual and perennial grasses and forbs that provide forage for domestic livestock. Most of the pastureland in the Action Area is associated with rural residential areas. While some pastures may be enhanced through the seeding of desirable forage plants such as tall fescue (*Schedonorus phoenix*), ryegrass (*Lolium multiflorum*), and various clovers (*Trifolium* spp.), they are less intensively managed than other types of agricultural lands and have a relatively low native diversity but often support some (usually minor) component of native California annual grassland species. Irrigation is variable, with some pasture areas flood- or sprinkler-irrigated while others are managed as dry-land pasture only. This habitat type is distinguished from extensive areas of California annual grassland that may be used as rangeland.

Inactive Agriculture

Inactive agriculture includes fields that have evidence of past cultivation (including surrounding landscape, evidence of tillage, leveled fields and/or irrigation checks and furrows) but are not currently used for crop production. These areas may have been recently disked but show no evidence of recent cultivation, resulting in dense growth of non-native annual grasses such as ripgut brome (*Bromus diandrus*), soft chess, (*Bromus hordeaceus*), oats, Italian ryegrass (*Lolium* spp.), barley, and weedy forbs such as bur clover (*Medicago polymorpha*), prickly lettuce (*Lactuca serriola*), filaree (*Erodium* spp.), and yellow star-thistle (*Centaurea solstitialis*). While species composition is similar to that of California annual grassland and ruderal areas, inactive farmland areas generally support a very low diversity and abundance of native plant species and are distinguished by a high degree of disturbance as a result of past cultivation.

3.2.5.2 Developed Areas

Developed areas constitute approximately 21% of the Action Area and include various types of urban and rural developed land use. Developed areas include urban areas, commercial and industrial buildings, transportation corridors, and barren areas where vegetation has been removed or is absent.

Barren

Barren areas are open plots of rock, gravel, or soil that are either completely devoid of vegetation or contain only sparse (less than 2%), widely scattered, predominantly weedy herbaceous plants. Within the Action Area, barren areas are associated with equipment yards adjacent to agricultural fields and various water storage or delivery features.

Urban

Urban habitat includes relatively higher density residential areas and parks that may include landscaped areas, yards, gardens, and various buildings. Many urban areas include large landscape and shade trees such as ash (*Franxinus* spp.), cedar (*Cedrus* spp.), eucalyptus (*Eucalyptus* spp.), London plane (*Platanus* spp.), maple (*Acer* spp.), redwood (*Sequoia sempervirens*), and pine (*Pinus* spp.). Because of a significant agricultural component, rural residential habitat is described above as an agricultural habitat type. Parkland includes developed and maintained open, grassy areas, picnic facilities, and children's playgrounds. Larger parks, such as Roeding Park in the City of Fresno, may include a pond or small lake.

Commercial and Industrial

Commercial and industrial areas include urban shops, businesses, warehouses, industrial plants, factories, junkyards, equipment storage yards, airports, and various municipal facilities as well as associated parking lots. Rural commercial areas include landfills, farm equipment yards, and agricultural processing and storage facilities; dairy farms are not considered to be a commercial and industrial habitat type but are instead described separately as an agricultural habitat type. Urban commercial and industrial areas often have associated landscaped vegetation.

Transportation Corridors

Transportation corridors in the Action Area include roads and railways, including portions of SR 99, SR 152, and SR 145, numerous paved urban and county roads, and the UPRR and BNSF railways. For the purpose of habitat characterization, narrow strips of landscaped and/or ruderal vegetation associated with these corridors were not separately mapped and quantified; instead, these areas were mapped together with their associated corridor. Dirt farm roads associated with agricultural fields also were not distinguished separately from the adjacent agricultural land use.

3.2.5.3 Natural and Seminatural Areas

Natural and seminatural habitats are distinguished from the land uses and vegetation types described in the previous sections by the degree of current human influence on the vegetation composition and structure. While the natural and seminatural vegetation types have been altered to some extent by past and present human activities, the composition and structure of these communities is generally not actively managed or controlled. A distinction is also made between those habitats that are largely characterized by native vegetation and those in which the dominant vegetation comprises introduced species. Natural and seminatural terrestrial habitats including California annual grassland, Great Valley mixed riparian forest, other riparian, eucalyptus woodland, and ruderal vegetation habitats are described below.

California Annual Grassland

California annual grassland habitat within the Action Area is best classified as part of the Amsinckia (*menziesii, tessellata*) alliance as defined by Sawyer et al. (2009) and the non-native grassland type described by Holland (1986). This community is characterized by an open-to-dense cover of grasses and herbaceous species less than 3 feet high. Scattered trees and shrubs may be present, but provide minimal cover.

California annual grassland in the Action Area is characterized by large expanses of open grassland comprised of nonnative annual grasses such as ripgut brome, soft chess, foxtail barley (*Hordeum jubatum*), medusa-head (*Taeniatherum caput-medusae*), and wild oat. Common non-native herbaceous species include yellow star-thistle, Italian thistle (*Carduus pycnocephalus*), prickly lettuce (*Lactuca serriola*), mustards (*Brassica* spp.), and wild radish (*Raphanus sativa*). Many native annual and perennial herbaceous species may also be present within this grassland community. California annual grasslands may be used for cattle or sheep grazing, but these areas are not actively managed as pasture. Areas of California annual grassland are on soils suitable for vernal pools.

Great Valley Mixed Riparian Forest

Great Valley mixed riparian forest communities include sensitive riparian communities as identified in *The Vegetation Classification and Mapping Program: List of California Terrestrial Natural Communities Recognized by the CNDDB* (CDFG 2003). The sensitive biological community Great Valley mixed riparian forest is equivalent to the valley foothill riparian community as defined by the CWHRS.

The cottonwood-willow riparian community is part of the *Populus fremontii* Forest Alliance, Fremont cottonwood forest as described by Sawyer et al. (2009) and most closely resembles the Great Valley cottonwood riparian forest described by Holland (1986). Mixed riparian forest and woodland most closely

resembles the *Populus fremontii* Forest Alliance described by Sawyer et al. (2009), while Holland (1986) describes this community as Great Valley mixed riparian forest.

Other Riparian

Several types of non-sensitive riparian communities were identified within the Action Area. Willow riparian forest in the Action Area may be classified as part of the *Salix lasiolepis* Shrubland Alliance (arroyo willow thickets) as defined by Sawyer et al. (2009) and most closely resembles the central coast arroyo willow riparian forest described by Holland (1986). Himalayan blackberry (*Rubus armeniacus*) brambles and giant reed (*Arundo donax*) (Sawyer et al. 2009) are also present in riparian communities.

Riparian communities are located on the banks of natural waterways including streams, sloughs, and rivers and, in some cases, constructed waterway features. Riparian areas occur along the banks of rivers and streams and are generally characterized by a prevalence of hydrophytic vegetation but do not meet other criteria for wetlands. Riparian communities may consist of overstory species that are facultative wetland; however, soils, hydrology, and/or understory vegetation are not representative of wetland communities.

Riparian communities can be found throughout the Action Area. Riparian areas form transition zones between terrestrial and aquatic ecosystems, providing essential habitat for a large variety of terrestrial as well as aquatic wildlife species.

Eucalyptus Woodlands

Eucalyptus woodlands are classified by Sawyer et al. (2009) as Eucalyptus (*globulus, camaldulensis*) seminatural woodland stands or eucalyptus groves. There is no corresponding natural community type in Holland (1986). These areas are characterized by relatively dense stands of eucalyptus trees. Within the Action Area, the understory vegetation typically comprises introduced annual grasses such as ripgut brome and Bermuda grass (*Cynodon dactylon*) with goose grass (*Galium aprine*) and dovefoot geranium (*Geranium molle*). In some areas, giant reed is also a common associated understory species.

Ruderal Vegetation

Ruderal vegetation types occur in areas where the natural vegetation has been removed or significantly degraded by past or current human activity. Ruderal vegetation is often associated with vacant lots, roadsides, and other highly disturbed areas. Vegetation in these areas is highly variable but often includes a mix of non-native annual grasses such as ripgut brome, soft chess, wild oat, Italian ryegrass, foxtail barley, and weedy forbs such as bur clover (*Medicago polymorpha*), filaree, yellow star-thistle, Italian thistle, milk thistle (*Silybum marinum*), Russian thistle (*Salsola tragus*), and many others. Due to the highly variable nature of ruderal habitats, this type was not classified according to Sawyer et al. (2009) or Holland (1986). Ruderal areas may be similar to California annual grassland but are characterized by a greater level of disturbance. Ruderal areas are also similar to inactive farmland but do not occur in areas with evidence of active farming in the recent past.

3.2.6 Aquatic Habitats

This section describes the wetland and other water features that were mapped in the Action Area. Jurisdictional waters are evaluated in detail in the *Merced to Fresno Section Draft Wetlands Delineation Report* (Authority and FRA 2011c). Jurisdictional water types have been broadly classified following *A Hydrogeomorphic Wetland Classification System* (USACE 1993) and the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

3.2.6.1 Depressional/Palustrine Wetlands

Depressional wetlands are a hydrogeomorphic class of wetlands that occur in topographic depression where the dominant water sources are precipitation, groundwater discharge, and both inflow and overland flow from the adjacent uplands (USACE 1993). The Palustrine system is a broad class of

nontidal wetlands that was developed to include vegetated wetlands traditionally called by names such as marsh, swamp, bog, fen, and prairie. The palustrine system also includes small, shallow permanent or intermittent water bodies such as ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers (Cowardin et al. 1979). Palustrine wetlands identified within the Action Area include vernal pools, coastal and valley freshwater marsh, Fremont cottonwood forested wetlands, retention basins, and agricultural tailwater ponds.

3.2.6.2 Fremont Cottonwood Forested Wetland

Fremont cottonwood forested wetlands occur on soils intermittently or seasonally flooded or saturated by freshwater systems. Frequently, these community types are found along riparian corridors, floodplains subject to high-intensity flooding, or on low-gradient depositions along rivers and streams. These communities are described as typically containing an overstory dominated by Fremont cottonwood or mixed with other tree species including box elder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), California walnut (*Juglans californica*), or California sycamore (*Platanus racemosa*). The shrub layer within this community type is typically dominated by willow species (*Salix* spp.) and California wild grape (*Vitis californica*). The understory of Fremont cottonwood forested wetlands may support emergent perennial vegetation such as cattails (*Typha* spp.), sedges (*Carex* spp.; *Schoenoplectis* spp.), and rushes (*Juncus* spp.). Freshwater forested wetlands are nontidal, flooded, depressional wetlands and are categorized as Cowardin class palustrine forested wetland. The *Populus fremontii* Forest Alliance, Fremont cottonwood forested wetland, is described by Sawyer et al. (2009) and is similar to the Great Valley cottonwood riparian forest described by Holland (1986).

3.2.6.3 Vernal Pools and Other Seasonal Wetlands

Vernal pools are a type of seasonal wetland characterized by a low, amphibious, herbaceous community dominated by annual herbs and grasses. Vernal pools are insular, astatic ecosystems that respond markedly to winter precipitation and summer desiccation. Vernal pools are associated with certain types of soil formations. Hardpan soil layers frequently form in the horizons of clay soils, leading to the formation of vernal pools with clay soils. California annual grasslands can occur on similar types of soil formations, but are not exclusively found associated with vernal pools. Once formed, these vernal pools have a specific flora and fauna associated with seasonal hydrology. The standing water that forms in vernal pools is ideal breeding habitat for several special-status species such as vernal pool fairy shrimp (VPFS) (*Brachinecta Lynchi*), Conservancy fairy shrimp (CFS) (*Branchinecta conservatio*), vernal pool tadpole shrimp (VPTS) (*Lepidurus packardi*), CTS, and western spadefoot toad (WST) (*Spea hammondii*). This plant community type is a CDFG special-status plant community and is a subclass of depressional wetlands which are considered palustrine emergent seasonally flooded wetlands.

Common plant species observed in vernal pools include woolly marbles (*Psilocarphus brevissimus*), popcorn flower (*Plagiobothrys* spp.), water pigmy-stonecrop (*Crassula aquatica*), annual hairgrass (*Deschampsia danthonioides*), purslane speedwell (*Veronica peregrina*), and toad rush (*Juncus bufonius*). Shallow vernal pools are often characterized by an abundance of non-native grasses and forbs such as Mediterranean barley (*Hordeum marinum*) and hyssop-loosestrife (*Lythrum hyssopifolium*), but these areas also typically contain relatively high cover of native vernal pool plants such as coyote thistle (*Eryngium* spp.). Deeper parts of vernal pools are often characterized by creeping spikerush (*Eleocharis macrostachya*). The quality of vernal pools identified within the Action Area ranges from low quality where they occur in areas of inactive farmland to moderate quality where they occur in grazed California annual grassland. No high-quality undisturbed vernal pools were identified within the Action Area.

3.2.6.4 Coastal and Valley Freshwater Marsh

Coastal and valley freshwater marsh includes sensitive wetland communities as identified on *The Vegetation Classification and Mapping Program: List of California Terrestrial Natural Communities Recognized by the CNDDB* (CDFG 2003). This biological community is equivalent to the *Schoenoplectus*

californicus Herbaceous alliance (Sawyer et al. 2009) and freshwater emergent wetland (Mayer and Laudenslayer 1988).

Freshwater marsh habitats are semi-permanently flooded areas that typically support perennial emergent vegetation such as cattails, sedges, and rushes. Freshwater marshes are found on floodplains, backwater areas, and within the channels of rivers and sloughs. Freshwater marshes are nontidal, flooded, depressional wetlands and designated as palustrine emergent semi-permanently flooded wetlands in Cowardin (1979).

3.2.6.5 Constructed Basins

Constructed basins are included within the palustrine wetland class. These constructed basins are highly disturbed and may be routinely managed through vegetation removal and dredging. Depending on substrate and management regimes, vegetation type and presence varies. Hydrology is variable based on precipitation events, irrigation inputs/removal, and other management objectives. These landscape or management features make up the constructed basin wetland types described below.

Stormwater retention basins are generally excavated earthen basins that have been constructed to hold urban stormwater runoff. Most of the stormwater retention basins in the Action Area are associated with urban communities as well as commercial and industrial areas. Most of these basins are devoid of vegetation or support ruderal species that become established when the water levels are low or the basins are dry. Constructed basins, on average, do not retain perennial water sources. They have the potential to support special-status species that rely on ephemeral inundation cycles such as vernal pool brachiopods and CTS.

Reservoirs include variously sized basins that have been constructed to hold water for urban, industrial, or agricultural use. Water is generally either diverted or pumped into these areas and is held for use at a later time. Reservoirs are often lined to prevent or reduce water loss as a result of seepage into the soil and are generally devoid of vegetation.

Agricultural tail water ponds are generally small, relatively shallow basins that are excavated in the low corners or along the side of an agricultural field or orchard for the purpose of capturing excess irrigation water. Excess water is then either allowed to gradually seep into the soil or is pumped into a nearby canal feature. Vegetation within these basins is often comprised of ruderal wetland plant species such as Bermuda grass, tall flat sedge (*Cyperus eragrostis*), sprangletop (*Leptochloa* spp.), and fireweed (*Epilobium* spp.).

3.2.6.6 Other Waters

Nonwetland waters investigated in the Wetland RSA include natural and constructed watercourses. All natural and constructed watercourses are considered potentially jurisdictional under the Preliminary Jurisdictional Determination (JD) format (USACE 2008a). Natural drainage and constructed water features are discussed below with additional information located in the *Merced to Fresno Section Draft Hydraulics and Floodplain Technical Report* (Authority and FRA 2011d) and in the *Merced to Fresno Section Draft Wetlands Delineation Report* (Authority and FRA 2011c).

3.2.6.7 Natural Watercourses

Historically, natural watercourses included riverine areas of the Wetland RSA, including the perennial San Joaquin River, Bear Creek, and several intermittent to ephemeral sloughs and creeks. Most historical natural watercourses have ephemeral hydrology either because of their small watershed size or because they have been impounded or diverted upstream into other watercourses for agricultural purposes. All are low-gradient systems with emergent vegetation along margins of pool-run habitat units with bottom substrates dominated by fine sediments (i.e., sand, silt, or clay). Riffle and other fast-water habitats are uncommon.

Historically, natural watercourses have been influenced by the anthropogenic stressors affecting streams elsewhere in the San Joaquin Valley, such as agricultural land conversions of floodplains and associated water diversions combined with more than a century of exotic fish and invertebrate introductions (McBain and Trush 2002). For example, recent fish sampling on the San Joaquin River in the vicinity of the Action Area yielded at least 10 non-native fishes among 14 taxa, none of which were identified as special-status fishes (CDFG 2007). Agricultural and municipal watercourses could potentially support special-status species for short time periods, but these watercourses usually represent “false pathways” for native fishes and are typically dominated by nonnative fishes that prey on or outcompete natives. For these reasons, special-status fishes were presumed to potentially occur only in historical natural watercourses. While many watercourses are now inhabited by primarily non-native species, many native fish species still persist in the river (Moyle 2002).

3.2.6.8 Constructed Watercourses

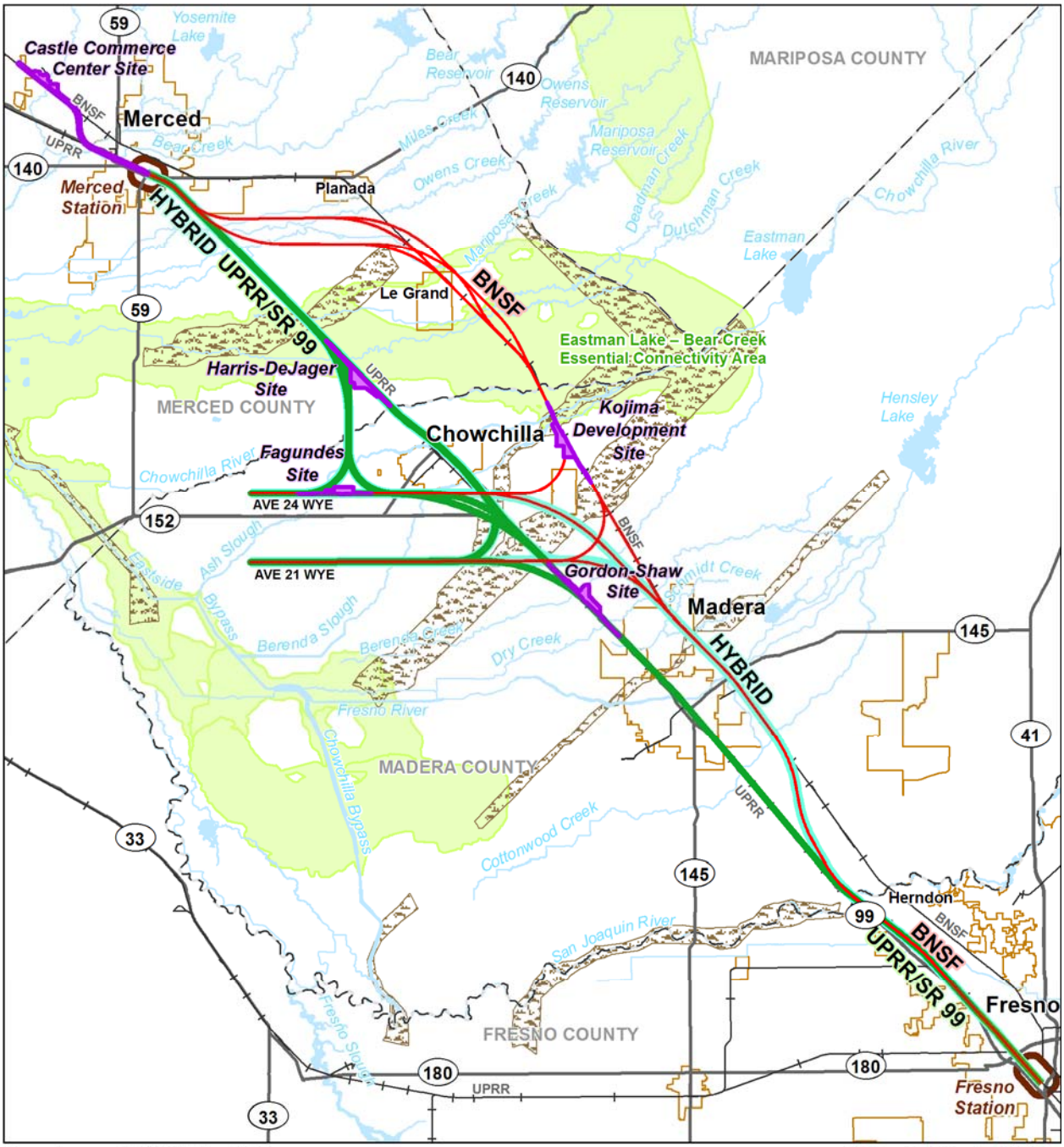
Constructed watercourses include linear water features such as canals and drains that have been constructed primarily for the conveyance of agricultural irrigation water. Canals range in size from small, shallow ditches (10 feet wide and 3 feet deep) to broad channels as much as 50 feet wide and 10 feet deep. Emergent vegetation as well as ruderal wetland species may occur in some areas, but many of the canals are routinely cleared of vegetation or treated with herbicide. A number of the canals convey water diverted from and discharge water into the natural drainage features described in the natural watercourse section above. Constructed waterways within the Wetland RSA are considered potentially jurisdictional under the Preliminary JD format (USACE 2008a).

3.2.7 Wildlife Movement Corridors

Wildlife linkages within the Action Area are planning areas that, among other services, provide landscape level connections for wildlife movement between two or more habitat areas. Habitat linkages aid in the dispersal and distribution of wildlife and are critical for maintaining healthy populations of multiple species including free ranging mammals, such as coyote, bobcat and the federally listed SJKF. One documented essential habitat connectivity area and one migratory bird flyway exist in the Action Area.

Figure 3-3 shows the wildlife movement corridors for the length of the Merced to Fresno Section HST alignment. Several sources of potential wildlife movement corridor data were evaluated in this report. Terrestrial movement corridors were determined from wildlife linkages as used in the *Recovery Plan for Upland Species of the San Joaquin Valley* (USFWS 1998) and Essential Connectivity Areas (ECAs) as developed by the California Department of Transportation and CDFG (Spencer et al. 2010). These corridors link together wildlife habitat that is fragmented by changes in vegetation or human disturbance. The fragmentation of open space areas by urbanization and transportation corridors tends to create isolated islands of wildlife habitat that is detrimental to threatened or endangered species that have lost significant habitat due to natural or human-induced causes. Wildlife movement and migration corridors allow for the recolonization of population sinks or localized extinctions, and allow for genetic flow between population segments of a species. Wildlife linkages are planning areas that, among other ecological values, provide a broad connection for wildlife movement between two or more habitat areas.

To meet the objective of delisting 11 species and facilitating long-term conservation of 23 other species, the *Recovery Plan for Upland Species of the San Joaquin Valley* (USFWS 1998) adopted an ecosystem-level strategy that established a network of reserves and conservation areas that represent all natural communities in San Joaquin upland ecosystems. This ecosystem-level strategy seeks to connect areas of suitable habitat through the establishment of habitat linkages. The Eastman Lake-Bear Creek ECA is one such area where connectivity and linkages between isolated habitat on the San Joaquin Valley floor and natural lands in the surrounding foothills are promoted (ESRP 2009, USFWS 1998). Linking the natural areas in the Sandy Mush Road area with the SJKF population east of SR 99 is listed as a recovery action in the *Recovery Plan for Upland Species of the San Joaquin Valley* (USFWS 1998). Lost hills saltbush (*Atriplex vallicola*) and blunt-nosed leopard lizard (*Gambelia sila*) are also identified as



Source: Spencer et al. (2010), Huber (2007).

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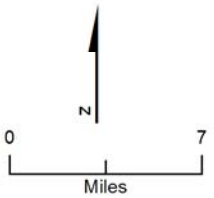


- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Station Study Area
- Potential Heavy Maintenance Facility
- City Limit
- County Boundary
- Railroad
- Essential Connectivity Area
- Modeled Wildlife Corridors

Figure 3-3
Wildlife Movement Corridors

target species associated with the Eastman Lake-Bear Creek ECA while lesser saltscale (*Atriplex minuscula*), palmate-bracted bird's beak (*Cordylanthus palmatus*), and Fresno kangaroo rat (*Dipodomys nitratoides exilis*) are identified as other federally listed species with recovery associated with this linkage.

In late 2000, The Nature Conservancy of California and the California Wilderness Coalition compiled habitat corridor information (Missing Linkages Project) to promote and support a process to "maintain a network of interconnected public and private conservation areas throughout [California] . . ." The proceedings of this effort were published in a document called *Missing Linkages: Restoring Connectivity to the California Landscape* (Penrod et al. 2001). Among other things, this planning process identified, mapped, and characterized landscape linkages, choke-points, and missing links within the California landscape that provided, or could provide, some level of function for wildlife movement and genetic dispersal. Penrod et al. (2001) defined these linkage terms as follows:

- Landscape Linkages: Large regional connections between habitat blocks ("core areas") meant to facilitate animal movements and other essential flows between different sections of the landscape.
- Choke-Point: A narrow, affected, or otherwise tenuous habitat linkage connecting two more habitat blocks ("core areas").
- Missing Link: A highly affected area currently providing limited to no connectivity function (due to intervening development, roadways, etc.), but based on location one that is critical to restore connectivity function.

In general, features identified that facilitated wildlife movement within linkages included riparian corridors or waterways, contiguous or semi-contiguous habitat patches, and culvert/bridge underpasses. Conversely, features that correlated with impeding wildlife movement included roads/highways, developed/urbanization, gaps in habitat patches, agriculture/ranching, dams/diversions, and logging. Of the 232+ linkages evaluated during this initial process, 136 (59%) were ranked as severely threatened. Considering target species present, conservation opportunity, overall threat, and documentation availability, 54 linkages were identified as high-priority sites, 99 were ranked as medium-priority sites, and 79 were ranked as low-priority sites. "Priority" as used in this ranking process denoted preservation/planning urgency.

Twenty-seven of the 232 linkages were identified within the Central Valley of California. Penrod et al. (2001) identifies the area near Deadman Creek and Dutchman Creek, near Sandy Mush Road and Le Grand, as the "Madera-Merced Linkage". This linkage is ranked as a high-priority choke-point and missing-link. It is reportedly severely threatened, with only moderate conservation potential, reflecting existing functional impairments due to development.

3.3 Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

Interrelated actions that are part of a larger action and depend on the larger action for their justification are considered interrelated. Interdependent actions having no independent utility apart from the proposed action are considered interdependent. The Merced to Fresno Section has independent utility with logical termini and can function without further construction of an adjoining section. Therefore, the proposed action is not interdependent.

3.3.1 HST System Summary

At final build, the HST System will connect and serve the major metropolitan areas of California, extending from San Francisco and Sacramento in the north to Los Angeles and San Diego in the south (Figure 3-4).

Figure 3-4
Statewide HST System (Phase 1 and 2) from Programmatic EIS

Following a programmatic environmental review, the Authority and the FRA approved the HST System for intercity travel in California, and selected corridors for project-level study in 2005. Building a system of such magnitude, complexity, and cost is impractical to implement as a singular project. The Authority divided the HST System into nine project sections, allowing phased system implementation.

The HST System is planned to be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley. Phase 2 would connect the Central Valley (Merced Station) to the state's capital, Sacramento, and another extension would connect Los Angeles to San Diego. There are nine individual Phase 1 and Phase 2 sections of the HST System:

Phase 1:

- San Francisco to San Jose
- San Jose to Merced
- Merced to Fresno
- Fresno to Bakersfield
- Bakersfield to Palmdale
- Palmdale to Los Angeles
- Los Angeles to Anaheim

Phase 2:

- Merced to Sacramento
- Los Angeles to San Diego

As a component of Phase 1 in the Central Valley, the Merced to Fresno Section is intended to connect a Merced HST Station and a Fresno HST Station. Other Phase 1 sections include the planned HST line south of the Merced to Fresno Section, which would extend to Bakersfield. A planned HST line west of the Merced to Fresno Section would pass through the Pacheco Pass, connecting the San Francisco to San Jose HST Project to the Central Valley and the rest of the HST System. South of the Bakersfield station, the HST line would continue to Los Angeles through Palmdale.

3.3.2 Interrelated Elements

As defined in the *USFWS and NMFS' Endangered Species Consultation Handbook* (USFWS and NMFS 1998) and based on the independent utility and logical termini of each section of the HST System, actions that are interrelated with or interdependent to the proposed action are limited to the individual section under consultation. Interrelated actions that are part of a larger action and depend on the larger action for their justification are considered interrelated. Interdependent actions having no independent utility apart from the proposed action are considered interdependent. The Merced to Fresno Section has independent utility with logical termini and can function without further construction of an adjoining section. The Merced to Fresno Section can be constructed without reliance on the adjoining HST sections.

The infrastructure and supporting facilities of the Merced to Fresno Section are composed of tracks, grade-separated right-of-way crossings, train stations, electrical power systems, train control, and maintenance facilities. The design includes a double-track right-of-way to accommodate planned project operational needs for uninterrupted rail movement. Additionally, the HST safety criteria preclude any at-grade intersections and, therefore, the system must be grade-separated from any other transportation system. This requires the HST System to have grade-separated overcrossings and undercrossings for roadways or roadway closures and modifications to existing systems that do not span the planned right-of-way.

These facilities are part of the construction of the Merced to Fresno Section proposed in this consultation. As such, they are not considered interrelated with, or interdependent to, the proposed action. The direct and indirect effects from each of these elements are discussed in detail in this BA to analyze how the proposed action may affect federally listed wildlife species and/or their designated critical habitats.

Other sections of the statewide HST System would be constructed and operated with many of the same project infrastructure and supporting facilities. While all nine individual sections of the statewide HST System are designed to have independent utility and logical termini, Phase 1 and Phase 2 of HST System would rely on the Merced to Fresno Section for statewide travel connectivity. As such, this BA describes the interrelated actions of the Merced to Fresno Section to the other sections in the Phase 1 HST System and their effects on federally listed species. Because the entire statewide HST System has not been designed or studied at a project level, the effects of the interrelated actions identified in this BA rely on the current range of federally listed species and the programmatic alignments of the Phase 1 statewide HST System. In addition, the biologists conducting the field surveys and preparing the biological technical reports for the other HST system sections have collaborated to discuss the types of habitat and species that have been observed or reported within the project sections.

Information and plans to construct Phase 2 portions (i.e., Merced to Sacramento and Los Angeles to San Diego) of the HST System are not currently known and therefore are excluded from the discussion in this BA.

Other future federal actions that are not a direct effect of the action under consideration (and not included in the environmental baseline or treated as indirect effects) are not considered in this BA.

3.4 Ongoing Activities Affecting Species or Habitat

3.4.1 Overview

Ongoing activities in the Action Area were evaluated to provide a region-level snapshot of other existing or proposed projects with the potential to affect federally listed species and their habitats. These projects and activities are not associated with the HST System or other federal projects in the central San Joaquin Valley. A comprehensive analysis of the cumulative effects of past, present, and future activities in the Action Area is outside the scope of this document; rather, the examples included herein are meant to illustrate some of the existing pressures on federally listed species such as SJKF and CTS and their associated habitats, independent of the proposed project.

Development and restoration programs in the Action Area that have the potential to affect federally listed species and their habitats in the central San Joaquin Valley fall under the following three general categories: (1) projects that would convert agricultural land to developed uses; (2) highway and transportation infrastructure; and (3) the San Joaquin River Restoration Program. These projects will occur in both rural and urban areas throughout southeast Merced County, western Madera County, and the Fresno metropolitan area; some will convert undeveloped agricultural land outside of existing urban growth boundaries.

3.4.2 Ongoing Activities in the Action Area

3.4.2.1 Conversion of Agricultural Lands and Mixed Development

The conversion of agricultural land would result from residential, mixed-development, retail, and commercial real estate development; public sector facilities expansion, such as the growth of the UC Merced campus; and new and expanded quarries, aggregate surface mines, and dairy facilities. In addition, housing and infrastructure required to accommodate the population growth in Merced, Madera, and Fresno counties (80%, 104%, and 59% population increase between 2010 and 2035, respectively) will result in 93,000 acres of new land development. Projected growth and conversion of land to urban uses associated with the No Project Alternative is anticipated to have a greater environmental effect in the Action Area over the 2010 to 2035 planning period than the Merced to Fresno Section.

3.4.2.2 Highway and Transportation Infrastructure

Multiple highway, regional road, and railroad improvements are planned for the region. These projects include highway widening, interchange improvements, bridge replacements, and freight rail expansion.

Highway and road widening projects are planned for urban and rural regions of the Action Area. For example, proposed projects include widening SR 99 from four to six lanes through most of the Action Area, new and reconstructed interchanges along SR 99, widening some existing two lane county roads to four lanes, and upgrades and capacity improvements to urban arterials.

3.4.2.3 San Joaquin River Restoration Program

The San Joaquin River Restoration Program (SJRRP) is a comprehensive long-term effort to restore flows within the San Joaquin River from Friant Dam to the confluence of Merced River in conjunction with a restoration program to restore a healthy population of SRCS in the river while reducing or avoiding adverse water supply effects from Interim and Restoration flows (U.S. Bureau of Reclamation and California Department of Water Resources 2011). Interim flows are experimental flows that began in 2009 and will continue until full restoration flows are initiated, with the purpose of collecting relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse. The SJRRP is being initiated in accordance with the terms and conditions of the *Natural Resources Defense Council* (*NRDC), et al., v. Kirk Rodgers, et al.* Settlement Agreement (Settlement) dated October 23, 2006, and Public Law 111-11 enacted on March 30, 2009. The Implementing Agencies of the SJRRP include the following: Bureau of Reclamation; USFWS; NMFS; California Department of Water Resources; and CDFG (U.S. Bureau of Reclamation and California Department of Water Resources 2011).

A summary of key milestone dates anticipated in the Settlement is provided below (U.S. Bureau of Reclamation and California Department of Water Resources 2011):

- **October 2009**
  Initiate interim flows and monitoring program.
- **September 2010**
  USFWS submits a completed permit application to NMFS for reintroduction of SRCS.
- **April 2012**
  NMFS issues a decision on the permit application for reintroduction of SRCS.
- **December 2012**
  Reintroduce SRCS and FRCS, if permitted by NMFS.
- **December 2013**
  Complete Phase 1 improvements identified in Settlement; and Secretary of the Interior, in consultation with NRDC and Federal Highway Administration (FHWA), develops operational guidelines.
- **January 2014**
  Initiate full restoration flows.
- **December 2016**
  Complete Phase 2 improvements identified in the Settlement.
- **December 2024**
  Secretary of Commerce reports to Congress on the progress made in reintroducing SRCS and FRCS, and discusses plans for future implementation of the Settlement.
- **December 2025**
  Review and revise restoration flows, if necessary.
- **January – July 2026**
  Any party to the Settlement may file a motion to request an increase, decrease, or material change in the quantity and/or timing of restoration flows.

3.4.3 Regional Effects on Species and Habitat

Fragmentation of agricultural and seminatural lands due to the combination of urban growth, regional infrastructure improvements, and increased roads and highways will create unavoidable effects on federally listed species and their habitat. Cumulative effects can be temporary or permanent, and short or long term. For example, the following potential effects may occur due to construction activities: degraded wetland function and value due to increased impervious surfaces in the landscape; introduction of invasive plant species; and incidental take, including mortality. Examples of long-term effects include reduced dispersal habitat and critical linkages for wide-ranging species such as the SJKF, and increased edge habitat that benefits pest species like feral cats and European starlings at the expense of native wildlife. Increased traffic capacity and associated safety features, such as highway dividers, present artificial boundaries for terrestrial species and can be a significant source of mortality for wildlife attempting to cross. Roads also encourage the spread of invasive plant species, with potentially negative consequences for native plant communities and remaining natural areas in the Action Area.

3.4.4 Cumulative Effects

Adverse effects from implementation of the Merced to Fresno Section included with potential effects from other proposed projects in the San Joaquin Valley could result in cumulative effects on federally listed wildlife species. Cumulative effects under ESA are those resulting from future state or private activities not involving federal activities that are reasonably certain to occur within the Action Area of the federal action subject to consultation. Projects that are anticipated to result in cumulative effects are listed in Section 5.22, Cumulative Effects.

Cumulative projects in the San Joaquin Valley, such as those identified in Section 5.22, will also be required to comply with the same regulatory requirements (e.g., federal, state, and local government laws and regulations) that protect federally listed species and wildlife movement and migration corridors. The other cumulative projects that were identified are largely outside of the Action Area and some are being completed along portions of the project alignment that have already been subjected to urban or industrial development. The cumulative effects of projects located within the Action Area combined with the effects of the Merced to Fresno Section are anticipated to cumulatively contribute to effects on biological resources, including wildlife habitat, wetlands, vernal pools, and listed species; however, few projects are actually located within the Action Area. These include the City of Chowchilla and the City of Madera general plan updates, and the San Joaquin River Restoration Program.

The general avoidance and minimization measures proposed in Section 2.7, Conservation Measures to be Incorporated into Project Design, are intended to reduce the nature and magnitude of cumulative effects on federally listed species. Additionally, the Merced to Fresno Section will comply with other federal, state, and local regulations through regulatory agency permitting processes, which will result in further development of specific avoidance and minimization measures, BMPs, and compensatory mitigation options.

4.0 Species/Critical Habitat Considered

This section presents the results of background research conducted for the HST project and presents the federally listed species that this BA will discuss. Section 4.1 details the methodology and sources used to develop the inventory of federally listed species and designated, or proposed, critical habitats that may be found within the Action Area. It also describes the methods used to collect data during the field surveys, the data processing, and the personnel and dates of the field surveys. Section 4.2 summarizes the results of the background review and presents the federally listed plant and wildlife species that were evaluated for their potential to occur within the Action Area. Finally, Section 4.4 focuses on the species and critical habitat that have been determined to have the potential to occur based on (1) the known distribution of the species, (2) the presence of suitable habitat within the Action Area, and (3) documented occurrence(s) of a species at a suitable dispersal site that would put that species within reach of the limit of direct effect.

4.1 Study Methods

This section presents the various methods, including background review, field surveys, and data processing and analysis, used to identify federally listed species and their suitable habitats in the Action Area. In addition, this section provides the names of personnel and dates of the field surveys, and describes coordination efforts with regulatory agency personnel and other professional contacts.

4.1.1 Pre-Survey Desktop Review

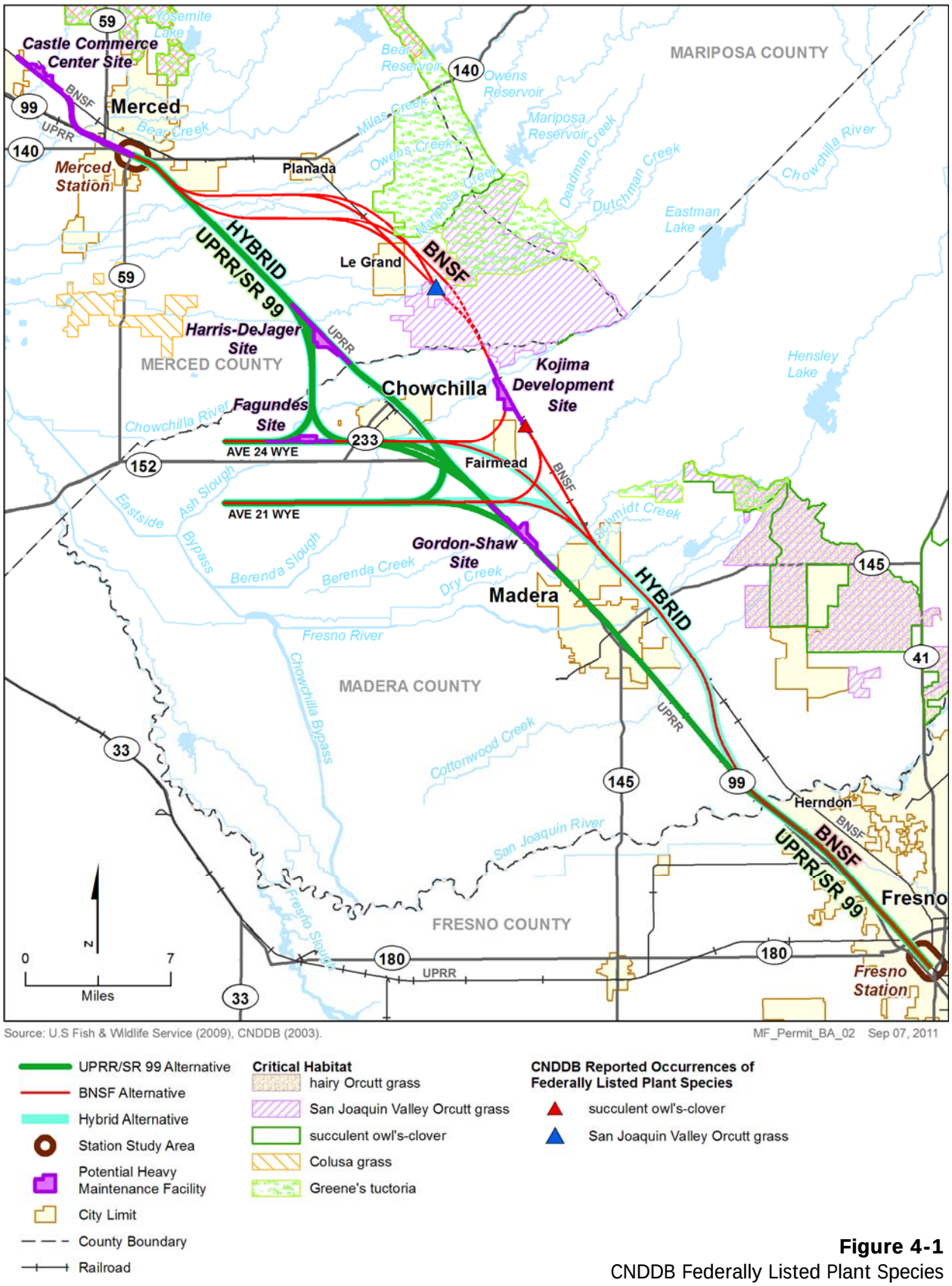
Prior to conducting field surveys, existing background information was reviewed to identify the locations of wetlands and other waters of the U.S., federally listed plant or wildlife species, wildlife movement/migration corridors and areas, and federally designated or proposed CHUs recorded or potentially occurring within the Merced to Fresno Section.

An inventory of federally listed species, designated and proposed critical habitats, and wildlife movement/migration corridors known or potentially occurring in the Action Area was created based on existing federal, resource agency information. Database queries focus on occurrences within the 15 U.S. Geological Survey (USGS) 7.5-minute study quadrangles (quads) that overlapped with the Merced to Fresno Section HST alignment. USFWS Sacramento Field Office web site: An official list of federal candidate, proposed, threatened, and endangered species and their federally designated or proposed critical habitats, known or having the potential to occur within a 9-quad search area around the Merced to Fresno alternative alignments was generated (USFWS 2011). The USFWS Official Species List can be found in Appendix E.

Recovery Plans reviewed included:

- Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998)
- Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon (USFWS 2005)
- Valley Elderberry Longhorn Beetle Recovery Plan (USFWS 1984)
- Draft Recovery Plan for the Giant Garter Snake (USFWS 1999c)
- A number of Federal Register publications, public agency technical reports, survey guidelines, and other published reports were also reviewed.

Figure 4-1 and Figure 4-2 provide the species, location, and occurrence number of federally listed species that have been reported to the CNDDB within 10 miles of the Merced to Fresno Section alignments.



Source: U.S Fish & Wildlife Service (2009), CNDDB (2003).

MF_Permit_BA_02 Sep 07, 2011

- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Station Study Area
- Potential Heavy Maintenance Facility
- City Limit
- County Boundary
- Railroad

Critical Habitat

- hairy Orcutt grass
- San Joaquin Valley Orcutt grass
- succulent owl's-clover
- Colusa grass
- Greene's tuctoria

CNDDB Reported Occurrences of Federally Listed Plant Species

- succulent owl's-clover
- San Joaquin Valley Orcutt grass

Figure 4-1
CNDDB Federally Listed Plant Species

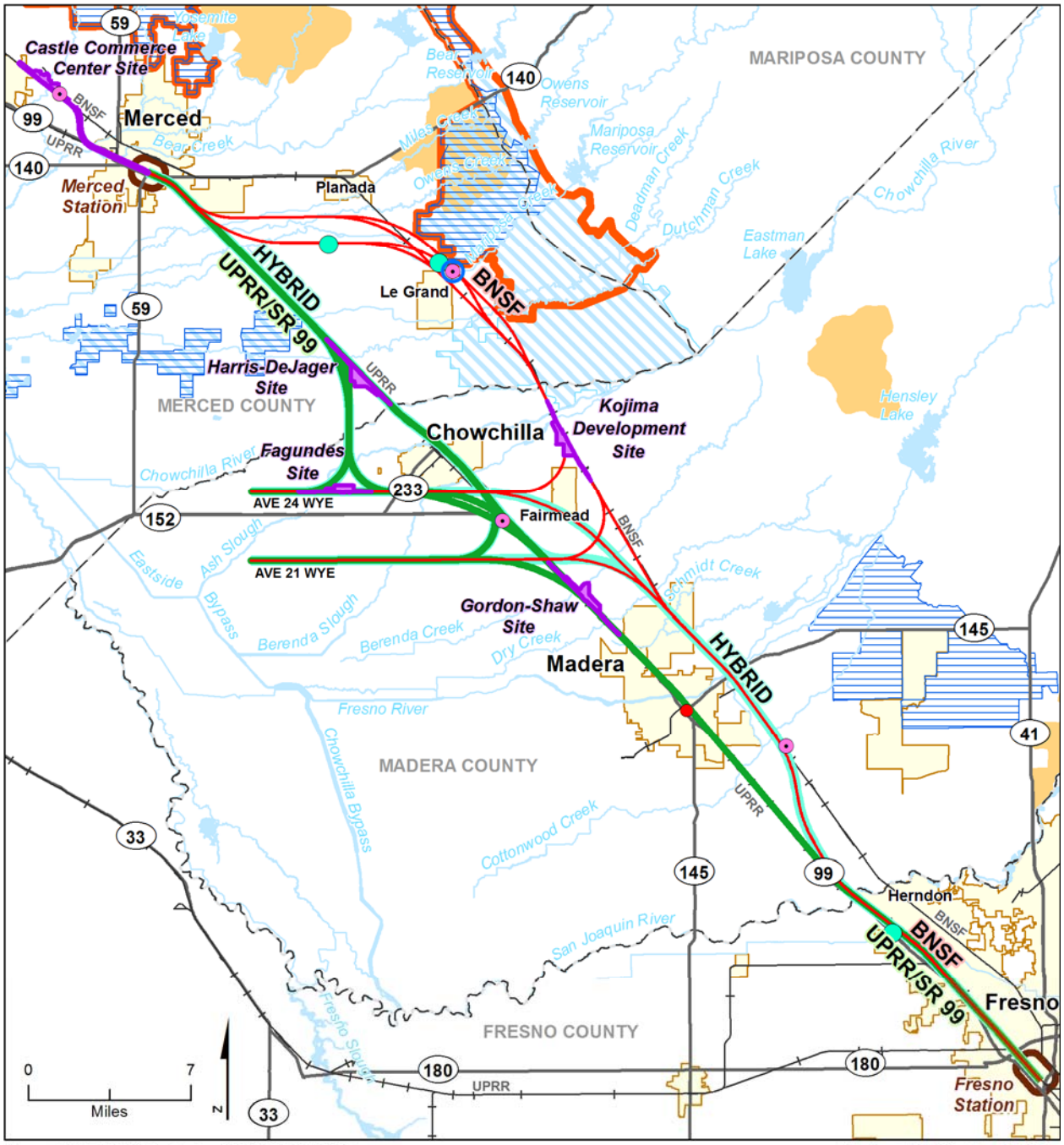


Figure 4-2
CNDDB Federally Listed Wildlife Species

4.1.1.1 Biological Field Survey Chronology

This section provides an overview of the initial fieldwork that was conducted to help establish and verify the biological setting. Reconnaissance-level field surveys were conducted to determine the presence or absence of jurisdictional waters and biological resources and to document the location of any biological resources through habitat characterization and mapping. All habitat characterization and mapping were done from publically accessible roads along or near the HST alternatives. The results of these surveys were used to establish the affected environment and provide background for the focused jurisdictional waters and special-status plant surveys. Focused surveys for special-status plants and jurisdictional waters, conducted where property access was granted, followed the methods defined for plants (Authority and FRA 2011a) and jurisdictional waters (Authority and FRA 2011c).

Reconnaissance-level mapping was conducted for the survey areas beginning in 2009 and intermittently through April 2011. The following provides brief descriptions of verification surveys conducted:

- Fisheries biologist Craig Williams and hydrologist Jeremy Thomas conducted preliminary evaluations of several watercourses during relatively dry periods between March 30 and April 2, 2009; Craig Williams and biologist Michael Clary conducted evaluations between April 28 and April 30, 2009; and Craig Williams and fisheries biologist Niel Nikirk conducted evaluations between April 24 and April 29, 2010. These evaluations were conducted to determine general hydrologic patterns in portions of the Action Area that overlapped with Merced to Fresno Section Action Areas; however, field observations made during these evaluations are relevant to aquatic habitat associated with the current alignment as discussed in this report.

- Biologists Michael Clary and Corinna Lu conducted terrestrial habitat surveys of the UPRR/SR 99 Alternative north-south alignment and the downtown Merced and Fresno stations from November 16 through 20, 2009. Further surveys were conducted by biologists Russell Huddleston and Danielle Tannourji. Temperatures during the November 2009 surveys ranged from 30 to 70°F with light winds and light precipitation on November 20. The primary objective of the November 2009 field surveys was to characterize and map the land use and habitat types within the Action Area.

- Biologists Russell Huddleston, Michael Clary, and Craig Williams conducted jurisdictional waters field surveys of the Merced to Fresno Corridor from December 7 through 10, 2009. Temperatures ranged from approximately 27 to 50°F with occasional light winds, moderate precipitation on December 7, and locally heavy morning fog on December 8. The objective of the December survey was to characterize and map each of the proposed alignment crossing locations of rivers, creeks, and sloughs (referred to in this report as “natural watercourses”).

- Biologist Michael Clary conducted terrestrial habitat surveys on May 6 and 7, 2010. Temperatures ranged from approximately 36 to 79°F with light winds. The primary objective of these surveys was to map habitat within areas of the UPRR/SR 99 and BNSF alternatives that had shifted subsequent to previous mapping and to map habitat in the BNSF Alternative Action Area, the Ave 24 Wye, and the HMF sites.

- Biologists Michael Clary, Judy Ferguson, and Dave Fornander conducted terrestrial habitat surveys on May 24 through May 26, 2010. Temperatures ranged from approximately 40 to 76°F with moderate winds. The primary objective of these surveys was to map habitat within areas of the UPRR/SR 99 and BNSF alternatives that had shifted subsequent to previous mapping and to map habitat in the BNSF Alternative Action Area, the Ave 24 Wye, and the HMF sites.

- Biologist Michael Clary conducted terrestrial habitat surveys on July 14 through July 16, 2010. Temperatures ranged from approximately 40 to 76°F with moderate winds. The primary objective of these surveys was to map habitat within areas of the HST alternatives that had shifted subsequent to previous mapping and to resolve questions related to earlier field mapping.

- Biologist Michael Clary conducted terrestrial habitat surveys on December 21 through December 23, 2010. Temperatures ranged from approximately 46 to 58°F with moderate rain. The primary objective of these surveys was to map habitat within areas of the HST alternatives that had shifted subsequent to previous mapping and to resolve questions related to earlier field mapping.
- Biologist Michael Clary conducted terrestrial habitat surveys on January 10 through January 12, 2011. Temperatures ranged from approximately 38 to 60°F with slight precipitation. The primary objective of these surveys was to map habitat within areas of the HST alternatives that had shifted subsequent to previous mapping and to resolve questions related to earlier field mapping.
- Biologist Michael Clary conducted terrestrial habitat surveys on January 29 through February 2, 2011. Temperatures ranged from approximately 36 to 58°F with slight precipitation. The primary objective of these surveys was to map habitat within areas of the HST alternatives that had shifted subsequent to previous mapping and to resolve questions related to earlier field mapping.
- Biologist Michael Clary conducted terrestrial habitat surveys on April 18 through April 22, 2011. Temperatures ranged from approximately 49 to 76°F. The primary objective of these surveys was to map habitat within areas of the HST alternatives that had shifted subsequent to previous mapping and to resolve questions related to earlier field mapping.

Following each reconnaissance-level survey, field-verified habitat data were noted on aerial photographs and digitized into the project geographic information system (GIS) database.

4.1.1.2 Habitat Assessment

Reconnaissance-level field surveys for the Merced to Fresno Section were standardized with the San Jose to Merced and Fresno to Bakersfield sections so that all sections followed consistent methods. The standardized vegetation community habitat mapping methods are described in the *High-Speed Train Central Valley Biological Resources and Wetlands Survey Plan* (Authority and FRA 2010b).

Habitat assessments consisted of field surveys to identify and map plant community and land cover types, including jurisdictional waters, and potential special-status plant and wildlife habitat, including both terrestrial and aquatic habitats.

Communities and habitat were mapped using the plant and wildlife habitat descriptions presented in *A Guide to Wildlife Habitats of California* (CDFG 1988), which are used in the *California Wildlife Habitat Relationships System* (CDFG 2009b. Field maps of the Action Area were created at a scale of 1:4800. The Action Area was overlaid onto aerial photographs with major roads, geographic features, and other notable landmarks to help orient survey teams and provide a reference for estimating the location of plant and wildlife habitats, special-status resources, and wildlife movement corridors.

Assessments of the RSAs were conducted on properties where access had been granted and, to the extent possible, from publicly accessible roadways where property access had not been granted. In areas where the RSAs were not accessible or visible from the roadway, biologists used other available resources, including aerial photography, to assess natural communities. In these instances, high-resolution aerial imagery signatures that were continuous between the RSAs and an accessible roadway were presumed to be consistent. Imagery signatures that were not continuous with an accessible roadway were presumed to match similar nearby signatures.

Sensitive natural communities including riparian boundaries and potential jurisdictional waters were identified and mapped on aerial photographs during the assessments. After field work was completed, hand-drawn locations of plant and wildlife habitats and observations of special-status species, their key habitat elements, any identified wildlife movement corridors, or special plant and wildlife notes were digitized, and global positioning system (GPS)-collected data were downloaded and imported into the GIS database. Hydrologic connectivity of both the constructed and natural drainage features was evaluated using a combination of aerial photographs and USGS 7.5-minute topographic quad maps. The plant and wildlife habitat assessment consisted of the following activities:

- Mapped and verified wildlife habitats based on vegetation communities identified in the California Gap Analysis Project (University of California-Santa Barbara 2002).
- Reviewed and made initial identifications of potential wetlands and waters of the U.S., waters of the state, and state streambeds.
- Mapped sensitive natural communities and habitats that may be suitable for special-status plant and wildlife species.
- Confirmed, identified, and described known or previously unreported suitable plant and wildlife habitats.
- Mapped special-status plant and wildlife habitat elements as identified in the prefield investigation.
- Identified and mapped locations of observed special-status plant and wildlife species.

All observed wildlife species (regardless of listing status) were identified to the lowest practical level and recorded using nomenclature found in *A Complete List of Amphibian, Reptile, Bird and Mammals Species in California* (CDFG 2008). For portions of the Action Area where designated CHUs were identified, the presence of habitat primary constituent elements (physical and biological landscape elements necessary for species survival and reproduction) were noted. The following biotic communities/habitats comprise the conditions for which federally listed plant and wildlife species may occur.

Special-Status Plant Habitat

To identify potential habitat for the 36 special-status plant species identified in the RSAs, key habitat constituents were mapped during the reconnaissance-level field surveys including natural and seminatural habitats, sensitive natural communities, and other terrestrial habitats with potential to provide suitable special-status plant habitat. These habitats were later used as the foundation for the analysis of direct and indirect effects.

Invertebrate Habitat

The pre-field investigation identified several special-status invertebrate species with potential to occur in the Action Area, including aquatic branchiopods (crustaceans in the taxonomic class *Branchiopoda*) associated with vernal pools (a type of seasonally inundated wetland) and one terrestrial insect, VELB, which uses a species of shrub for larval habitat.

To refine potentially suitable wildlife habitat for special-status vernal pool branchiopods, key habitat constituents were mapped or recorded during the reconnaissance-level field surveys. Where vernal pool habitat was accessible, soil conditions (such as wetland indicators), topography, and other indicators (such as plant composition) were noted to help determine how long aquatic features retain water throughout the season. Key habitat for the VELB is the larval host plant Mexican elderberry (*Sambucus* spp.); USFWS surveys for elderberry plants were conducted during the special-status plant surveys. Protocol surveys for this species were not conducted.

Fish Habitat

Aquatic habitat surveys were conducted between March 30 and April 2, 2009, and between April 28 and April 30, 2009. Aquatic habitat surveys were conducted at proposed HST drainage crossing (natural and constructed watercourses) locations to characterize potential fish habitat in historically natural watercourses. At each crossing, habitat features were recorded for one or two representative channel reaches after walking the entire length of channel bound by the Action Area. For locations where

crossings were inaccessible, observations were made from the nearest accessible point(s) upstream and/or downstream. Key channel and habitat features observed included apparent hydrology (i.e., perennial, intermittent, ephemeral), bankfull[1] width, bankfull depth, substrates (e.g., silt, sand, gravel, cobble), and presence of large woody debris. Fish were assumed potentially present if field observations indicated sufficient ephemeral hydrology, including any evidence of surface flow during recent wet seasons. No fish sampling was performed.

Watercourses were determined to have suitable habitat for special-status fish species if they met one or more of the following criteria:

- Are perennial.
- Meet use attainability analysis standards.
- Are identified as critical habitat or EFH by NMFS or the USFWS for species of concern.
- Have appropriate riparian cover, substrate, temperature, and passage/connectivity required to support the full life cycles of special-status fish species.

Amphibian and Reptile Habitat

To identify potentially suitable wildlife habitat for special-status amphibian and reptile species, key habitat constituents mapped during the reconnaissance-level field surveys included potential breeding pools (e.g., stock ponds, vernal pools and other seasonal wetlands, streams, and canals), creek/stream/river substrates, refugia habitat (e.g., small mammal burrows), soil conditions (e.g., sandy soils, moist substrates, alkali soils), vegetation communities (e.g., bush seepweed - iodine bush scrub), topography, watershed boundaries, foraging habitat, and prey base.

Bird Habitat

Biologists recorded observations of special-status bird species, evaluated potential nest sites for raptors protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712) and California Fish and Game Code 3503.5, and maintained a list of all observed migratory bird species. Bird species were identified based on direct observation, call, song, or diagnostic signs including nest type (size) and pellets. To identify potentially suitable habitat for special-status and migratory bird species, key habitat constituents were mapped during the reconnaissance-level field surveys. These habitat constituents included nesting and roosting habitat (e.g., mature trees, bridges, power lines, and burrows), topography, the presence or absence of vegetative cover, vegetation communities, foraging habitat, and prey base. Diagnostic signs such as fresh whitewash, pellets, castings, feathers, and nests were also recorded and mapped.

Mammal Habitat and Wildlife Movement Corridors

To identify potentially suitable wildlife habitat for special-status mammal species, key habitat constituents mapped during the reconnaissance-level field surveys included topography and the presence or absence of vegetative cover, foraging habitat, and migration barriers (i.e., canals and roadways). Diagnostic signs of special-status wildlife species such as fresh tracks, scat, and skeletal remains (of target special-status species or prey species) were also recorded and mapped, as feasible. The *Central Valley Biological Resources and Wetlands Survey Plan* (Authority and FRA 2010b) describes the methods in further detail.

Free-ranging wildlife species (specifically, mammals such as SJKF, coyote [*Canis latrans*], raccoon [*Procyon Lotor*], striped skunk [*Mephitis mephitis*], etc.) have the potential to use wildlife movement

[1] As cited in Simon and Castro 2003, bankfull discharge is the maximum discharge that can be contained within the channel without overtopping the banks and is generally accepted to represent the flow that occurs, on average, every 1 to 2.3 years.

corridors within the Action Area. Drainage corridors and ECAs identified in the literature review (Spencer et al. 2010) were evaluated and supplemented with incidental field observations (where access was permitted) to determine their utility as movement corridors for wildlife on both a local and regional population level. This literature review identified areas such as creeks and other drainages in the Action Area that may be used by wildlife as movement corridors.

4.1.2 Wetland Delineation Methods

Wetlands and waters of the U.S. were delineated using a combination of field surveys and aerial imagery mapping. Wetland types were classified according to the *Hydrogeomorphic Wetland Classification System* (USACE 1993) and the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Information from the wetland delineation will be used to obtain a preliminary JD from the USACE. A preliminary JD is "preliminary" in the sense that a recipient of a preliminary JD can later request and obtain an approved JD from the USACE if that becomes necessary or appropriate during the permit process or during the administrative appeal process (USACE 2008a). A permittee can identify effects, compensatory mitigation requirements, and other resource protection measures with a preliminary JD, because the USACE will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. (USACE 2008a).

A wetland delineation survey was conducted as prescribed in the *Central Valley Biological Resources and Wetlands Survey Plan* (Authority and FRA 2010b). Teams of qualified wetland scientists conducted a detailed delineation of wetlands and other waters within the Action Area. The delineation was performed with the dual intent of obtaining a preliminary JD, as described in USACE Regulatory Guidance Letter No. 08-02 (USACE 2008a), and to document the presence of habitat that has the potential to support vernal pool-dependent species. Of primary concern to the wetland scientists was the potential of the habitat to support the VPFS, CFS and the VFTS. These federally listed species require seasonal vernal pools to successfully complete their lifecycle.

Different survey methods were used during the wetland delineation survey depending on the type of feature being delineated (e.g., wetland, other waters of the U.S., or waters of the state). Additionally, methods varied depending on land use and whether the surveyors had permission to enter a given area. The *Merced to Fresno Section Draft Wetlands Delineation Report* (Authority and FRA 2011c) describes the delineation methods in further detail.

Wetland delineations will be supplemented with California Rapid Assessment Methods (CRAM) to assess the health of wetlands and riparian habitats. CRAM field work was completed in September 2011 and a report is currently being drafted. The report will provide a standardized assessment of the ambient status of wetland values, which will be used to determine appropriate mitigation measures for affected wetlands.

4.1.3 Focused Field Surveys

4.1.3.1 Special-Status Plant Survey Methods

This section provides a summary of methods used to survey for special-status plants. A more detailed survey methodology is discussed in the *Merced to Fresno Section Draft Special-Status Plants Survey Report* (Authority and FRA 2011a). Special-status plant surveys were conducted in late March, late April, and late May in accordance with the *CNPS Botanical Survey Guidelines* (CNPS 2001), the *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996a), and the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009c).

Botanical surveys were floristic in nature, meaning that all observed plant species regardless of listing status were identified to the level necessary to determine whether they are a special-status species. Species were identified and recorded according to nomenclature found in *The Jepson Manual: Higher*

Plants of California (Hickman 1993). Surveys were timed after reviewing reference sites and weather trends to conduct plant surveys within the appropriate phenological (blooming) period(s).

Special-status plant field surveys were conducted May 24-27, April 18-21, and March 15-17, 2011, for 100 parcels where permission to access has been granted. Surveyors were Virginia Dains, David Charlton, Rocky Brown, Paul Andreano, Robin Murray, Robert Conohan, Bryan Chevillet, and Holly Hill. Qualifications of field staff for the March 2011 survey are provided in Appendix C. Environmental conditions varied daily through the survey period from clear skies to light precipitation. Temperatures ranged widely from 40°F to 70°F with moderate winds. The special-status plant field surveys consisted of the following activities:

- Four teams of one botanist and one Trimble Mapping and Navigation Specialist walked meandering transects across accessible parcels having suitable habitat for the special-status plants.
- Survey transects were spaced at 15- to 50-foot intervals, depending upon the habitat type, existing vegetation, plant cover, and structural complexity.
  - Where the onsite habitat type was determined to be suitable and likely to support special-status species, surveyors and intervals were closer together. These areas were typically fields and/or grasslands supporting vernal pools and/or areas where microhabitat for special-status plant species occurred (e.g. specialized soils such as alkali soils, clay, or sand, etc.).
  - Many of the parcels where permission for entry was granted consisted entirely of active agriculture lands (orchards, vineyards, row crops) or urban developed areas that provided limited or no suitable habitat for special-status plants. Botanical surveys in these areas were generally limited to the edges of the fields, orchards, vineyards, drainage ditches, canals, windrows, and roadsides.
  - Completely developed urban residential, commercial, and industrial parcels were not included in the special-status species survey; however, ruderal and disturbed areas were surveyed, as some special-status plant species are known to occur in disturbed soils.

The *Merced to Fresno Section Special-Status Plant Survey Report* (Authority and FRA 2011a) details a full field survey methodology.

4.1.3.2 Wetland Survey Methods

Where possible, jurisdictional waters habitat assessments were conducted by walking portions of drainage channels within the Action Area. Field data characterizing adjacent riparian vegetation and channel characteristics were collected at each crossing location. Riparian vegetation characterization noted dominant and subdominant vegetation per vegetative strata within the channel and along the edges of the channel for each crossing location. Channel characterization included channel type and dimensions, substrate, and apparent flow regime (perennial, intermittent, ephemeral). The width and depth of ordinary high-water flows were determined based on field observations of indicators such as shelving, destruction of terrestrial vegetation, scour, presence of litter and debris, and water staining among others included in the USACE Regulatory Guidance Letter No.05-5 (USACE 2005). In many areas, access was limited or not possible, and natural drainage features were evaluated instead from the nearest public road or other accessible location upstream and/or downstream of the Action Area. Because aquatic habitat is also mapped in the Wetland Delineation Report (add reference), preliminary mapped features from that study were used to calculate aquatic habitat areas. Wetland delineation field surveys were conducted on four occasions in April and May 2010 and in January and February 2011, generally between 7 a.m. and 5 p.m. Field delineations were conducted on parcels of land where access had been granted to the wetland RSA. Surveys only included those parcels where suitable habitat was present and where right-of-entry was granted. Developed parcels and urban areas were not included in the survey. The wetland delineation was completed following guidance provided in the *Corps of Engineers Wetland Delineation Manual* (USACE 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE 2008b).

The following provides brief descriptions of staff and field conditions:

- Biologists Russell Huddleston, Michael Clary, Deborah Waller, and Gretchen Herron conducted wetland and waters field surveys on April 26 through 29, 2010.Temperatures ranged from approximately 44 to 86°F with occasional light winds and trace precipitation on April 28. Terrestrial habitat surveys for the majority of the BNSF Alternative Action Area were also completed at this time.
- Biologists Deborah Waller and Russell Huddleston conducted additional wetlands and waters field surveys on May 24 through May 26, 2010. Temperatures ranged from approximately 60 to 88°F with no precipitation.
- Biologists Gretchen Herron, Morgan King, Steve Long, Victor Leighton, Yolanda Molette, and Michael Clary conducted wetlands and waters field surveys from February 7 through 10, 2011.
- Biologists Gretchen Herron, Morgan King, Steve Long, Victor Leighton, Yolanda Molette, and Michael Clary conducted wetlands and waters field surveys from January 25 through January 28, 2011.

The primary objective of these surveys was to characterize and delineate wetlands and waters on accessible parcels.

Aerial Imagery Mapping Methods

Most of the jurisdictional waters identified in the wetland RSA were delineated based on high resolution aerial photographs (Mapcon Mapping, Ltd. 2007). Due to access limitations, this methodology was approved by the USACE regulatory staff as an acceptable method of completing the wetland delineation. Potential waters and wetland features that were visible on printed aerial imagery within the wetland RSA were identified and digitized using GIS technology.

Aerial imagery (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) was used to identify wetlands and other waters present in the Action Area. Wetlands and other waters were initially identified based on landscape signatures viewable on imagery overlayed with National Wetlands Inventory and Central Valley Vernal Pool Habitat dataset (BIOS 2009). Two aerial imagery sources (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) were used to identify landscape signatures of palustrine wetlands and other waters early and late in the growing season. Mapcon aerial imagery was collected (flown) in early in the growing season (February and March; 30cm aerial photography, Mapcon Mapping, Ltd. 2007) and prepared in September. Google Earth imagery (2011) was dated from June and September 2009 and 2010 (late growing season).

The Mapcon 2007 imagery dataset was selected for project use based on adequate Action Area coverage, higher quality resolution, and imagery collection during the wet season (February and March). Wet season imagery is preferred in identifying the maximum extent of wetlands and other waters signatures on the landscape. Precipitation preceding February fly dates (2007) was 51% of normal. However imagery reviewed from other vintages were not considered to contain better representation of wetland signatures as these images were collected during the drier portions of the growing season, contained lower quality resolution, or had insufficient coverage of the Action Area. Aerial imagery sources reviewed prior to selection of the 2007 imagery (Mapcon Mapping, Ltd. 2007) include:

- 2007 50cm aerial photography – Collected in June and July of 2007.
- 2009 1m aerial photography – Collected in June of 2009.
- 2009 30cm aerial photography – Collected from March to June of 2009.

4.1.4 Data Processing and Analysis

Information gathered in the field was organized in the office using ArcGIS software and summarized in tables for future reference. All GPS data were differentially corrected to achieve sub-meter accuracy. All hand-drawn locations of wetlands and other waters, botanical resources, wildlife habitats, incidental

observations of federally listed species, key macro- or micro-habitat elements, and wildlife movement/migration corridors or other relevant field notes were digitally converted from the field maps.

Where permission to enter was limited, a GIS specialist with the assistance of a qualified biologist estimated the extent or limits of the various resources remotely using background information, manual image interpretation, and image processing. This was particularly the case for wetlands and other waters. More detailed information regarding the mapping of the extent of these features can be found in the *Merced to Fresno Section Draft Wetlands Delineation Report* (Authority and FRA 2011c).

4.2 Special-Status Species Occurrence Potential

Habitat types identified during the reconnaissance-level field assessments were compared against the known habitat requirements for each special-status species with potential to occur in the Action Area. The potential for a particular special-status species to occur within the Action Area was then assessed and ranked as either no potential, future potential, unlikely potential, low potential, moderate potential, or high potential. Federally listed species identified and their corresponding potential to occur in the Action Area are provided in Table 4-1.

4.2.1 No Potential

Special-status species with no potential to occur include those with no current or historic range in the Action Area, and with no suitable habitat present in the Action Area. Several special-status fish species were identified within the Action Area but were determined not to have potential to occur within the Action Area. Definitions for occurrence potential are provided below. Species with future, low, moderate or high potential to occur in the Action Area are discussed in Section 5.

4.2.2 Future Potential

Several special-status fish species that currently have no potential to occur may have a low to moderate potential to occur following the SJRRP, which is anticipated to be in the implementation phase before construction of the Merced to Fresno Section begins. These species are considered to have a future potential to occur in the Action Area.

4.2.3 Unlikely Potential

Special-status species with an unlikely potential to occur in the Action Area include those reported to have a current or historic range in the Action Area, but either (1) have no potentially suitable habitat identified within the Action Area; (2) are presumed to be extirpated from the Action Area; or, (3) have a current range that is well documented not to include the Action Area.

4.2.4 Low Potential

Special-status species with low potential to occur include those with either (1) a potential current range and low or marginal quality (i.e., disturbed, fragmented, or otherwise degraded) habitat identified in the Action Area; or (2) a potential historic (but not current) range and habitat of any quality within the Action Area.

4.2.5 Moderate Potential

Special-status species with moderate potential to occur include those with potential current range and moderate quality habitat in the Action Area.

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Table 4-1
Federally Listed Species with the Potential to Occur in the Action Area

Scientific Name	Common Name	Federal Status1	State Status2	CNPS/CDFG Status 3	Natural Communities4	Potential to Occur	Rationale
Brassicaceae							
Caulanthus californicus	California jewel-flower	FE	SE	List 1B.1	Chenopod scrub, pinyon and juniper woodland, valley and foothill grassland in subalkaline, sandy loam soils. 230 to 3,000 feet (70 to 914 meters).	Unlikely	This species is considered extirpated from the San Joaquin Valley. There are no reported extant occurrences within 10 miles of the limit of direct effect; however, there is one historic extirpated occurrence of this species reported inside the limit of direct effect (Occurrence 38; CNDDB, 2003a). Moderate quality annual grassland habitat is present in the special-status plant study area.
Poaceae							
Neostapfia colusana *Critical Habitat*	Colusa grass	FT	SE	List 1B.1	Vernal pools usually in large or deep vernal pool bottoms; adobe soils. 15 to 365 feet (5 to 200 meters).	Moderate	Vernal pool habitat is present in the special-status plant study area. The 3 nearest occurrences are reported as extirpated (Occurrence 42; CNDDB, 2003a) and possibly extirpated (Occurrences 12 and 39; CNDDB, 2003a), respectively located 2.43 miles north, 3.21 miles northeast and 4.12 miles southwest of the limit of direct effect. The nearest presumed extant occurrence is located approximately 4.90 miles north of the limit of direct effect (Occurrence 43; CNDDB, 2003a). Critical Habitat for this species has been designated in the Action Area 2.09 miles southwest of the limit of direct effect.
Orcuttia inaequalis *Critical Habitat*	San Joaquin Valley Orcutt grass	FT	SE	List 1B.1	Vernal pools in volcanic mudflow and clay substrates. 100 to 2,500 feet (30 to 760 meters).	High	Vernal pool habitat is present in the special-status plant study area. There is one possibly extirpated occurrence located within the limit of direct effect (Occurrence 10; CNDDB, 2003a). The nearest presumed extant occurrence is located 0.72 miles northeast of the limit of direct effect (Occurrence 51; CNDDB, 2003a). Critical habitat for this species has been designated within the limit of direct effect.
Orcuttia pilosa *Critical Habitat*	hairy Orcutt grass	FE	SE	List 1B.1	Vernal pools in volcanic mudflow and clay substrates. 150 to 660 feet (45 to 200 meters).	High	Vernal pool habitat is present in the special-status plant study area. The CNDDB reports one presumed extant occurrence within the limit of direct effect (Occurrence 19; CNDDB, 2003a). Critical habitat for this species has been designated in the regional area 2.61 miles northeast of the limit of direct effect.
Tuctoria greenei *Critical Habitat*	Greene's tuctoria	FE	Rare	List 1B.1	Dry bottoms of vernal pools in open grasslands on Anita clay and Tuscan loam soils. 100 to 3,515 feet (30 to 1,070 meters).	High	Vernal pool habitat is present in the special status plant study area. The CNDDB reports one presumed extant occurrence within the limit of direct effect (Occurrence 28; CNDDB, 2003a). Critical habitat for this species has been designated within the limit of direct effect.
Scrophulariaceae							
Castilleja campestris ssp. succulenta *Critical Habitat*	succulent owl's-clover	FT	SE	List 1B.2	Vernal pools, swales, and seasonal wetlands in grassland complexes on acidic soils. 160 to 2,400 feet (49 to 730 meters).	High	Vernal pool habitat is present in the special-status plant study area. There is one presumed extant occurrence reported within the limit of direct effect (Occurrence 62; CNDDB, 2003a). Critical habitat for this species has been designated within the limit of direct effect.

Scientific Name	Common Name	Federal Status1	State Status2	CNPS/CDFG Status 3	Natural Communities4	Potential to Occur	Rationale
Invertebrates							
Branchinecta conservatio	Conservancy fairy shrimp	FE	—	—	Found in large, turbid pools in the northern 2/3 of the Central Valley; inhabit astatic pools located in swales formed by old, braided alluvium, filled by winter/spring rains, last until June.	Moderate	Vernal pools are present in the habitat study area. The nearest CNDDB reported occurrence is located approximately 1.89 miles south of the limit of direct effect and is presumed extant (Occurrence 34; CNDDB, 2003b). Critical habitat for this species has been designated within the limit of direct effect.
Branchinecta lynchi	vernal pool fairy shrimp	FT	—	—	Vernal pools inhabit small, clear-water sandstone depression pools and grassed swale, earth slump, or basalt-flow depression pools.	High	Vernal pools are present in the habitat study area. There are three CNDDB reported presumed extant occurrences of this species within the limit of direct effect (Occurrence 12, 153, and 181; CNDDB, 2003b). One additional presumed extant occurrence is located within the habitat study area 0.06 miles southwest of the limit of direct effect (Occurrence 310; CNDDB, 2003b). Critical habitat for this species has been designated within the limit of direct effect.
Branchinecta longiantenna	longhorn fairy shrimp	FE	—	—	Endemic to the eastern margin of the central coast mountains in seasonally astatic grassland vernal pools. Inhabit small, clear-water depressions in sandstone and clear-to-turbid clay/grass-bottomed pools in shallow swales.	Unlikely	The habitat study area is outside the known range for this species. There are no CNDDB reported occurrences of this species within 10 miles of the limit of direct effect (CNDDB 2003b).
Lepidurus packardi	vernal pool tadpole shrimp	FE	—	—	Seasonal pools in unplowed grassland with old alluvial soils underlain by hardpan or in sandstone depressions; water in the pools has very low alkalinity and conductivity.	High	Vernal pools are present within the habitat study area. There are two CNDDB reported and presumed extant occurrences within the limit of direct effect (Occurrences 81 and 244; CNDDB 2003b). Critical habitat for this species has been designated within the limit of direct effect.
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	FT	—	—	Blue, or Mexican, elderberry shrubs with stem diameters of 2-8 inches. Species always found close to host plant. Larvae may remain in stems for up to 2 years.	Moderate	Valley elderberry shrubs have been identified within the habitat study area. The nearest CNDDB reported occurrence is located 0.96 miles northeast of the limit of direct effect, and is presumed extant (Occurrence 134; CNDDB 2003b).
Fish							
Oncorhynchus mykiss	Central Valley steelhead	FT	—	SC	Adult steelhead migrate through mainstem Sacramento and San Joaquin rivers to cold-water spawning grounds in streams above the Valley floor. Following emergence from spawning gravels, juveniles either remain in their native streams or move downstream to rear in mainstem rivers and estuaries before entering the ocean.	Low (but moderate in the foreseeable future)	Could occur in the habitat study area in small numbers and would likely benefit to a limited extent from the SJRRP, although not the focus of current restoration plans (Reclamation et al. 2009). Critical habitat for this species has been designated within the regional area approximately 5.90 miles northwest of the limit of direct effect.
Oncorhynchus tshawytscha	Central Valley spring-run Chinook salmon	FT	ST	—	Over-summer in deep pools of the mainstem Sacramento River and its large perennial tributaries where fish can access cold headwaters during the warmer months. Water temps above 27 degrees Celsius is lethal to adults.	Future	This species is the primary target species of San Joaquin River Restoration Program, but an experimental population does not currently occur in the regional area (Reclamation et al. 2009).

Scientific Name	Common Name	Federal Status1	State Status2	CNPS/CDFG Status 3	Natural Communities4	Potential to Occur	Rationale
Hypomesus transpacificus	delta smelt	FT	ST	—	Adults occur in open brackish waters and large freshwater channels.	No	The regional area is outside of the current and historic range of this species; it is only reported to occur downstream of Mossdale in the San Joaquin River system (Moyle 2002).
Amphibians							
Ambystoma californiense	California tiger salamander	FT	ST	SC	Annual grasslands and grassy understory of valley-foothill hardwood habitats (i.e. oak-savannah). Require vernal pools or other seasonal water sources for breeding. Require mammal burrows or other underground refuges.	High	Vernal pools with adjacent California annual grassland habitat occur within the habitat study area. This species has been observed in vernal pool habitat adjacent to the BNSF alignment during field surveys. The CNDDB reports three occurrences within the limit of direct effect; two are denoted as extirpated (Occurrences 583 and 616; CNDDB 2003b) and one is presumed extant (Occurrence 901; CNDDB 2003b). Critical habitat for this species has been designated within the regional area 1.52 miles northeast of the limit of direct effect.
Rana aurora draytonii	California red-legged frog	FT	—	SC	Pools in marshes, streams, ponds, with emergent vegetation, and typically without predatory fish, require adequate hibernacula such as small mammal burrows and moist leaf litter.	Unlikely	The habitat study area is outside the known range for this species (Jennings et al.1993). There are no CNDDB reported occurrences of this species within 10 miles of the limit of direct effect (CNDDB 2003b).
Reptiles							
Gambelia (=Crotaphytus) sila	blunt-nosed leopard lizard	FE	SE	FP	Resident of sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief. Seek cover in mammal burrows, under shrubs or structures such as fence posts; they do not excavate their own burrows.	Unlikely	Suitable habitat for this species has not been identified in the habitat study area. The nearest CNDDB reported occurrence is located 3.70 miles south of the limit of direct effect and is presumed extant (Occurrence 403; CNDDB 2003b).
Thamnophis gigas	giant garter snake	FT	ST	—	Found in freshwater marshes and low-gradient streams. Prefers habitat with dense emergent vegetation, deep and shallow pools of water (which persist throughout the seasonal cycle of activity, open areas along water margins, and upland habitat with access to structures suitable for hibernation and escape from flooding. Has adapted to drainage canals and irrigation ditches.	Unlikely	The CNDDB reports one possibly extirpated occurrence of this species within the limit of direct effect (Occurrence 144; CNDDB 2011b). The habitat study area is currently outside the current range of this species (USGS 2009).

Scientific Name	Common Name	Federal Status1	State Status2	CNPS/CDFG Status 3	Natural Communities4	Potential to Occur	Rationale
Mammals							
Dipodomys nitratoides exilis	Fresno kangaroo rat	FE	SE	—	Sands and saline sandy soils in chenopod scrub and annual grassland communities on the Valley floor. Recently they have been found only in alkali sink communities between 200 to 300 feet (61 to 91 meters) in elevation. There are no known populations within the circumscribed historical geographic range in Merced, Madera, and Fresno Counties. (CSUS 2006)	Unlikely	Suitable habitat for this species is not present in the habitat study area. The CNDDB reports one extirpated occurrence within the limit of direct effect (Occurrence 15, CNDDB 2003b). The nearest presumed extant occurrence is located approximately 7.19 miles southwest of the limit of direct effect (Occurrence 22; CNDDB 2003b).
Vulpes macrotis mutica	San Joaquin kit fox	FE	ST	—	Annual grassland or grassy open stages with scattered shrubby vegetation; need loose-textured sandy soils for burrowing, and suitable prey base.	High	The habitat study area is within range and contains potentially suitable habitat for this species. The CNDDB reports two presumed extant occurrences within the limit of direct effect (Occurrence 24 and 25; CNDDB 2003b), and one additional presumed extant occurrence within the habitat study area 0.01 miles southwest of the limit of direct effect.

Definitions

No Potential: No historic range or habitat within the habitat study area

Future Potential: Potential following the San Joaquin River Restoration Program

Unlikely Potential: No suitable habitat and presumed extirpated within the habitat study area

Low Potential: Low or marginal quality habitat within habitat study area

Moderate Potential: Potential current range and moderate habitat within the habitat study area

High Potential: Presumed extant, observed or otherwise expected.

Designations:

-- = No status designation.

[a] Federal Status:

FE (Endangered) = Listed as endangered under the ESA.

FT (Threatened) = Listed as threatened under the ESA.

FC (Critical Habitat)

[b] State Status:

SE (Endangered) = Listed as endangered under the California Endangered Species Act.

ST (Threatened) = Listed as threatened under the California Endangered Species Act.

SR (Rare) = Listed as rare under the California Endangered Species Act.

SC (Species of Special Concern) = California Department of Fish and Game

FP (Fully Protected) = California Department of Fish and Game

[c] CNPS Status

LIST 1A = Presumed extinct in California.

LIST 1B = Rare, threatened, or endangered in California and elsewhere.

LIST 2 = Rare, threatened, or endangered in California, but more common elsewhere.

LIST 3 = More information about this plant (Review List).

.1 = Seriously endangered in California; .2 = Fairly endangered in California; .3 = Not very endangered in California

4.2.6 High Potential

Special-status species with high potential to occur include those reported as presumed extant, observed, or otherwise expected (i.e., professional opinion or other documentation) to occur in the Action Area.

4.2.7 Occurs

Special-status species positively identified within the Action Area during reconnaissance field surveys.

4.3 Federally Listed Plant and Wildlife Species

As determined by the background review of federally listed plant and wildlife species, 11 listed plant species were evaluated for their potential to occur within the regional area. These federally listed species included three plant species that have federally designated CHUs within the limit of direct effect. Federally listed plant and wildlife species with the potential to occur in the Action Area are provided in Table 4-2.

Table 4-2
Federally Listed Species with the Potential to Occur in the Action Area

Common Name	Scientific Name	Federal Status
Colusa grass	*Neostapfia colusana*	FT
San Joaquin Valley Orcutt grass	*Orcuttia inaequalis*	FT
hairy Orcutt grass	*Orcuttia pilosa*	FE
Greene's tuctoria	*Tuctoria greenei*	FE
succulent owl's-clover	*Castilleja campestris* ssp. *succulenta*	FT
Conservancy fairy shrimp	*Branchinecta conservatio*	FE
vernal pool fairy shrimp	*Brachinecta lynchi*	FT
vernal pool tadpole shrimp	*Lepidurus packardi*	FE
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
Central Valley Steelhead	*Oncorhynchus mykiss*	FT
Central Valley spring-run Chinook salmon	*Oncorhynchus tshawytscha*	FT
California tiger salamander, Central Valley DPS	*Ambystoma californiense*	FT
San Joaquin kit fox	*Vulpes macrotis mutica*	FE
FT (Federally Threatened) = Listed as threatened under ESA. FE (Federally Endangered) = Listed as endangered under ESA.		

Based on the background review, 15 federally listed wildlife species were initially evaluated for their potential to occur within the project area. These listed wildlife species were composed of five invertebrates, four fish, two amphibians, two reptiles, and two mammal species. In addition, three of the federally listed wildlife species evaluated have designated critical habitat within the limit of direct effect.

4.3.1 Plants

Of the 11 federally listed plant species identified as having potential to occur within the limit of direct effect, six species were ruled out based on the lack of suitable habitat, extensive areas converted by human development, extensive water diversions, local or regional extirpations, and/or because the Action

Area lies outside of these species' known geographic or elevation range. The potential for the remaining five federally listed plant species to be present within the Action Area is further evaluated in this BA.

4.3.2 Wildlife

Of the 15 federally listed wildlife species initially evaluated, seven were ruled out based on the lack of suitable habitat, extensive areas converted by human development, extensive water diversions, local or regional extirpations, and/or because the Wildlife RSA lies outside of these species' known geographic range. Additionally, two species that have recently been delisted (American peregrine falcon [*Falco peregrines*] and bald eagle [*Haliaeetus leucocephalus*]) were recorded on the list but will not be considered for consultation. The remaining six federally listed wildlife species are further evaluated for their potential to occur in the Wildlife RSA in this BA (see Table 4-1).

4.3.3 Anadromous Fish

Based on consultations with NMFS (see Appendix F), two anadromous fish species have the potential to occur now or in the reasonably foreseeable future (CVS and SRCS). CVS have a moderate potential to use the San Joaquin River from other population strongholds to the north (i.e., Stanislaus River). It has been determined that the continuous SJRRP interim flows since 2009 have increased the potential for CVS to use habitat within the Action Area. Considering the implementation of the SJRRP, it is expected that habitat for SRCS will be restored within the portion of the San Joaquin River located in the Action Area in the near future. Both species are therefore further evaluated in this BA.

4.3.4 Critical Habitat

Six CHUs were identified during initial evaluation of the limit of direct effect. Three designated CHUs were identified for listed vernal pool branchiopods (VPFS, VPTS, CFS). Three of the federally designated CHUs for plant species (hairy Orcutt grass, San Joaquin Orcutt grass, Greene's tuctoria) occur within the limit of direct effect.

4.4 Species/Critical Habitat Potentially Occurring in the Action Area

4.4.1 Colusa Grass

Colusa grass (*Neostapfia colusana*) is a federally threatened, state endangered and CNPS List 1B.1 species in the grass family (*Poaceae*). This species was listed as threatened in March 1997 (Federal Register 63: 54975). A 5-year review completed in 2008 recommended that Colusa grass remain a federally listed threatened species (Federal Register 74:12878).

Critical habitat for this species was designated in 2006 (Federal Register 71:7118); the nearest (CHU) is located approximately 2.09 miles southwest of the Merced to Fresno Section. This species is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005).

4.4.1.1 Species Description

Colusa grass is a robust, tufted annual grass that grows to between 0.8 to 3.1 inches tall. Bloom period is between May and August. It is the only species in the genus *Neostapfia*, and its closest relatives are the Orcutt grasses.

Threats to Colusa grass populations include land conversion to agriculture, urbanization and other forms of habitat loss and fragmentation. These threats continue to affect the species, as do dryland farming, flood control projects, and competition from invasive native and non-native plants (USFWS 2005).

4.4.1.2 Habitat Requirements and Range

Colusa grass occurs on the rim of alkaline basins in the Sacramento and San Joaquin Valleys, as well as on acidic soils of alluvial fans and stream terraces along the eastern margin of the San Joaquin Valley and into the adjacent foothills; elevations range from 18 feet to about 350 feet at known sites (USFWS 2005). Colusa grass has been found in Northern Claypan and Northern Hardpan vernal pool types (Sawyer and Keeler-Wolf 1995) within rolling grasslands (USFWS 2005). It grows in pools ranging from 0.02 to 617.5 acres, with a median size of 0.5 acre, and also occurs in the beds of intermittent streams and in artificial ponds. This species typically grows in the deepest portion of the pool or stream bed, but may also occur on the margins. It appears that deeper pools and stock ponds are most likely to provide the long inundation period required for germination. Colusa grass usually grows in single-species stands, rather than intermixed with other plants. Several soil series are represented throughout the range of Colusa grass. In the San Joaquin Valley Vernal Pool Region, soils are clay or silty clay loam in the Landlow and Lewis series (USFWS 2005).

The current distribution of this species, as published in the *USFWS 2008 Five-Year Review* (USFWS 2008), is 43 presumed extant occurrences in Yolo, Solano, Merced, and Stanislaus counties. Within the Action Area, the USFWS recognizes potential affect to this species in the USGS 7.5-minute El Nido, Merced, Planada and Atwater quadrangles.

4.4.1.3 RSA / Indirect Effect

Colusa grass may occur in areas of potentially suitable habitat within the limit of direct and indirect effect. Potentially suitable habitat is presumed to be present in vernal pools within those quads where USFWS recognizes potential effect on this species. The limit of direct effect conforms to the construction footprint while the limit of indirect effect conforms to a 100-foot radius that surrounds the construction footprint. This 100-foot-radius area of indirect effect was also defined during 2011 field surveys.

4.4.1.4 Documented Occurrences and Survey Results

The CNDDB reports 22 presumed extant occurrences of Colusa grass within the limit of direct and indirect effects, all within Merced County (CNDDB 2003a). The nearest presumed extant occurrence is located approximately 4.90 miles north of the Merced to Fresno Section (Occurrence 43; CNDDB, 2003a).

Colusa grass was not identified during 2011 special-status plant surveys where permission to enter was granted.

4.4.1.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat has been identified in the Action Area. Because permission to enter was not granted to conduct special-status plant surveys in all potentially suitable habitats, this species is assumed to have a moderate potential to occur in the Action Area.

4.4.2 San Joaquin Valley Orcutt Grass

San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) was federally listed as threatened in March 1997 (Federal Register 58:14338). It was listed as state endangered under the California Endangered Species Act in January 1987. Additionally, it is a CNPS List 1B.1 species.

This species is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005). Critical habitat for this species has been designated and occurs within the Merced to Fresno Section as discussed in Section 4.4.3 below.

4.4.2.1 Species Description

San Joaquin Valley Orcutt grass is a small, tufted annual in the grass family (*Poaceae*). Mature plants grow in tufts of several erect stems, each of which ranges from 2.0 to 11.8 inches long. The entire plant

is grayish-green, due to long hairs on the stem and leaves. The oval lemmas are 0.16 to 0.20 inch long and their tips are divided into 5 teeth approximately 0.08 inch long; the central tooth is longer than the others, hence the name *inaequalis* ("unequal"). At maturity, the spikelets of the plant are aggregated into a dense, hat-shaped cluster, which separates it from other members of the genus *Orcuttia*. The bloom period for this species is generally between April and September.

Threats to San Joaquin Valley Orcutt grass populations include habitat loss due to highway construction, residential development, and other forms of urbanization. Other threats include inappropriate grazing and foraging during grasshopper outbreaks (USFWS 2005).

4.4.2.2 Habitat Requirements and Range

San Joaquin Valley Orcutt grass is typically found in Northern Claypan, Northern Hardpan, and Northern Basalt Flow vernal pools within rolling grassland on alluvial fans, high and low stream terraces, and tabletop lava flows (USFWS 2005). Occupied pools range in surface area from 0.05 to 12.1 acres, with a median area of 1.54 acres (USFWS 2005).

Historically, this species has always been restricted to the Southern Sierra Foothills Vernal Pool Region; prior to 1990, 20 occurrences had been reported in Merced, Madera, and Fresno counties. Since 1990, 18 additional occurrences have been found, including one in Tulare County. Within the Merced to Fresno Section, the USFWS recognizes potential affect to this species in the USGS 7.5-minute Gregg, Fresno North, Merced, Planada, Le Grand, Kismet, and Plainsburg quadrangles.

4.4.2.3 RSA / Indirect Effect

San Joaquin Valley Orcutt grass may occur in areas of potentially suitable habitat within the limit of direct and indirect effect. Potentially suitable habitat is presumed to be present in vernal pools within those quads where USFWS recognizes potential effect on this species. The limit of direct effect conforms to the construction footprint while the limit of indirect effect conforms to a 100-foot radius that surrounds the limit of direct effect. This 100-foot radius area of indirect effect was also defined during 2011 field surveys.

4.4.2.4 Documented Occurrences and Survey Results

The CNDDB reports 24 presumed extant occurrences of San Joaquin Valley Orcutt grass within 10 miles of the Merced to Fresno Section, including one possibly extirpated occurrence located within the limit of direct effect (Occurrence 10; CNDDB 2003a). The nearest presumed extant occurrence is located 0.72 mile northeast of the Merced to Fresno Section (Occurrence 51; CNDDB 2003a).

San Joaquin Valley Orcutt grass was not identified during 2011 special-status plant surveys in areas where permission to enter had been granted.

4.4.2.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat for San Joaquin Valley Orcutt grass has been identified in the Action Area. Because permission to enter was not granted to conduct special-status plant surveys in all potentially suitable habitats, and because critical habitat exists and CNDDB reported possibly extirpated occurrence within the Merced to Fresno Section, this species is presumed to have a high potential to occur in the Action Area.

4.4.3 Critical Habitat for San Joaquin Valley Orcutt Grass

Critical habitat was first designated for the federally threatened San Joaquin Valley Orcutt grass in 2003 (Federal Register 68-46683), with a revised designation established in 2005 (Federal Register 70:46923). Species by unit designations were published in 2006 (Federal Register 71:7117). The designation includes a total of 136,312 acres in six units of critical habitat located in five San Joaquin Valley counties.

4.4.3.1 Defined Critical Habitat

The primary constituent elements (PCEs) of designated critical habitat for San Joaquin Valley Orcutt grass include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full lifecycle of the plant, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected to those vernal pools, swales, and other ephemeral wetlands and depressions that are hydrologically and ecologically connected (USFWS 2006).

Multiple units of designated critical habitat for San Joaquin Valley Orcutt grass lie within 10 miles of the project; however, only critical habitat unit (CHU) SJVAL 2 occurs within the Merced to Fresno Section. This 31,981-acre unit is south and east of the community of Le Grand (see Figure 4-1).

4.4.3.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for San Joaquin Valley Orcutt grass occurs in the limit of direct effect at one location. Approximately 10 acres of CHU SJVAL 2 was mapped as vernal pool within the Merced to Fresno Section.

4.4.4 Hairy Orcutt Grass

Hairy Orcutt grass (*Orcuttia pilosa*) is a federally endangered, state endangered and CNPS List 1B.1 species in the grass family (*Poaceae*). Hairy Orcutt grass was listed as endangered in March 1997 (Federal Register 62:14338).

Critical habitat for this species was originally designated in 2003 (Federal Register 68:46683) and was revised in 2005 (Federal Register 70:46923); the nearest CHU is located 2.61 miles northeast of the Merced to Fresno Section (see Figure 4-1). This species is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005).

4.4.4.1 Species Description

The plant has several stems that are 2 to 8 inches tall and that branch only from the lower nodes. Each stem ends in a long, spike-like inflorescence. Leaves are grayish, with soft, straight hairs. The upper spikelets are densely crowded and hairy. It blooms from May to September (Hickman 1993).

Habitat loss resulting from development, agriculture, overgrazing, trampling, and displacement by nonnative plants poses the greatest threat to existing populations (CNPS 2011).

4.4.4.2 Habitat Requirements and Range

Hairy Orcutt grass is found on volcanic basalt or clay substrates in vernal pool grassland complexes at elevations between 150 and 650 feet. This species is found in Butte, Glenn, Madera, Merced, Stanislaus, and Tehama counties. Within the Action Area, the USFWS recognizes potential affect to this species in the USGS 7.5-minute Gregg, Merced, Kismet, Plainsburg, Herndon and Madera quadrangles.

4.4.4.3 RSA / Indirect Effect

Hairy Orcutt grass includes areas of potentially suitable habitat within the limit of direct and indirect effect. Potentially suitable habitat is presumed to be present in vernal pools within those quads where USFWS recognizes potential effect on this species. The limit of direct effect conforms to the construction footprint while the limit of indirect effect conforms to a 100-foot radius that surrounds the limit of direct effect. This 100-foot area of indirect effect was also defined during 2011 field surveys.

4.4.4.4 Documented Occurrences and Survey Results

The CNDDB reports eight presumed extant occurrences of hairy Orcutt grass within 10 miles of the Action Area, including one occurrence within the limit of direct effect (Occurrence 19; CNDDB 2003a). This occurrence is reported in pools east of the BNSF Railway along Avenue 15.

Hairy Orcutt grass was not identified during 2011 special-status plant surveys in areas where permission to enter had been granted.

4.4.4.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat for hairy Orcutt grass has been identified in the Action Area. Because permission to enter was not granted to conduct special-status plant surveys in all potentially suitable habitat, and because a CNDDB presumed extant occurrence is identified within the Action Area, this species is presumed to have a high potential to occur in the Action Area.

4.4.5 Greene's Tuctoria

Greene's tuctoria (*Tuctoria greenei*) is a federally endangered, state rare, and CNPS List 1B.1 species in the grass family (*Poaceae*). This species was federally listed as endangered in March 1997 (Federal Register 58:14338).

Greene's tuctoria is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005). Critical habitat for this species has been designated and is discussed in Section 4.4.6 below.

4.4.5.1 Species Description

Greene's tuctoria is 2 to 6 inches tall with stems becoming decumbent and often purplish colored. The outward curving leaves are less than 1 inch long. The spikelet tips are irregularly short-toothed and deeply veined. Fruits are slightly flattened laterally. It blooms from May to July (Hickman 1993).

Habitat loss resulting from development, agriculture, and overgrazing poses the greatest threat to existing populations (CNPS 2011).

4.4.5.2 Habitat Requirements And Range

Greene's tuctoria is found on clay or Tuscan loam substrates in vernal pool grassland complexes at elevations between 100 and 3,515 feet. This species is found in Butte, Colusa, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tulare, and Tehama counties. Within the limit of direct effect, the USFWS recognizes potential affect to this species in the USGS 7.5-minute Merced, Planada, Le Grand, Kismet, and Plainsburg quadrangles.

4.4.5.3 RSA / Indirect Effect

Greene's tuctoria includes areas of potentially suitable habitat within the limit of direct and indirect effect. Potentially suitable habitat is presumed to be present in vernal pools within those quads where USFWS recognizes potential effect on this species. The limit of direct effect conforms to the construction footprint while the limit of indirect effect conforms to a 100-foot radius that surrounds the limit of direct effect. This 100-foot area of indirect effect was also defined during 2011 field surveys.

4.4.5.4 Documented Occurrences and Survey Results

The CNDDB reports nine presumed extant occurrences of Greene's tuctoria within 10 miles of the Action Area, one of which is located within the limit of direct effect (Occurrence 28; CNDDB 2003a). This occurrence is reported in vernal pools near Santa Fe Boulevard north of the Chowchilla River.

Greene's tuctoria was not identified during 2011 special-status plant surveys in areas where permission to enter had been granted.

4.4.5.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat for Greene's tuctoria has been identified in the Action Area. Because permission to enter was not granted to conduct special-status plant surveys in all potentially suitable habitat, and because a CNDDB presumed extant occurrence is identified within the Action Area, this species is presumed to have a high potential to occur in the Action Area.

4.4.6 Critical Habitat for Greene's Tuctoria

Critical habitat was first designated for the federally endangered Greene's tuctoria in 2003 (Federal Register 68:46683), with a revised designation established in 2005 (Federal Register 70:46923). Species by unit designations were published in 2006 (Federal Register 71:7117). The designation includes a total of 145,119 acres in six units of critical habitat located in eight California counties.

4.4.6.1 Defined Critical Habitat

The PCEs of designated critical habitat for Greene's tuctoria include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full cycle of the plant's life, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected to those vernal pools, swales, and other ephemeral wetlands and depressions that are hydrologically and ecologically connected (USFWS 2006).

Two units of designated critical habitat for Greene's tuctoria occurs within 10 miles of the Merced to Fresno Section; however, only CHU GREEN 7 occurs within the limit of direct effect. This 86,576 acre unit is north and east of the community of Le Grand (see Figure 4-1).

4.4.6.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for Greene's tuctoria occurs in the limit of direct effect at two locations, both of which are associated with CHU GREEN 7. Approximately 3 acres of CHU GREEN 7 was mapped as vernal pool during 2010 habitat surveys within the Merced to Fresno Section.

4.4.7 Succulent Owl's-Clover

Succulent owl's-clover (*Castilleja campestris* ssp. *succulenta*) is a federally threatened, state endangered, and CNPS List 1B.2 species in the figwort family (*Scrophulariaceae*).

This species was listed as threatened in March 1997 (Federal Register 62:14338) and is addressed in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005). Critical habitat for this species has been designated and is discussed in Section 4.4.8 below.

4.4.7.1 Species Description

Succulent owl's-clover grows 4 to 12 inches tall and has spear-shaped leaves with smooth edges. Inflorescences are spike-like with green spear-shaped bracts that are generally larger than the deep yellow to orange flowers. It blooms from April to May (Hickman 1993).

Habitat loss resulting from development, agriculture, overgrazing, and trampling poses the greatest threat to existing populations (CNPS 2011).

4.4.7.2 Habitat Requirements and Range

Succulent owl's-clover is found on acidic soils in vernal pool grassland complexes at elevations between 160 and 2,400 feet.

Succulent owl's-clover is found in Fresno, Madera, Merced, Mariposa, San Joaquin, and Stanislaus counties. Within the Action Area, the USFWS recognizes potential affect to this species in the USGS 7.5-minute Gregg, Fresno North, Merced, Planada, Le Grand, Plainsburg and Berenda quadrangles.

4.4.7.3 RSA / Indirect Effect

Succulent owl's-clover includes areas of potentially suitable habitat within the limit of direct and indirect effect. Potentially suitable habitat is presumed to be present in vernal pools within those quads where USFWS recognizes potential effect on this species. The limit of direct effect conforms to the construction footprint while the limit of indirect effect conforms to a 100-foot radius that surrounds the limit of direct effect. This 100-foot area of indirect effect was also defined during 2011 field surveys.

4.4.7.4 Documented Occurrences and Survey Results

The CNDDB reports 59 presumed extant occurrences of succulent owl's-clover within 10 miles of the Action Area, including one occurrence within the limit of direct effect (Occurrence 62; CNDDB 2003a). This occurrence is identified as being located along the margin of northern hardpan vernal pools 3.5 air miles northeast of the community of Fairmead.

Succulent owl's-clover was not identified during 2011 special-status plant surveys in areas where permission to enter had been granted.

4.4.7.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat for succulent owl's-clover has been identified in the Action Area. Because permission to enter was not granted to conduct special-status plant surveys in all potentially suitable habitat, and because a CNDDB presumed extant occurrence is identified within the Action Area, this species is presumed to have a high potential to occur in the Action Area.

4.4.8 Critical Habitat for Succulent Owl's-Clover

Critical habitat was first designated for the federally threatened succulent owl's-clover in 2003 (Federal Register 68:46683), with a revised designation established in 2005 (Federal Register 70:46923). Species by unit designations were published in 2006 (Federal Register 71:7117). The designation includes a total of 175,873 acres in six units of critical habitat located in seven San Joaquin Valley counties.

4.4.8.1 Defined Critical Habitat

The PCEs of designated critical habitat for succulent owl's-clover include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full lifecycle of the plant, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected to those vernal pools, swales, and other ephemeral wetlands and depressions that are hydrologically and ecologically connected (USFWS 2006).

Multiple units of designated critical habitat for succulent owl's-clover lie within 10 miles of the Merced to Fresno Section. However, only CHU SUCCL 3B occurs within the limit of direct effect. This 71,900 acre unit is north of the community of Le Grand (see Figure 4-1).

4.4.8.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for succulent owl's-clover occurs in the limit of direct effect at two locations, both of which are associated with CHU SUCCL 3B. Approximately 3 acres of CHU SUCCL 3B was mapped as vernal pool during 2010 habitat surveys within the limit of direct effect.

4.4.9 Conservancy Fairy Shrimp

CFS is a federally endangered small crustacean in the *Branchinectidae* family. This species was listed as endangered on September 19, 1994 (59 CFR 48136) and is addressed in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005). A 5-year review completed in 2009 recommended that CFS remain a federally listed endangered species (Federal Register 74:12878).

Critical habitat for this species has been designated within the Merced to Fresno Section and is discussed in Section 4.4.10 below.

4.4.9.1 Species Description

CFS have delicate elongate bodies, large stalked compound eyes, no carapaces, and 11 pairs of swimming legs. Males range from 0.6 to 1.1 inches long, with females measuring slightly smaller, between 0.6 and 0.9 inches (USFWS 2005). They glide gracefully upside down, swimming by beating their legs in a complex, wavelike movement that passes from front to back. CFS feed on algae, bacteria, protozoa, rotifers, and bits of detritus.

Threats to this species are primarily from habitat loss and fragmentation due to urban development and agricultural conversion.

4.4.9.2 Habitat Requirements and Range

CFS occurs in vernal pools found on several different landforms, geologic formations, and soil types. They have been observed in vernal pools ranging in size from 323 to 3,834,675 square feet, with a mean size of 299,936 square feet (USFWS 2005). Populations of CFS with the Central Valley have been located in northern hardpan pools within swales of old braided alluvium (Belk et al. 1999). Large pools with a mean size of 6.89 acres and a moderately turbid water column are the typical habitat parameters for this species (Belk et al 1999). CFS have been found at elevations ranging from 16 to 5,577 feet, and at water temperatures as high as 73°F (USFWS 2005).

The historical distribution of CFS is not known. However, the distribution of vernal pool habitats in the areas where CFS is now known to occur were once more continuous and larger in area than they are today (Holland 1998). It is likely CFS once occupied suitable vernal pool habitats throughout a large portion of the Central Valley and southern coastal regions of California (USFWS 2005).

CFS are known to be located in a few isolated populations distributed over a large portion of California's Central Valley and in southern California. In the San Joaquin Valley vernal pool region, CFS are found in the Grasslands Ecological Area in Merced County, and at a single location in Stanislaus County (USFWS 2005).

4.4.9.3 RSA / Indirect Effect

The RSA for CFS includes vernal pools and seasonal wetlands suitable to support this species within the Merced to Fresno Section, as well as an additional 250-foot limit of indirect effect. This limit of indirect effect is consistent with the guidance in the *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* (USFWS 1996b).

4.4.9.4 Documented Occurrences and Survey Results

The CNDDB reports six presumed extant occurrences of CFS within the Action Area, all within Merced County (CNDDB 2003b). The nearest presumed extant occurrence is located approximately 1.89 miles south of the Merced to Fresno Section (Occurrence 34; CNDDB 2003b).

No protocol-level habitat assessment or focused presence/absence surveys for CFS were conducted; however, the wetland delineation surveys identified seasonal wetlands and vernal pools that could provide habitat for this species.

4.4.9.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat has been identified in the Wildlife RSA. Because permission to enter was not granted to conduct protocol-level branchiopod surveys in all potentially suitable habitat, CFS are presumed to have a moderate potential to occur in suitable habitat within the Action Area.

4.4.10 Critical Habitat for Conservancy Fairy Shrimp

Critical habitat was first designated for the federally endangered CFS in 2003 (Federal Register 68-46683), with the final designation established in 2006 (Federal Register 71-7117). The designation includes a total of 161,786 acres in California and Oregon. California holds six units of critical habitat located in Butte, Colusa, Mariposa, Merced, Solano, Stanislaus, Tehama, and Ventura counties.

4.4.10.1 Defined Critical Habitat

The PCEs of designated critical habitat for CFS include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full lifecycle of CFS, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected to those vernal pools, swales, and other ephemeral wetlands and depressions that are hydrologically and ecologically connected (USFWS 2003).

Multiple units of designated critical habitat for CFS lie within 10 miles of the project; however, only CHU CONSFS 6 occurs within the Merced to Fresno Section. This 86,019-acre unit is located north and east of the community of Le Grand (see Figure 4-2).

4.4.10.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for CFS occurs in the Merced to Fresno Section at one location. Approximately 3acres of CHU CONSFS 6 was mapped as vernal pool within the limit of direct effect.

4.4.11 Vernal Pool Fairy Shrimp

VPFS has been federally listed as threatened since September 1994 (Federal Register 59:48136). This species is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005).

Critical habitat for this species has been designated within the Merced to Fresno Section and is discussed in Section 4.4.12 below.

4.4.11.1 Species Description

VPFS is 1 to 1.5 inches long, translucent in appearance, and found in California's vernal pools. Due to the ephemeral nature of their habitat, fairy shrimp have short life spans, typically from December to early May. Shrimp eggs are laid by the adults each winter season. However, eggs may lie dormant (as cysts) in the soil for many years before hatching. VPFS are filter and suspension feeders. Their diet mainly consists

of unicellular algae, bacteria, and ciliates. They may also scrape algae, diatoms, and protists from the surface of rocks, sticks, and plant stems.

Threats to this species are primarily from habitat conversion due to urban and agricultural development.

4.4.11.2 Habitat Requirements And Range

VPFS have a high potential to occur within a spectrum of vernal pools and inundated nonwetlands. VPFS occupy a variety of different vernal pool habitats: from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools. Populations of VPFS within the Central Valley are located in small swales, earthen pools, and basalt flow depressions that are typically smaller in scale than other branchiopod habitat (Eriksen and Belk 1999). Pools vary dramatically in size from 10 hectares to 0.56 square meters (Eriksen and Belk 1999). Although the species has been collected from large vernal pools, including one that exceeds 25 acres, it tends to occur in small vernal pools or seasonal wetlands in unplowed grasslands (Eriksen and Belk 1999). It is most frequently found in seasonally aquatic pools measuring less than 0.05 acre. The species has the ability to inhabit disturbed/constructed sites that are avoided by more habitat-specific species (Eriksen and Belk 1999).

4.4.11.3 RSA / Indirect Effect

The RSA for VPFS includes vernal pools and seasonal wetlands suitable to support this species within the Merced to Fresno Section, as well as an additional 250-foot limit of indirect effect. This limit of indirect effect is consistent with the guidance in the 1996 Programmatic BO (USFWS 1996b).

4.4.11.4 Documented Occurrences and Survey Results

The CNDDB reports 184 presumed extant occurrences of VPFS within the Action Area, including three occurrences within the Merced to Fresno Section (Occurrences 12, 153, and 181; CNDDB 2003b).

No protocol-level habitat assessment or focused presence/absence surveys for VPFS were conducted; however, the wetland delineation surveys identified seasonal wetlands and vernal pools that are presumed to provide suitable habitat for this species.

4.4.11.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat has been identified in the Action Area. Because permission to enter was not granted to conduct protocol-level branchiopod surveys in all potentially suitable habitat, and because multiple presumed extant occurrences are reported within the Action Area, VPFS are presumed to have a high potential to occur in suitable habitat within the Action Area.

4.4.12 Critical Habitat for Vernal Pool Fairy Shrimp

Critical habitat was first designated for the federally threatened VPFS in 2003 (Federal Register 68-46683), with the final designation established in 2006 (Federal Register 28-7117). The designation includes a total of 597,821 acres in California and Oregon. California holds 29 units of critical habitat located in the Sacramento Valley, San Joaquin Valley, and Central California coastal counties.

4.4.12.1 Defined Critical Habitat

The PCEs of designated critical habitat for VPFS include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full lifecycle of the VPFS, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected to those vernal pools, swales, and other ephemeral wetlands and depressions that are hydrologically and ecologically connected (USFWS 2003).

Multiple units of designated critical habitat for VPFS occur within 10 miles of the Merced to Fresno Section. However, only CHU VERFS 22 occurs within the Merced to Fresno Section. This 69,094-acre unit is located northeast of the community of Le Grand (see Figure 4-2).

4.4.12.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for VPFS occurs in the limit of direct effect at one location. Approximately 3 acres of CHU VERFS 22 was mapped as vernal pool within the Action Area.

4.4.13 Vernal Pool Tadpole Shrimp

VPTS is federally listed as endangered (Federal Register 59-48136). Critical habitat was first designated for the VPTS in 2003 (Federal Register 68-46683), with the final designation established in 2006 (Federal Register 28-7117). VPTS is included in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005).

Critical habitat for this species has been designated within the Merced to Fresno Section and is discussed in Section 4.4.14 below.

4.4.13.1 Species Description

VPTS is a small crustacean, 1 to 1.5 inches long and brown in color, found in California's vernal pools. As dictated by this ephemeral habitat, VPTS have short life spans, which last from December until the pools dry up in late spring or summer. Individuals can reach sexual maturity in 18 days and complete their life span in 9 weeks. VPTS reach maturity on average at 25 days, with first reproduction occurring at 54 days or a minimum carapace length of 0.393 inch (USFWS 2005). Eggs (as cysts) remain dormant in the soil during the dry season and may lie dormant in the soil for many years before hatching.

VPTS feeds on small invertebrates, amphibian eggs, and some vegetation. Although it has not been documented, VPTS probably preys on CFS when they co-occur (Eriksen and Belk 1999). VPTS is more temperature-tolerant than the VPFS.

This species is threatened by habitat loss, primarily from development, agriculture, and encroachment of non-native grasses.

4.4.13.2 Habitat Requirements and Range

Populations of VPTS within the Central Valley occur in a variety of ephemeral wetland habitats that are typically larger in scale to accommodate the longer life span of this species (USFWS 2005). However, pools where VPTS have been found vary dramatically in size from 2 to 88 acres (USFWS 2005). VPTS occupies a variety of different vernal pool habitats, from small, clear, sandstone rock pools to large, turbid, alkaline, grassland valley floor pools (Eng et al. 1990, Helm 1998).The species is adaptable to soil and water conditions, but over 50% of known occurrences have been associated with High Terrace landforms and Redding and Corning soils (USFWS 2005).

VPTS are endemic to California's Central Valley, from Shasta County to Merced County; the majority of the populations are distributed in the northern and eastern portions of the Central Valley. This species is found in vernal pools and seasonal wetlands containing highly turbid water, often in unplowed grasslands. These seasonal pools contain old alluvial soils underlain by hardpan, or occur in sandstone depressions; water in the pools has very low alkalinity and conductivity.

4.4.13.3 RSA / Indirect Effect

The RSA for VPTS includes vernal pools and seasonal wetlands suitable to support this species within the Merced to Fresno Section, as well as an additional 250-foot limit of indirect effect. This limit of indirect effect is consistent with the guidance in the 1996 Programmatic BO (USFWS 1996b).

4.4.13.4 Documented Occurrences and Survey Results

The CNDDB reports 34 presumed extant occurrences of VPTS within the Action Area, including two occurrences within the limit of direct effect (Occurrences 81 and 244;CNDDB 2003b).

No protocol-level habitat assessment or focused presence/absence surveys for VPTS were conducted; however, the wetland delineation surveys identified seasonal wetlands and vernal pools that are presumed to provide suitable habitat for this species.

4.4.13.5 Potential to Occur in the Action Area

Potentially suitable vernal pool habitat has been identified in the Wildlife RSA. Because permission to enter was not granted to conduct protocol-level branchiopod surveys in all potentially suitable habitat, and because multiple presumed extant occurrences are reported within the Action Area, VPTS are presumed to have a high potential to occur in suitable habitat within the Action Area.

4.4.14 Critical Habitat for Vernal Pool Tadpole Shrimp

Critical habitat was first designated for the federally threatened VPTS in 2003 (Federal Register 68-46683), with the final designation established in 2006 (Federal Register 28-7117). In Oregon and California, 597,821 acres were designated as critical habitat. California holds 29 units of critical habitat located in the Sacramento Valley, San Joaquin Valley, and Central California coastal counties.

4.4.14.1 Defined Critical Habitat

The PCEs of designated critical habitat for VPTS include vernal pools, seasonal wetlands, and other ephemeral wetlands and depressions that become dry in the summer but maintain inundation and moisture long enough to support the full lifecycle of VPTS, and vernal pool complexes, including networks of pools, swales, and other ephemeral features that are hydrologically and ecologically connected (USFWS 2003).

Multiple units of designated critical habitat for VPTS occur within 10 miles of the Merced to Fresno Section. However, only CHU VERTS 15 occurs within the Merced to Fresno Section. This 53,564-acre unit is located east of the community of Le Grand (see Figure 4-2).

4.4.14.2 Presence or Absence in the Limit of Direct Effect

Designated critical habitat for VPTS occurs in the Merced to Fresno Section at two locations, both associated with CHU VERTS 15. Approximately 12 acres of CHU VERTS 15 was mapped as vernal pool within the limit of direct effect.

4.4.15 Valley Elderberry Longhorn Beetle

VELB is an insect that was federally listed as threatened in August 1980 (Federal Register 80:23899). The *Valley Elderberry Longhorn Beetle Recovery Plan* (USFWS 1984) was published in June 1984. A 5-year review of the VELB Recovery Plan was undertaken in September 2006 (USFWS 2006). The USFWS is currently considering a proposal to delist the species.

4.4.15.1 Species Description

VELB is a medium-sized beetle, about 0.75 inch long. The forewings of the female are dark metallic green with red margins, whereas those of the male are primarily red with dark green spots. Beetles remain hidden in the stems and trunks of elderberry shrubs as larvae and pupae for 1 to 2 years. Adults emerge from the shrubs mid-March through June, at about the same time that the elderberry shrub produces flowers (USFWS 1984, 1991, 2006).

The primary threats to survival of this species are considered to be loss of habitat due to agricultural conversion, stream and river channelization, removal of riparian vegetation, and recreational, industrial, and urban development.

4.4.15.2 Habitat Requirements and Range

VELB has only been found in association with elderberry shrubs, which are often found in or close to riparian habitats along Central Valley rivers and their tributaries. Both larvae and adults feed only on this plant. Elderberry shrubs often occur in clumps that consist of several stems attached to a main trunk. Stems and trunks must be equal to or greater than 1 inch in diameter to provide suitable habitat for the VELB larvae (USFWS 1999a). This beetle is generally found along waterways and in floodplains in the Central Valley that support remnant stands of riparian vegetation; however, the species may be found associated with elderberry plants that are outside of the riparian corridor.

4.4.15.3 RSA/Indirect Effect

The RSA for VELB includes elderberry shrubs with stems with diameters greater than 1 inch at ground level within the Merced to Fresno Section, as well as an additional 100-foot limit of indirect effect outside of the drip line of each shrub. This limit of indirect effect is consistent with the guidance in the USFWS *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a).

4.4.15.4 Documented Occurrences and Survey Results

The CNDDB reports six presumed extant occurrences of VELB within the Action Area (CNDDB 2003b). The nearest occurrence is located 0.96 miles northeast of the Merced to Fresno Section (Occurrence 134; CNDDB 2003b).

Elderberry shrub locations were recorded as part of the botanical surveys within the Action Area. During the 2010 and 2011 surveys, three elderberry shrubs were observed (Figure 4-3).

No focused presence/absence surveys for VELB were proposed or conducted.

4.4.15.5 Potential to Occur in the Action Area

VELB has been documented within a 10-mile radius of the Merced to Fresno Section. Based on the species-specific habitat requirements (*i.e.*, presence of the host plant at locations described above), there is moderate potential for the species to occur in the Action Area.

The presence of VELB is inferred wherever elderberry shrubs are of a suitable size to host larvae. This inference is based on the known distribution of the species, the presence of host plants within the Action Area, and documented occurrences of the species within the limit of direct effect.

4.4.16 Central Valley Steelhead Distinct Population Segment

4.4.16.1 Species Description

CVS is an anadromous (i.e., “sea-run”) Pacific coastal rainbow trout classified and managed by NMFS as a distinct population segment (DPS). Individuals returning have been recorded over 20 pounds (Moyle et al. 1995). Prior to 1850, annual CVS spawning escapements were between 1 million and 2 million individuals; however, this number has been reduced to approximately 3,600 in the Central Valley (NMFS 2009b).

CVS was initially listed as federally threatened on March 19, 1998 (Federal Regulation Vol. 63 No. 53, 1998). Following an additional court-ordered status review, the threatened status of this species was reaffirmed on January 5, 2006 (Federal Regulation Vol. 71, No. 3, 2006). Critical habitat was designated

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potentially sensitive information

on September 2, 2005, and became effective on January 2, 2006 (70 Federal Register 52488); the designation does not include any accessible waterways in the Action Area.

Populations of CVS are threatened through habitat degradation and fragmentation. Through an extensive series of dams and other diversions, historic spawning and rearing habitat is now inaccessible to CVS. This species requires water temperatures under 60°F that is found at higher elevations now largely inaccessible to anadromous runs (NMFS 2008). Natural populations are subject to habitat degradation and various impacts from water development activities and land use activities. Extensive stocking of hatchery steelhead may have had deleterious effects on the genetic integrity of native runs (NMFS 2008). It is likely that inadequately screened water diversions, excessive water temperatures, and predation by non-native species have largely contributed to the decline of this species. The lack of adequate monitoring and research continues to limit the understanding of the viability of CVS.

4.4.16.2 Habitat Requirements and Range

The species enters the California Central Valley as adults in August with a peak run occurring in late September through October (Moyle 2002). Tributaries to the Sacramento and San Joaquin Rivers are preferred spawning sites, with adult CVS often ascending long distances to spawn in suitable habitat. Potential critical habitat for CVS is illustrated in Figure 4-4. Spawning generally occurs from December through April depending on the local population. Unlike other Pacific salmonids, CVS are iteroparous, returning to spawn multiple times to their natal watersheds (McEwan 2001). Adult females dig redds in coarse gravel in tail-outs of pools or in riffles. Eggs then incubate and hatch, depending on water temperature, in 3 to 4 weeks; first they hatch into sac-fry and then emerging from the gravel after an additional 2 to 3 weeks. Free living (swim-up) fry live in quiet edge waters of streams passively feeding for several weeks (Moyle 2002). Under good food conditions juvenile CVS can reach 4 to 5 inches in total length in their first year and 6 to7 inches total length by the end of their second year. Juvenile CVS typically rear in freshwater for a longer period than other salmonids (1 to 3 years), with both juveniles and adults spending varying amounts of time in fresh and salt water (McEwan 2001). Smolts (ocean-adapted juveniles) enter the ocean near the San Francisco Bay-Sacramento/San Joaquin River estuary.

Most sub-adults/adults reside in the ocean for 1 to 3 years before returning to their natal streams in the Central Valley to spawn (Moyle 2002). Habitat requirements are similar to those for Chinook salmon in that CVS require cool fresh waters with sufficient dissolved oxygen and minimal turbidity for successful incubation and rearing. However, unlike most juvenile Chinook salmon, juvenile CVS require habitat with consistently cool temperatures as emigration is unlikely for juvenile CVS prior to spending at least one full summer within their natal stream.

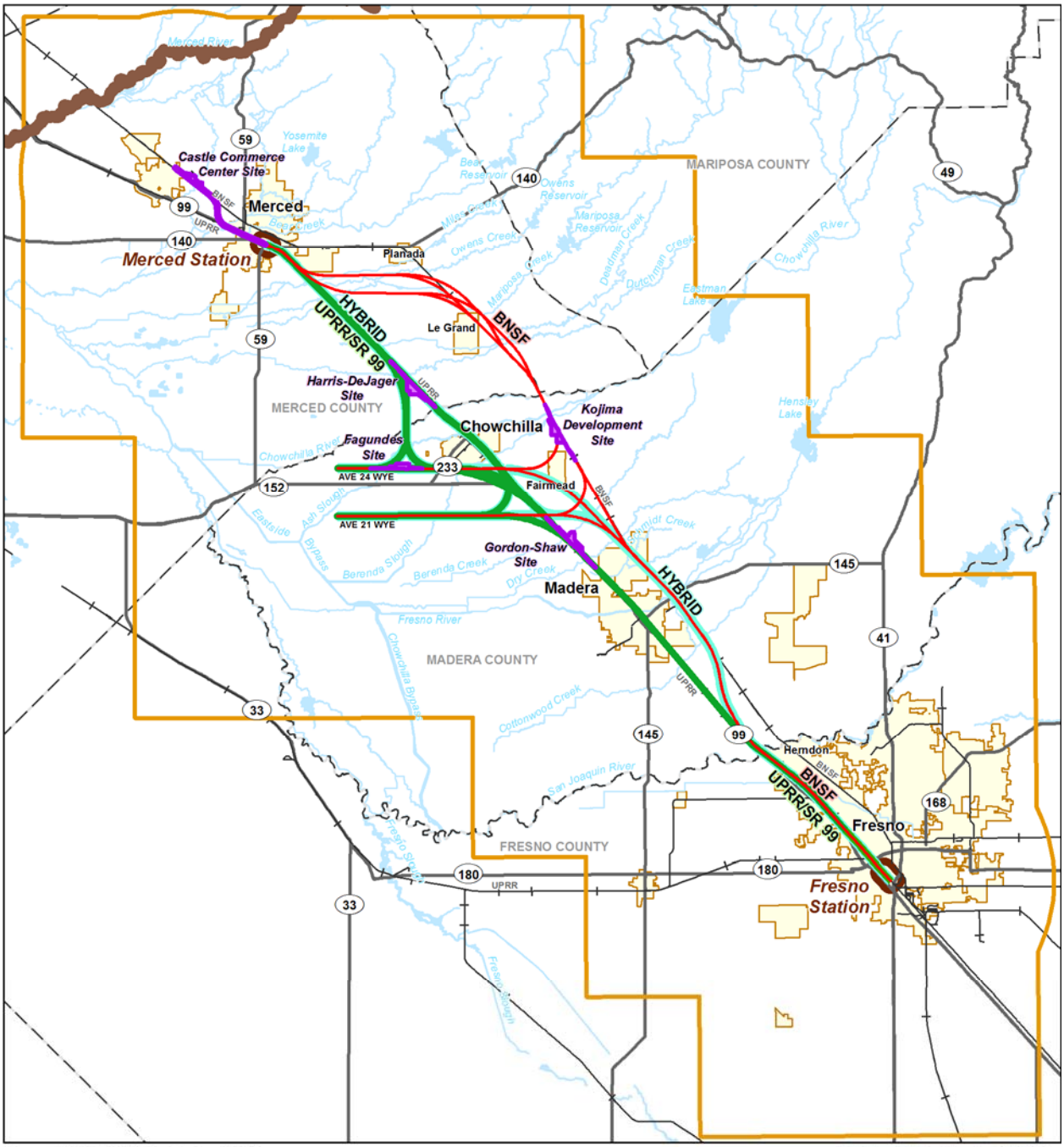
CVS is thought to have occurred historically from the McCloud River and other northern tributaries to Tulare Lake and the Kings River in the southern San Joaquin Valley. The NMFS Biological Review Team reported that recent spawner surveys of small Sacramento River tributaries (Mill, Deer, Antelope, Clear, and Beegum creeks) and incidental captures of juvenile CVS via monitoring on the Calaveras, Cosumnes, Stanislaus, Tuolumne, and Merced rivers confirmed that CVS are distributed throughout accessible streams and rivers in the Central Valley (NMFS 1996).

4.4.16.3 RSA / Indirect Effect

The RSA for CVS includes the Merced to Fresno Section crossing of the San Joaquin River plus an additional 400-foot limit of indirect effect upstream and downstream of the river crossing.

4.4.16.4 Documented Occurrences and Survey Results

Prior to the interim flows that occurred in 2009, the San Joaquin River from Friant Dam to Mendota Pool rarely sustained flows conducive to the lifecycle of CVS (U.S Bureau of Reclamation et al. 2009). There are no known natal populations of CVS within the upper San Joaquin River upstream of the Merced River confluence.



Source: U.S Fish & Wildlife Service (2009).

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UPRR/SR 99 Alternative
BNSF Alternative
Hybrid Alternative
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Regional Area
Critital Habitat
Central Valley steelhead

Figure 4-4
Central Valley Steelhead Critical Habitat

4.4.16.5 Potential to Occur in the Action Area

The known range of CVS encompasses the entire limit of direct effect; within the RSA, there are no known natal populations of CVS. A self-sustaining population is not known to currently occur in the RSA due to numerous downstream barriers, altered flows, and habitat conditions. With the re-inundation of the San Joaquin River in 2009, there is potential for straying CVS from other populations, particularly from spawning areas in adjacent watersheds with similar hydrological parameters such as the Stanislaus River (NMFS 2008), to exist. CVS have been known to migrate successfully through minimum water depths of 7 inches and jump as high as 17 feet (NMFS 2008) and are anticipated to have the potential to navigate through migration obstacles (e.g., Hills Ferry Fish Barrier and the Mendota Pool) to reach the Action Area. No breeding populations of CVS are currently verified to be utilizing the reinundated segment of the San Joaquin River from Friant Dam to Mendota Pool. The species could begin using the river from adjacent established population(s) (i.e., Stanislaus River) by the anticipated time construction of the Merced to Fresno Section begins in fall 2012.

4.4.17 Central Valley Spring-run Chinook Salmon

4.4.17.1 Species Description

SRCS are large, anadromous salmonids, commonly reaching 30 to 40 inches in length and averaging 20 to 22 pounds or greater (Moyle 2002). SRCS can be distinguished from other salmon by the body coloration and the spots on the back and tail. Juveniles (i.e., parr) usually have 6 to 12 broad dark bars (referred to as parr marks) evenly spaced and centered along the lateral line.

NMFS recognizes the SRCS as one Evolutionary Significant Unit (ESU) that includes all naturally spawned populations of SRCS in the Sacramento River and its tributaries (Moyle 2002). This ESU was listed as threatened on September 16, 1999 (64 Federal Register 50394). Critical habitat was designated on September 2, 2005, and became effective on January 2, 2006 (70 Federal Register 52488); the designation does not include any accessible waterways in the RSA. NMFS issued results of a 5-year review on August 15, 2011, that concluded this species should remain listed as threatened (76 Federal Register 50447). SRCS are also listed as threatened by the State of California.

4.4.17.2 Habitat Requirements and Range

A majority of the adult SRCS are 3 years old at their entrance to freshwater from the ocean. Like all salmon, SRCS do not feed during migration to spawning sites upstream. SRCS migrate as adults into the Central Valley from March through September. Spring-run spawning occurs from mid-August to late October (Yoshiyama et. al. 1998).

Eggs are laid in redds, and embryos hatch following an approximate 2-month incubation period. Sac-fry remain in the gravel for another 2 to 3 weeks adsorbing the yolk sac. Juvenile SRCS emerge and rear in the river in the Central Valley from 1 to 7 months beginning in late November through April. Following fry emergence, they begin external feeding. While rearing, juveniles feed on drifting insects (Moyle et al. 1995). Juveniles begin to move downstream after hatching and enter the estuary as smolts, physiologically adapted for life in saltwater.

SRCS are found throughout the mainstem of the Sacramento, Feather, Yuba, and American rivers and other tributaries within the Sacramento Valley and the San Joaquin, Cosumnes, Calaveras, Mokelumne, Stanislaus, and Merced rivers and their tributaries in the San Joaquin Valley. Many of the SRCS runs in both the Sacramento and San Joaquin Valleys are supported by both federal and State of California operated hatcheries (NMFS 2009b).

Principal threats to SRCS are from water conveyance, storage and diversion for agriculture and hydro-power; modification of streamflows which have resulted in altered habitat conditions and stream processes; natural resources exploitation and extraction; and land use and urban development(NMFS 2011).

4.4.17.3 RSA/Indirect Effect

The RSA for SRCS includes the Merced to Fresno Section as well as an additional 400-foot limit of indirect effect.

4.4.17.4 Documented Occurrences and Survey Results

SRCS were extirpated from the San Joaquin River above Friant Dam by the 1950s (Moyle 2002), and no run currently exists within the San Joaquin River.

4.4.17.5 Potential to Occur in the Action Area

SRCS are extirpated within the San Joaquin River but have been specifically targeted for recovery within the Action Area as a key implementation feature of the SJRRP (U.S. Bureau of Reclamation et al. 2009). Figure 4-5 illustrates the SRCS restoration area. The SJRRP is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows. As a result of the SJRRP Settlement (NRDC 2005), the U.S. Bureau of Reclamation has begun the implementation of the SJRRP with the initiation of interim flows in 2009 (U.S. Bureau of Reclamation et al. 2009). Prior to the interim flows, the San Joaquin River from the Friant Dam to Mendota Pool rarely sustained flows conducive to the lifecycle of SRCS (U.S. Bureau of Reclamation and California Department of Water Resources 2011). Juvenile SRCS typically rear in freshwater for a shorter period than CVS, emigrating as fry, sub-yearlings, and yearlings to the Pacific Ocean (Meyers et al 1998). SRCS require cool fresh water while they mature over the summer. The interim flows that have been continuous since 2009 are not at the specified flow capacity for salmon reintroduction (U.S. Bureau of Reclamation and California Department of Water Resources 2011).Though stray FRCS have been observed moving past the Hills Ferry Barrier at the confluence of the Merced and San Joaquin rivers, no spawning activity for any salmonid has been identified in the re-inundated San Joaquin River (Sloan 2010). SRCS are scheduled to be reintroduced to the San Joaquin River no later than December 31, 2012 (U.S. Bureau of Reclamation 2010). The reintroduced SRCS will be considered an experimental population by NMFS. By definition, under Section j of the ESA, all experimental populations are classified as threatened, and subject to Section 9 of the ESA.

4.4.17.6 EFH Assessment

In addition, SRCS is a federal species under the jurisdiction of NMFS for conservation of its EFH. Freshwater EFH for SRCS does not occur in the RSA. EFH for this species, however, includes viable aquatic habitat and most of the historically accessible habitat for Pacific salmon along the Sacramento River basin, the lower San Joaquin River, and several tributaries downstream of the RSA. Effects on designated EFH downstream of the RSA for Chinook salmon are addressed in the EFH assessment in Section 5.0.

4.4.18 California Tiger Salamander

The Central California DPS of CTS was federally listed as threatened in April 2004 (Federal Register 69:47212). The species was listed as threatened in March 2010 under the California Endangered Species Act. The recovery plan for CTS is still under development.

Critical habitat for CTS (central population) was designated in August 2005. The listing covers nearly 200,000 acres of critical habitat designated in 19 counties(Federal Register 70:49379). There is no designated critical habitat for CTS within the Action Area.

4.4.18.1 Species Description

The CTS is a large terrestrial salamander; they are black, with several white or pale yellow spots or bars. Adults are thought to forage on a variety of invertebrates. Hatchlings begin feeding on zooplankton, transitioning as they age to tadpoles (primarily *Pseudacris* sp.) and aquatic invertebrates (Calherps 2011).

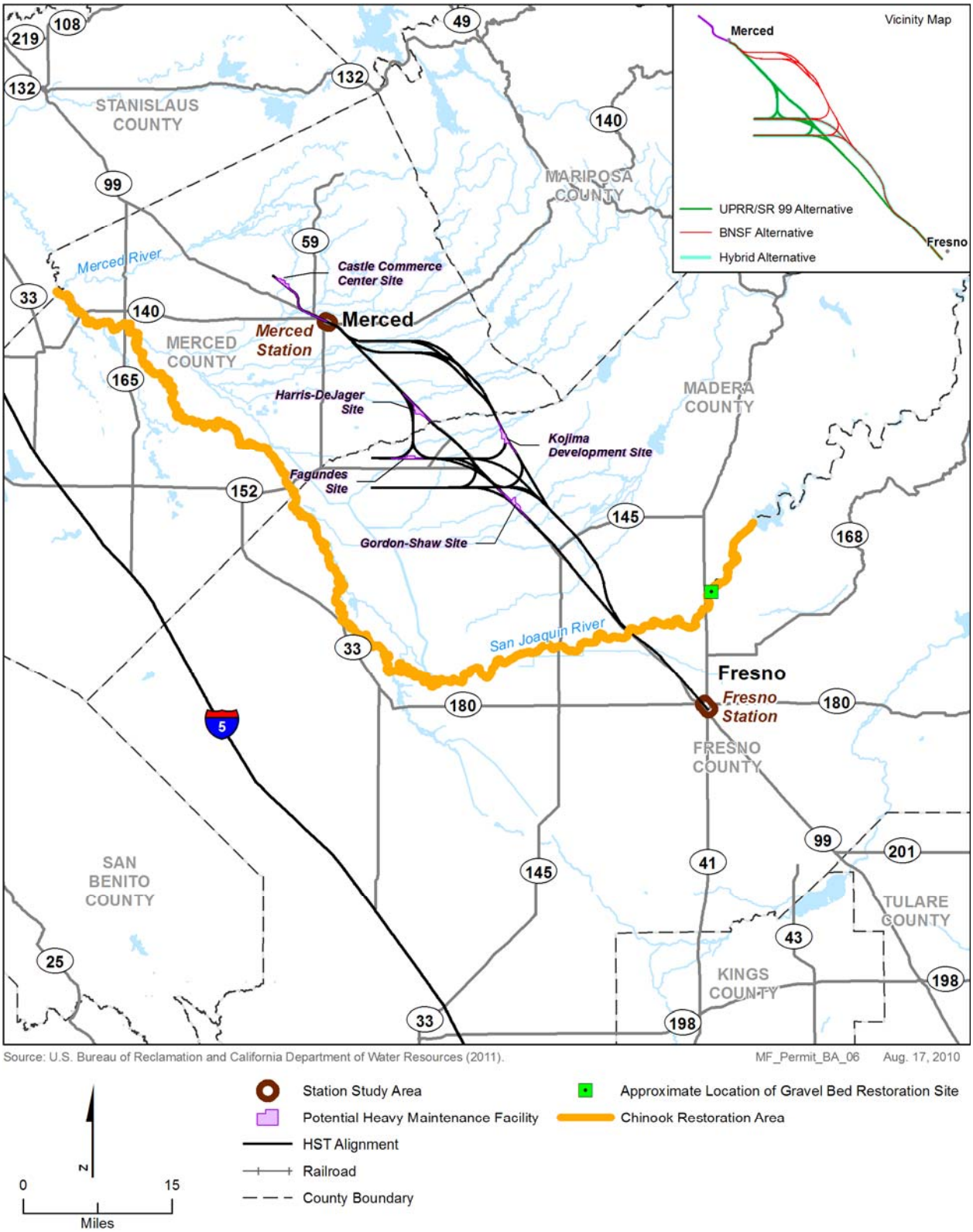

Figure 4-5
Spring-run Chinook Restoration Area

During summer months, CTS use subterranean refuge sites, usually small mammal burrows but also crevices in the soil, typically referred to as "aestivation" sites. Aestivation habitat is generally constructed by mammals that live underground such as ground squirrels (*Spermophilus beecheyi*) and Botta's pocket gophers (*Thomomys bottae*) (Goals Project 2000). The adults emerge from November from within their aestivation burrows fat night for mass migration occurs during rainy nights in early winter (October to November) in order to migrate to freshly inundated breeding pools (Calherps 2011).

Successful long-term recruitment of CTS populations requires ephemeral ponds which are inundated on average of 4 to 5 months of the year (Calherps 2011). Certain CTS populations may breed in slow streams and other semi-permanent waters such as cattle ponds that do not contain fish (Calherps 2011) Breeding can occur explosively all at once, or it can continue for several months as dictated by precipitation (Calherps 2011).The peak breeding period typically occurs between December and February. Adults engage in mass migration to breeding ponds during a few rainy nights from November to May, departing shortly after breeding.

Threats to species survival include road construction and associated traffic, agricultural land conversion, urban development, non-native predators (largemouth bass, bullfrogs, and mosquito fish, etc), and hybridization with the introduced barred salamander (*Ambystoma mavortium*) (Calherps 2011).

4.4.18.2 Habitat Requirements and Range

CTS is distributed throughout portions of the Central Valley and Central Coast ranges from Colusa County south to San Luis Obispo and Kern counties, from sea level to 3,460 feet. This species requires suitable upland terrestrial habitat within range of seasonal breeding ponds in order to survive. Suitable upland habitat for CTS consists of annual grasslands, oak savannah, and pastures that support fossorial mammals that create appropriately sized burrow refugia. Seasonal ponds, or semi-permanent calm waters that hold water for a minimum of 3 to 4 months in duration for breeding and larval maturation are required within access of upland habitats for long-term population survival. Annual grassland scattered with seasonally inundated features such as vernal pools and stock ponds contains the highest density of breeding populations of CTS (AmphibiaWeb 2010).

A review of the CNDDB (CDFG 2010) and CWHRS (CDFG 2005) databases indicates that the limit of direct effect is entirely within the known geographic distribution of the CTS.

4.4.18.3 RSA / Indirect Effect

The RSA for the CTS includes vernal pools and other seasonal wetlands as well as the associated California annual grasslands and select agricultural types such as pastures and dry land grain crops (upland habitats) which compose the upland habitat for this species (Calherps 2011).

4.4.18.4 Documented Occurrences and Survey Results

The CNDDB has reported 80 presumed extant CTS occurrences within the regional area, including one occurrence within the limit of direct effect in vernal pools at the Great Valley Conservation Bank north of the Chowchilla River (Occurrence 901; CNDDB 2003b). In addition, three presumed extant occurrences are reported within 1.24 miles of the limit of direct effect (Occurrences 307, 389 and 684; CNDDB 2003b). Two occurrences from within the RSA are reported as extirpated, one near Fresno (Occurrence #583; CNDDB 2003b) and one near Madera (Occurrence #616; CNDDB 2003b). One presumed extant occurrence is located near the community of Le Grand within the Great Valley Mitigation Bank (Occurrence #901; CNDDB 2003b). CTS larvae were identified in a degraded vernal pool near the intersection of White Rock Road and Santa Fe Avenue during special-status plant surveys in 2011; however, protocol-level surveys for the species were not performed within the Wildlife RSA. Habitat surveys have identified potentially suitable habitat for CTS in vernal pools and other seasonal wetlands, California annual grasslands, and select agricultural habitat, such as pastures and dry land grain crops, throughout the limit of direct effect; however, many of these areas are fragmented from potentially suitable aquatic breeding habitat by urbanization, agriculture, and other areas of detrimental activities. Agricultural fields are regularly disked or turned, eliminating burrows that potentially crush or smother

fossorial mammals. Frequent rodenticide application directly kills small mammal species and their associated amphibian species, reducing burrow availability (upland salamander refugia) in fallowed or pasture land (Calherps 2011).

4.4.18.5 Potential to Occur in the Action Area

Potentially suitable aquatic and upland dispersal habitat has been identified in the Wildlife RSA. Due to the presence of potentially suitable habitat as well as a verified occurrence within the Action Area, CTS are confirmed to occur within the Action Area.

4.4.19 San Joaquin Kit Fox

SJKF is a subspecies of kit fox that has a broad distribution in the San Joaquin Valley. It is a federally endangered and state threatened species. The USFWS listed the species in the Federal Register on March 11, 1967 (Federal Register 32:4001) and discussed SJKF in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998). In February 2010, a 5-year review of the plan was conducted to review the status of the species. The review did not suggest any changes to the listing (USFWS 2010b).

Critical habitat for SJKF has not been designated; however, designated landscape linkages for the species are present in the Central Valley.

4.4.19.1 Species Description

SJKF has a small, slim body with an average body length of 30 inches; it stands about 12 inches high at the shoulder and has long legs, large ears, and a long bushy tail that tapers at the tip. The average weight of an adult male is about 5 pounds. The ears are conspicuously large and densely covered on the inside with stiff, white hairs. The summer coat is light buff to buff-gray on the back and white on the belly; its winter coat is grizzled gray on the back, rust to buff on the sides, and white beneath. The tail is distinguished by a prominent black tip (USFWS 1998, 2010b).

SJKF is primarily nocturnal. Adult foxes are usually solitary during the late summer and fall. By September and October, adult females (i.e., vixens) begin to excavate, clean, and enlarge their pupping dens. Adult males join the vixens in October or November (Morrell 1972), and mating occurs between December and March (USFWS 1998). Pups are typically born in late February or early March (Egoscue 1962, Morrell, 1972), emerge from dens in March and April, and begin foraging for themselves between June and August, dispersing shortly thereafter in August or September (Morrell 1972; USFWS 2010b). Numerous threats to this species have been identified. In addition to habitat loss and fragmentation due to agricultural and urban development, predation, starvation, flooding, disease, drought, shooting, trapping, poisoning, and road kills are implicated in the decline of the species. SJKF has declined throughout its range as a result of habitat loss, predator and pest control programs, and inter-specific competition with coyotes (Cypher et al. 2000).

4.4.19.2 Habitat Requirements and Range

SJKF inhabits arid valley and foothill grasslands, sparsely vegetated scrub/shrub habitats (O'Farrell 1983; USFWS 1998), and some agricultural and urban areas (Jensen 1972, Morrell 1972). In Merced County, the species most frequently uses grassland in proximity to natural or constructed watercourses (Orloff et al. 1986). SJKF is quite tolerant of human disturbances and will, to a minimal extent, use developed and agricultural lands, particularly for foraging and movement or migration. However, the use of agricultural lands by SJKF is dependent on prey availability and refugia opportunities. Lands producing row crops are inundated weekly during irrigation, which impedes foraging and precludes the establishment, maintenance, and use of earthen dens (Warrick et al. 2007). On the other hand, orchards and vineyards that are located within 1 mile of natural lands have been reported to potentially provide adequate habitat for nighttime foraging by the species (Warrick et al. 2007). Although SJKF is known to

fully utilize urban environments near the southern extend of their range, urban environments within the Merced to Fresno Section are not known to support populations of this species.

SJKF use complex dens for shelter, protection, and rearing of young (USFWS 1998). Dens may be used year round. Most dens are located in flat terrain or the lower slopes of hills, and are commonly found in washes, drainages, and roadside berms. SJKF are reputed to be poor diggers and are usually found in areas with loose-textured, friable soils (Morrell 1972, O'Farrell 1983). Some studies have suggested that where hardpan layers predominate, some individuals create dens by enlarging California ground squirrel or American badger (*Taxidea taxus*) burrows (Morrell 1972, Jensen 1972, Orloff et al. 1986). They also commonly den in human-made structures such as small-diameter culverts. A diet of small rodents such as kangaroo rats and California ground squirrels is common (Jameson and Peeters 2004). SJKF appear to be affected by precipitation-related prey availability.

The historic range of SJKF included the San Joaquin Valley, from southern Kern County north to Tracy in San Joaquin County, and portions of the Inner Coast Range, such as the Carrizo Plain, Salinas Valley, Temblor Range, Cholame Hills, and Elkhorn Plain (USFWS 1998). The present-day distribution is comprised of fragmented populations that use remaining natural lands, mostly from Merced County southward to southern Kern County. The largest remaining populations occur in western Kern County in and near the Elk Hills and the Buena Vista Valley, as well as in the Carrizo Plain in San Luis Obispo County (USFWS 1998).

Two recovery recommendations for SJKF in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) are (1) to expand and connect existing refuges and reserves; and (2) to maintain, expand, and establish linkages/movement corridors.

The Merced to Fresno Section intersects satellite areas (i.e., portions of habitat that support isolated populations of a species but may be too isolated to support populations of species in the wake of significant climatic or environmental events) and linkage recovery areas (i.e., areas that provide a spatial linkage between satellite and core population areas) identified by the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) for the SJKF. Core recovery areas, which are portions of habitat large enough to sustain long-term populations of specific species, will not be affected by the Merced to Fresno Section. The Merced to Fresno Section will traverse areas identified as "other lands with potential" for SJKF recovery (referred to as satellite areas) include the Eastern Merced and Western Madera Satellite areas (USFWS 1998).

In areas outside of the Core, Satellite, and Linkage areas, populations of SJKF are not expected to occur frequently; however, dispersing individuals may be present on occasion. In general, habitats that are natural and are not disturbed on a regular basis may provide suitable habitat and opportunity for breeding, denning, foraging, or dispersing activities. In contrast, agricultural and other developed areas provide limited opportunity for denning; however, individual SJKF may disperse or forage in these areas.

As noted by Spencer et al. (2010), land use within the California Central Valley ecoregion (Sacramento Valley, San Joaquin Valley, and Sacramento-San Joaquin Delta regions) has largely been converted to agriculture and urban landcovers. As such, remaining habitat blocks are small in size and spatially fragmented relative to other ecoregions in the state.

As shown on Figure 3-3, the Eastman Lake-Bear Creek ECA occurs in association with the corridors of Deadman Creek and Dutchman Creek, from their headwaters in the Sierra Nevada Range east of Planada and Le Grand, westward to their confluence points with the Eastside Bypass, and largely follows the spatial arrangement of the Madera-Merced Linkage reported by Penrod et al. (2001), along Sandy Mush Road. Portions of this ECA within the Merced to Fresno Section are co-located with the Sandy Mush Road Area, which is promoted in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998), for its high biological function and value.

From a habitat perspective, Sandy Mush Road largely follows the Dutchman Creek corridor, which crosses the UPRR/SR 99 Alternative just north of the potential Harris-DeJager HMF site, and crosses the BNSF

and Hybrid alternatives south of Le Grand. With the exception of roadways and scattered urban centers, land use in the Sandy Mush Road Area near the HST alternatives is almost entirely agricultural. Land use near the western origin of Sandy Mush Road is also agricultural, but is near the southern boundary of the Great Valley Grasslands State Park, which comprises expansive native grasslands and wetland complexes. Great Valley Grasslands State Park is part of the larger Grasslands Ecological Area, an approximately 160,000-acre habitat preserve located within the historic floodplain of the San Joaquin River.

4.4.19.3 Madera-Merced Linkage (Eastman Lake-Bear River ECA)

In the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998a), the biological function and value of the Sandy Mush Road area was promoted for SJKF and blunt-nosed leopard lizard. Specifically, this document established the following planning goal: "Maintain and enhance movement of kit foxes between the Mendota area, Fresno County, natural lands in western Madera County, and natural lands along Sandy Mush Road and in the wildlife refuges and easement lands of Merced County. Specifically, maintain and enhance the Chowchilla or Eastside Bypass and natural lands along this corridor through acquisition, easement, or safe harbor initiatives." In addition, this document states, "Link natural lands in the Sandy Mush Road area of Merced County with the population of kit foxes on natural lands to the east by a safe harbor initiative on farmland."

This earlier work by the USFWS formed the foundation for the more formalized corridor identification process undertaken by the Missing Linkages Project in late 2000 (Penrod et al. 2001). Later work (Constable et al. 2009) by conservation biologists recommended that SJKF be conserved aggressively in southwestern Merced County, which is currently understood to be the northern-most limit of self-sustaining populations of SJKF.

In 2010, the California Department of Transportation and CDFG collaboratively published *The California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* (Spencer et al. 2010). This project was commissioned "… because a functional network of connected wildlands is essential to the continued support of California's diverse natural communities in the face of human development and climate change …"

This project produced maps, data, and mitigation guidelines for ECAs, which were defined as areas essential for ecological connectivity between natural landscape blocks. Using GIS modeling processes very similar to those used by the Missing Linkages Project, Spencer et al. (2010) identified the Eastman Lake-Bear Creek ECA, which largely follows the spatial arrangement of the Madera-Merced Linkage developed by Penrod et al. (2001).

4.4.19.4 RSA / Indirect Effect

The RSA for the SJKF includes areas suitable to support this species within the Merced to Fresno Section, as well as an additional 1,000-foot limit of indirect effect.

4.4.19.5 Documented Occurrences and Survey Results

A review of the CNDDB (CDFG 2003b) and CWHRS (CDFG 2005) databases as well as the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) and the *San Joaquin Kit Fox 5-Year Review* (USFWS 2010) indicates that the Wildlife RSA occurs within the known geographic range of the SJKF. Additionally, several movement corridors and landscape linkages for this species occur in the limit of direct effect.

A wide-ranging species, SJKF has been reported in Merced, Madera, and Fresno Counties. The *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) describes current populations throughout the San Joaquin Valley floor and surrounding foothills to the east and west.

The CNDDB reports nine occurrences within the Action Area, two of which are reported from within the Merced to Fresno Section (Occurrences 24 and 25; CNDDB 2003b). One additional occurrence is reported from within the Action Area (Occurrence 89; CNDDB 2003b). Occurrences 24 and 25 were located in

nonirrigated agricultural areas north and northeast of the community of Le Grand in Merced County, while Occurrence 89 consisted of a presumed road mortality along SR 99 near Herndon in Fresno County.

No protocol-level presence/absence surveys were conducted for SJKF.

4.4.19.6 Potential to Occur in the Action Area

SJKF has the potential to occur in areas of suitable habitat throughout the Action Area. Suitable foraging and breeding habitat for the SJKF in the Wildlife RSA may be found in natural lands such as annual grassland, barren, and pasture. Although the species may be found in natural areas throughout the Merced to Fresno Section, SJKF has a greater potential to den and breed in natural areas within or adjacent to mitigation banks. The species is also expected to have a greater potential to occur within identified linkage areas and satellite recovery areas described in the *Recovery Plan for Upland Species of the San Joaquin* Valley, *California* (USFWS 1998) and *5-Year Review Plan* (USFWS 2010). California Connectivity Project linkages (Spencer et al. 2010), where large blocks of natural areas and less habitat fragmentation occur, are also considered to have high potential for SJKF to den and breed. SJKF may be found in riparian corridors and habitat linkages, which provide dispersal opportunities and may provide foraging or breeding habitat.

Although agricultural lands are suboptimal for SJKF breeding, the species may use agricultural lands for foraging and dispersal. Grain crops and alfalfa, in particular, may host appropriate SJKF prey species. Agricultural areas within 1 mile of natural habitat blocks may be used more frequently for foraging and dispersal than agricultural lands isolated from movement corridors and natural lands.

The presence of SJKF is inferred throughout the Wildlife RSA with the exception of the urban habitats. This inference is based on the known distribution of the species, the presence of suitable habitats within the Wildlife RSA, and documented occurrences of the species near the Merced to Fresno Section.

5.0 Effects Analysis

As described in Section 4, 13 federally listed plant and animal species have the potential to occur in all or a portion of the Action Area. Each federally listed plant and wildlife species was determined to have the potential to exist within the Action Area based on literature review, aerial interpretation, desktop research, pre-field investigations, reconnaissance-level field surveys and habitat mapping. Figures 4-1 and 4-2, respectively, show the location of federally listed plant and wildlife species that have reported occurrences that intersect the Action Area, as well the location of designated critical habitat.

The federally listed species inferred or otherwise documented to be present within the Action Area include the following (*FT- Federally Threatened, FE - Federally Endangered*):

- Colusa grass- *FT*
- San Joaquin Valley Orcutt grass - *FT*
- Hairy Orcutt grass - *FE*
- Greene's tuctoria - *FE*
- Succulent owl's-clover - *FT*
- CFS - *FT*
- VPFS - *FE*
- VPTS - *FT*
- VELB - *FT*
- CVS - *FT*
- SRCS - *FT*
- CTS - *FT*
- SJKF - *FE*

Critical habitat is designated within the limit of direct effect for the following six species:

- San Joaquin Valley Orcutt grass.
- Greene's tuctoria.
- Succulent owl's-clover.
- CFS.
- VPFS.
- VPTS.

This section discusses potential effects on federally listed species and any designated critical habitat(s). As discussed in Section 3, the Action Area and affected acreage is analyzed and calculated differently for plants, invertebrates and other wildlife species depending upon their mobility and potential to be indirectly affected by the Merced to Fresno Section.

Table 5-1 presents the potential effects in terms of suitable habitat for the 13 federally listed plant and wildlife species discussed in Section 4. Due to the absence of observations from the Action Area, the potential effects on listed plant species and many wildlife species are reported in Table 5-1 as the minimum and maximum acreages that could be affected by the construction and operation of the Merced to Fresno Section in habitats with potentially suitable habitat as classified based on literature review, aerial interpretation, desktop research, field observation or imagery interpretation. This estimate does not assume that all of the acreage within the unsurveyed natural habitat is covered by the listed plant species; rather, it is the acreage of potentially suitable habitat that will be directly or indirectly affected by construction and operation of the Merced to Fresno Section.

Table 5-1
Potential Direct and Indirect Effects on Federally Listed Species

Federally Listed Species Name (Common Name/Scientific Name)	CWHR Vegetation Community or Wildlife Association	Type	MIN	MAX
			Acres of Effects[a]	
Colusa grass *(Neostapfia colusana)*	Seasonal wetland/vernal pool habitat within USGS El Nido, Planada, Merced and Atwater quadrangles	Direct	1.76	6.42
		Indirect	0.00	0.16
San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*)	Seasonal wetland/vernal pool habitat within USGS Gregg, Fresno North, Merced, Planada, Le Grand, Kismet and Plainsburg quadrangles	Direct	7.89	43.42
		Indirect	0.00	6.20
hairy Orcutt grass (*Orcuttia pilosa*)	Seasonal wetland/vernal pool habitat within USGS Gregg, Herndon, Madera, Merced and Kismet quadrangles	Direct	7.35	21.64
		Indirect	0.00	3.28
Greene's tuctoria (*Tuctoria greenei*)	Seasonal wetland/vernal pool habitat within USGS Merced, Planada, Le Grand, Kismet and Plainsburg quadrangles	Direct	7.28	40.18
		Indirect	0.00	4.56
succulent owl's-clover (*Castilleja campestris* ssp. *succulenta*)	Seasonal wetland/vernal pool habitat within USGS Gregg, Fresno North, Merced, Planada, Le Grand, Berenda, and Plainsburg quadrangles	Direct	7.89	32.36
		Indirect	0.00	4.17
Conservancy fairy shrimp *(Branchinecta conservatio)*	Seasonal wetland/vernal pool habitat within USGS Gregg, El Nido, Merced, Planada, Atwater, Le Grand, Kismet and Plainsburg quadrangles	Direct	7.28	42.93
		Indirect	0.24	18.69
Vernal pool fairy shrimp *(Brachinecta lynchi)*	Seasonal wetland/vernal pool habitat throughout the project area	Direct	9.16	45.18
		Indirect	0.48	21.05
Vernal pool tadpole shrimp (*Lepidurus packardi*)	Seasonal wetland/vernal pool habitat within USGS El Nido, Merced, Planada, Atwater, Le Grand and Plainsburg quadrangles	Direct	7.28	40.18
		Indirect	0.24	17.71
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	Mixed riparian and other riparian throughout the project area	Direct	6.11	13.03
		Indirect	5.61	18.54
Central Valley Steelhead (*Oncorhynchus mykiss*)	San Joaquin River natural watercourse aquatic habitat	Direct	0.96	5.00
		Indirect	7.25	15.56
Central Valley spring-run Chinook Salmon (*Oncorhynchus tshawytscha*)	San Joaquin River natural watercourse aquatic habitat	Direct	0.96	5.00
		Indirect	7.25	15.56

Federally Listed Species Name (Common Name/Scientific Name)	CWHR Vegetation Community or Wildlife Association	Type	MIN	MAX
			Acres of Effects[a]	
California tiger salamander, central population (*Ambystoma californiense*)	Aquatic habitat: Seasonal wetland/vernal pool habitat throughout the project area.	Direct aquatic	9.16	45.18
		Indirect aquatic	0.48	21.05
	Upland habitat: Pasture, California annual grassland, and other riparian throughout the project area.	Direct upland	103.00	405.85
		Indirect upland	77.29	274.69
San Joaquin kit fox (*Vulpes macrotis mutica*)	Upland habitat: Pasture, California annual grassland, and other riparian throughout the project area.	Direct upland	49.88	189.35
		Indirect upland	440.25	1,746.85

[a] Does not include Heavy Maintenance Facilities (See Section 5.1.4)

[b] Data presented is effects on acreage of potentially suitable habitat mapped during 2009-2011 field surveys

[c] This acreage includes potential vernal pool habitat with the 0.22 coefficient applied as described in Section 4.1.2.B.

Notes:

"MIN" and "MAX" determinations are based on the smallest and largest amount of acreage covered by any continuous combination of HST Alternatives.

Effects on all federally listed plant species were based on suitable CHWR habitats and wetlands and other waters features within construction footprint.

Effects on all federally listed wildlife species are based on the CWHR determinations of habitats and range, except as noted below:

{vernal pool tadpole shrimp and vernal pool fairy shrimp} Disturbances based on vernal pools/seasonal wetland habitat in the Wetland RSA.

{San Joaquin kit fox} Recovery areas based on the 5 year review of the San Joaquin kit fox (USFWS 2001d). Natural lands include, annual grasslands, barren and pasture. Agricultural lands include grain crop, deciduous orchard, row crop, hayfield, vineyard, etc.

5.1 Effects on Colusa Grass

Colusa grass is a vernal pool obligate species with populations documented in Merced County. Although this species was not found within the RSA during special-status plant surveys, vernal pool habitat that may support populations of this plant may occur within the RSA where permission to enter was not granted, as discussed in Section 4.4.1. Affects to this species are calculated by summing the acreage of potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies observed occurrences of this species.

5.1.1 Mechanism and Explanation of Possible Effects

Although Colusa grass was not found within the RSA, natural and semi-natural areas remain within Merced County that could support this species. Where suitable habitat is present, several mechanisms may contribute to direct or indirect effects on Colusa grass that include the clearing of native vegetation, construction-related soil disturbances, and other forms of habitat degradation and modification. Direct effects associated with initial vegetation clearance may result from the reduction, degradation, pollution, conversion, and fragmentation of suitable vernal pool habitat. Indirect effects may result from changes to vernal pool hydrology due to upgradient soil compaction or changes to topography, increased competition from non-native plant species, or interruption to pollination mechanisms.

Construction and operation of the Merced to Fresno Section will result in adverse direct and indirect effects on populations of Colusa grass if the species is present within the RSA. This species occurs in vernal pool habitats (USFWS 2005; Stone et al. 1988); therefore, vernal pools within the Action Area for this species are presumed to represent the area of direct and indirect effect on Colusa grass.

Total effects on Colusa grass would include a maximum of 6.58 acres of potentially suitable habitat. These would result from 8.18 acres of direct effects and 0.16 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

5.1.1.1 Construction Phase – Direct Effects

Construction activities may result in the permanent or temporary removal, destruction, covering, or unearthing of Colusa grass individual plants or of populations of this species. Direct effects may result from the use of heavy machinery to clear, excavate, compact, or otherwise prepare the ground surface for construction of the Merced to Fresno Section. Vegetation will be allowed to reestablish after construction in some areas (primarily associated with temporary construction easements), which may allow the species to recolonize, as the seeds can naturally persist in a soil seed bank (USFWS 2005).

Where natural habitat that could support Colusa grass occurs, construction activities may disturb, penetrate, drain, fill, pollute, or otherwise modify or degrade habitats, causing direct effects on federally listed plants, including Colusa grass.

5.1.1.2 Construction Phase – Indirect Effects

Within the RSA, indirect effects on Colusa grass may occur from construction-related changes to habitat heterogeneity, hydrology, fragmentation, dust and shading, as well as from the introduction of non-native invasive plant species. Each of these may result in mortality or harm to individuals or populations and potentially result in loss of suitable habitat.

Construction activities may facilitate the spread of non-native invasive plant species through the introduction of seeds and propagules, thereby increasing competition for resources (i.e., sun, water) and potentially decreasing success in flowering, pollinating, seeding, and germination. However, this condition persists in many areas throughout the RSA due to extensive cultural disturbances. Ground disturbance will create an opportunity for non-native invasive plants species to compete with Colusa grass and destructively alter appropriate habitat both in and outside the construction footprint.

5.1.1.3 Operations Phase – Direct Effects

Direct effects on populations of Colusa grass associated with operation and maintenance will be limited where habitats within the limit of direct effect were modified or degraded during construction. Wherever natural lands are modified or degraded during construction, the species is unlikely to reoccur and operational activities that require maintenance of the railway are unlikely to result in direct effects on the species.

In some areas, where the track is at-grade and drainage swales are constructed, appropriate habitat for the species may occur and the species may colonize a portion of the right-of-way. If operations and maintenance activities occur where the species re-colonizes the areas, potential direct effects may occur where maintenance-associated ground disturbance, clearing, or grubbing are required. These direct effects may be either permanent or temporary (if the plant is able to reestablish) in duration. These effects would be caused by similar mechanisms as those described above for construction but to a lesser degree, as operational activities have a smaller footprint than construction activities.

The HST in the Merced to Fresno Section, as a passenger train, would not carry cargo that would be hazardous in the event of a derailment. The train would be powered by an electrical current and thus would not emit fuels (oil, gasoline etc.) in the case of a derailment. Thus, potential effects from train operations would not occur within the RSA.

5.1.1.4 Operations Phase – Indirect Effects

Indirect effects on Colusa grass associated with operation and maintenance would occur where habitats within the limit of direct effect will be modified or degraded during construction. Because natural lands will be converted and made unsuitable during construction, operational activities that require maintenance of the railway are not expected to result in indirect effects on the species.

In some areas, where the track is at-grade and drainage swales are constructed, appropriate habitat for the species may occur and the species may colonize a portion of the right-of-way. If operation and maintenance activities occur where the species re-colonizes the area within the limit of direct effect, or immediately adjacent to the right-of-way, including within federal interest areas, indirect effects may occur where ground disturbing, clearing, or grubbing are required. Such effects would be caused by similar mechanisms as those described above for construction, but to a much lesser degree given that operation activities have a smaller footprint than construction activities.

5.1.2 Conservation Measures

The general conservation measures discussed in Section 2.7 will be implemented to minimize and avoid the affects of the Merced to Fresno Section on Colusa grass as appropriate. These measures include the following:

- Construction work windows for wetlands and other waters of the U.S.
- Pre-construction surveys.
- Contractor education and environmental training.
- Biological monitoring during construction.
- Cleaning of construction equipment.
- ESA and WEF fencing for wildlife exclusion and habitat protection.
- Relocation of federally listed species.
- Restoration of temporarily disturbed areas as appropriate.

In addition, the measures listed below will be implemented to avoid and minimize effects on this species:

- Protocol-level, pre-construction botanical surveys for Colusa grass will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as “natural lands.”

- Areas that support Colusa grass that will be temporarily disturbed will be restored onsite to pre-construction conditions in areas determined appropriate during final design. Prior to disturbance, pre-construction conditions will be documented detailing species composition, species richness, percent cover of key species, and photo points will be established. Success criteria of restored areas will be determined through consultation with the USFWS.

- All directly affected populations of Colusa grass will be documented. Documentation will include the density and percent cover of the species and key habitat characteristics including soil type, associated species, hydrology, topography, and photo documentation of pre-construction conditions.

- In the unlikely event that Colusa grass is identified in the RSA through protocol-level botanical pre-construction surveys, the USFWS will be notified and the Authority will work with the USFWS to avoid, minimize and potentially compensate for potential direct and indirect effects on the species.

5.1.2.1 Compensatory Mitigation

In the event that Colusa grass is identified within the RSA during protocol-level pre-construction surveys, compensation for adverse effects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool

invertebrates, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species.

5.1.3 Net Project Effects on the Species

Total effects on Colusa grass would range from a minimum of 1.76 acres to a maximum of 6.58 acres of potentially suitable habitat. The total effects are composed of 1.76 to 6.42 acres of direct effects and 0.00 to 0.16 acre of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

Potentially suitable habitat occurs in areas where vernal pools have been identified based on field observation or imagery interpretation. Protocol-level surveys will be conducted prior to construction to confirm the presence or absence of this species within the limit of direct effect. However, presence is currently presumed in areas of suitable habitat that are subject to project-related disturbance. Therefore, this Project may affect, likely to adversely affect Colusa grass.

In the event that Colusa grass is identified during protocol-level surveys, the FRA will reinitiate consultation with the USFWS. Colusa grass is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.2 Effects on San Joaquin Valley Orcutt Grass

Within the RSA, San Joaquin Valley Orcutt grass is known to occur in vernal pools in Merced, Madera, and Fresno counties. Although this species was not found within the RSA during special-status plant surveys, natural and seminatural areas that may support this species remain to be surveyed where permission to enter was not available, as discussed in Section 4.4.2. Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies observed occurrences of this species.

5.2.1 Mechanism and Explanation of Possible Effects

Construction in areas where permission to enter was not granted that include suitable vernal pool habitat for San Joaquin Valley Orcutt grass may result in adverse effects on this species if present. If this species is present within the RSA in previously unsurveyed areas, effects on this species may occur as result of construction and operation. Direct and indirect effects will be similar to those described in Section 5.1.1 for Colusa grass.

5.2.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on this species as appropriate. The measures listed below will be implemented to avoid and minimize effects on San Joaquin Valley Orcutt grass:

- Protocol-level botanical surveys for San Joaquin Valley Orcutt grass will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as “natural lands.”
- If populations of San Joaquin Valley Orcutt grass are identified, then the additional measures proposed for the Colusa grass in Section 5.1.2 will be applied for this species.

5.2.2.1 Compensatory Mitigation

In the event that San Joaquin Valley Orcutt grass is identified during protocol-level pre-construction surveys, compensation for adverse affects will be determined through consultation with the USFWS. The

compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If populations are identified during protocol-level surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.2.3 Net Project Effects on the Species

Total effects on San Joaquin Valley Orcutt grass would range from a minimum of 7.89 acres to a maximum of 49.62 acres of potentially suitable habitat. The total effects are composed of 7.89 to 43.42 acres of direct effects and 0.00 to 6.20 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

Potentially suitable habitat occurs in areas where vernal pools have been identified based on field observation or imagery interpretation. Protocol-level surveys will be conducted prior to construction to confirm the presence or absence of this species within the limit of direct effect; however, presence is currently presumed in areas subject to project-related disturbance. Therefore, this project may affect, likely to adversely affect San Joaquin Valley Orcutt grass.

In the event that San Joaquin Valley Orcutt grass is indentified during protocol-level surveys the FRA will reinitiate consultation with the USFWS. San Joaquin Valley Orcutt grass is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.3 Effects on San Joaquin Valley Orcutt Grass Critical Habitat

Critical habitat for San Joaquin Valley Orcutt grass has been designated in Merced and Madera counties. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.3.

5.3.1 Mechanism / Explanation of Possible Effects

The limit of direct effect occurs within approximately 158 acres of designated CHU SJVAL 2 for San Joaquin Valley Orcutt grass. This area contains a maximum of 10 acres of PCEs listed in the critical habitat designation (mapped as seasonal wetlands/vernal pools) that will be subject to the same adverse effects as discussed in Section 5.1.1 for Colusa grass.

5.3.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on critical habitat for San Joaquin Valley Orcutt grass. The measures listed below will be implemented to avoid and minimize effects on San Joaquin Valley Orcutt grass critical habitat:

- Protocol-level botanical surveys for San Joaquin Valley Orcutt grass PCEs will be conducted within designated critical habitat prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as “natural lands.”

- If San Joaquin Valley Orcutt grass PCEs are identified, the additional measures proposed for the Colusa grass in Section 5.1.2 will be applied for this species.

5.3.2.1 Compensatory Mitigation

In the event that San Joaquin Valley Orcutt grass PCEs within designated critical habitat are identified during protocol-level pre-construction surveys, compensation for adverse effects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If populations are identified during protocol-level botanical surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.3.3 Net Project Effects on Critical Habitat

Because PCEs within designated critical habitat have been identified in the limit of direct effect, the Merced to Fresno Section will adversely affect a maximum of 10 acres of PCEs within critical habitat designated for San Joaquin Valley Orcutt grass.

5.4 Effects on Hairy Orcutt Grass

Hairy Orcutt grass is known to occur in vernal pools within Merced and Madera counties. Although this species was not found within the RSA during special-status plant surveys, natural and seminatural areas that may support this species remain to be surveyed where permission to enter was not available, as discussed in Section 4.4.4. Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies observed occurrences of this species.

5.4.1 Mechanism and Explanation of Possible Effects

Construction in areas where permission to enter was not granted that include suitable vernal pool habitat for hairy Orcutt grass may result in adverse effects on hairy Orcutt grass if present. If this species is present within the RSA in previously unsurveyed areas, effects on this species may occur as result of construction and operation. Direct and indirect effects will be similar to those described in Section 5.1.1 for Colusa grass.

5.4.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on this species as appropriate. The measures listed below will be implemented to avoid and minimize effects on hairy Orcutt grass:

- Protocol-level botanical surveys for federally listed plant species, including hairy Orcutt grass, will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as “natural lands.”

- If populations of hairy Orcutt grass are identified, then the additional measures proposed for the Colusa grass in Section 5.1.2 will be applied for this species.

5.4.2.1 Compensatory Mitigation

In the event that hairy Orcutt grass or other federally listed plant species is observed in the RSA during protocol-level pre-construction surveys, compensation for adverse affects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this species. If populations are identified during protocol-level

surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.4.3 Net Project Effects on the Species

Total effects on hairy Orcutt grass would range from a minimum of 7.35 acres to a maximum of 24.92 acres of potentially suitable habitat. The total effects are composed of 7.35 to 21.64 acres of direct effects and 0.00 to 3.28 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

Potentially suitable habitat occurs in areas where vernal pools have been identified based on field observation or imagery interpretation. Protocol-level surveys will be conducted prior to construction to confirm the presence or absence of this species within the limit of direct effect; however, presence is currently presumed in areas of suitable habitat that are subject to project-related disturbance. Therefore, the Merced to Fresno Section may affect and is likely to adversely affect hairy Orcutt grass.

In the event that hairy Orcutt grass is identified during protocol-level botanical surveys, the FRA will reinitiate consultation with the USFWS. Hairy Orcutt grass is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.5 Effects on Greene's Tuctoria

Greene's tuctoria is known to occur in vernal pools within Merced, Madera, and Fresno counties. Although this species was not found within the RSA during special-status plant surveys, natural and seminatural areas that may support this species remain to be surveyed where permission to enter was not available, as discussed in Section 4.4.5. Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies potential effect on this species.

5.5.1 Mechanism and Explanation of Possible Effects

Construction in areas where permission to enter was not granted that include suitable vernal pool habitat for Greene's tuctoria may result in adverse affects to Greene's tuctoria if present.

If this species is present within the RSA in previously unsurveyed areas, effects on this species may occur as result of construction and operation. Direct and indirect effects will be similar to those described in Section 5.1.1 for Colusa grass.

5.5.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on this species as appropriate. The measures listed below will be implemented to avoid and minimize effects on Greene's tuctoria:

- Protocol-level botanical surveys for federally listed plant species, including Greene's tuctoria, will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as "natural lands."
- If populations of Greene's tuctoria are identified, then the additional measures proposed for the Colusa grass in Section 5.1.2 will be applied for this species.

5.5.2.1 Compensatory Mitigation

In the event that Greene's tuctoria or other federally listed plant species is observed during protocol-level pre-construction surveys, compensation for adverse effects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If populations are identified during protocol-level surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.5.3 Net Project Effects on the Species

Total effects on Greene's tuctoria would range from a minimum of 7.28 acres to a maximum of 44.74 acres of potentially suitable habitat. The total effects are composed of 7.28 to 40.18 acres of direct effects and 0.00 to 4.56 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

Potentially suitable habitat occurs in areas where vernal pools have been identified based on field observation or imagery interpretation. Protocol-level surveys will be conducted prior to construction to confirm the presence or absence of this species within the limit of direct effect; however, presence is currently presumed in areas subject to project-related disturbance. Therefore, the Merced to Fresno Section may affect and is likely to adversely affect Greene's tuctoria.

In the event that Greene's tuctoria is identified during protocol-level botanical surveys, the FRA will reinitiate consultation with the USFWS. Greene's tuctoria is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.6 Effects on Greene's Tuctoria Critical Habitat

Critical habitat for Greene's tuctoria has been designated in Merced County. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.6.

5.6.1 Mechanism / Explanation of Possible Effects

The limit of direct effect occurs within approximately 12 acres of designated CHU GREEN 7 for Greene's tuctoria. This area contains a maximum of 3 acres of PCEs listed in the critical habitat designation (mapped as seasonal wetlands/vernal pools) that will be subject to the same adverse effects as discussed in Section 5.1.1 for Colusa grass.

5.6.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on critical habitat for Greene's tuctoria. The measures listed below will be implemented to avoid and minimize effects on Greene's tuctoria critical habitat:

- Protocol-level botanical surveys for Greene's tuctoria will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as "natural lands."
- If populations of Greene's tuctoria are identified, then the additional measures proposed for Colusa grass in Section 5.1.2 will be applied for this species.

5.6.2.1 Compensatory Mitigation

In the event that Greene's tuctoria PCEs within designated critical habitat are identified during protocol-level pre-construction surveys, compensation for adverse effects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If populations are identified during protocol-level surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.6.3 Net Project Effects on Critical Habitat

Because PCEs within designated critical habitat have been identified in the limit of direct effect, the Merced to Fresno Section may affect and is likely to adversely affect a maximum of 3 acres of PCEs within critical habitat designated for Greene's tuctoria.

5.7 Effects on Succulent Owl's-clover

Succulent owl's-clover is known to occur in vernal pool habitat within Merced, Madera, and Fresno counties. Although this species was not found within the RSA during special-status plant surveys, natural and seminatural areas that may support this species remain to be surveyed where permission to enter was not available, as discussed in Section 4.4.7. Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies observed occurrences of this species.

5.7.1 Mechanism and Explanation of Possible Effects

Construction in areas where permission to enter was not granted that include suitable vernal pool habitat for succulent owl's-clover may result in adverse effects on succulent owl's-clover if present.

If this species is present within the RSA in previously unsurveyed areas, effects on this species may occur as result of construction and operation. Direct and indirect effects will be similar to those described in Section 5.1.1 for Colusa grass.

5.7.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on this species as appropriate. The measures listed below will be implemented to avoid and minimize effects on succulent owl's-clover:

- Protocol-level botanical surveys for federally listed plant species, including succulent owl's-clover, will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as "natural lands."
- If populations of succulent owl's-clover are identified, then the additional measures proposed for the Colusa grass in Section 5.1.2 will be applied for this species.

5.7.2.1 Compensatory Mitigation

In the event that succulent owl's-clover or other federally listed plant species is observed within the RSA during protocol-level pre-construction surveys, compensation for adverse affects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If

populations are identified during protocol-level surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.7.3 Net Project Effects on the Species

Total effects on succulent owl's-clover would range from a minimum of 7.89 acres to a maximum of 36.53 acres of potentially suitable habitat. The total effects are composed of 7.89 to 32.36acres of direct effects and 0.0 to 4.17 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

Potentially suitable habitat occurs in areas where vernal pools have been identified based on field observation or imagery interpretation. Protocol-level surveys will be conducted prior to construction to confirm the presence or absence of this species within the limit of direct effect; however, presence is currently presumed in areas subject to project-related disturbance. Therefore, the Merced to Fresno Section may affect and is likely to adversely affect succulent owl's-clover.

In the event that succulent owl's-clover is identified during protocol-level botanical surveys, the FRA will reinitiate consultation with the USFWS.

Succulent owl's-clover is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.8 Effects on Succulent Owl's-clover Critical Habitat

Critical habitat for succulent owl's-clover has been designated in Merced County. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.8.

5.8.1 Mechanism / Explanation of Possible Effects

The limit of direct effect occurs within approximately 12 acres of designated CHU SUCCL 3B for succulent owl's-clover. This area contains a maximum of 3 acres of PCEs listed in the critical habitat designation (mapped as seasonal wetlands/vernal pools) that will be subject to the same adverse effects as discussed in Section 5.1.1 for Colusa grass.

5.8.2 Conservation Measures

The general conservation measures discussed in Sections 2.7 and 5.1.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on critical habitat for succulent owl's-clover. The measures listed below will be implemented to avoid and minimize effects on succulent owl's-clover critical habitat:

- Protocol-level botanical surveys for succulent owl's-clover will be conducted prior to any ground-disturbing activities in areas where permission to enter was not granted, timing previously prevented full protocol-level botanical surveys, or where the project design changes. Surveys will be conducted in areas of suitable habitat and areas identified as "natural lands."
- If populations of succulent owl's-clover are identified, then the additional measures proposed for Colusa grass in Section 5.1.2 will be applied for this species.

5.8.2.1 Compensatory Mitigation

In the event that succulent owl's-clover PCEs within designated critical habitat are identified during protocol-level pre-construction surveys, compensation for adverse effects will be determined through consultation with the USFWS. The compensatory mitigation provided to upland and vernal pool wildlife species (e.g., vernal pool brachiopods, CTS, and SJKF) would provide ample conservation of natural lands with appropriate habitat to support this and other federally listed plant species. If populations are

identified during protocol-level surveys, the compensatory mitigation proposed for Colusa grass (Section 5.1.2) will also be applied for this species.

5.8.3 Net Project Effects on Critical Habitat

Because PCEs within designated critical habitat have been identified in the limit of direct effect, the Merced to Fresno Section may affect and is likely to adversely affect a maximum of 3 acres of PCEs within critical habitat designated for succulent owl's-clover.

5.9 Effects on Conservancy Fairy Shrimp

CFS has potential to occur within vernal pools and other seasonal wetlands throughout the RSA. Shrimps of the genus *Branchinecta* were observed during reconnaissance field surveys but were not sampled per USFWS protocols to identify to a species level. Listed vernal pool branchiopods have the potential to occur sporadically within vernal pool and other seasonal wetlands in low densities throughout the limit of direct effect where the land use has been previously altered for urban development.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies occurrences of this species.

5.9.1 Mechanism and Explanation of Possible Effects

The construction and operation of the Merced to Fresno Section may result in direct and indirect effects on populations of CFS through the degradation or loss of seasonally inundated depressions such as vernal pools that maintain a minimum inundation period of 49 days (Belk et al 1999).

Natural and seminatural areas remain throughout the RSA that could support this species within vernal pool and other seasonal wetlands. The clearing of native vegetation, soil disturbance, and the operation of construction equipment are some of the mechanisms that may contribute to direct and indirect effects on the species. Direct effects from construction and operation of the Merced to Fresno Section may include harm or mortality from heavy equipment, disruption or penetration of the underlying hardpan soils, and water pollution in vernal pools and seasonal wetlands. Indirect effects from HST construction and operation activities may be caused by erosion, soil compaction, increased siltation/sedimentation, fractures in the hardpan soils, destruction of native vegetation or alteration of wetland hydrology to vernal pools or seasonal wetlands.

5.9.1.1 Construction Phase – Direct Effects

Direct effects on CFS would only occur if ground-disturbing activities eliminated or significantly altered the pools that support the reproductive cycle of this species. As a direct result of the construction of the Merced to Fresno Section, seasonally inundated depressions such as vernal pools and noninundated wetlands would potentially eliminate populations of this species from within the limit of direct effect.

Construction of the Merced to Fresno Section may alter or remove habitats (e.g., vernal pools, inundated non-wetlands) that are potentially occupied by CFS. Excavation, buildup of the rail bed, placement of permanent and temporary roads, structures, and staging areas, and other equipment operation may disturb, penetrate, drain, fill, pollute, or otherwise degrade or destroy aquatic habitats. Runoff from the limit of direct effect could potentially contain pollutants (e.g., chemical laden runoff, petroleum products, pesticides, herbicides) into suitable habitat that effect CFS and other vernal pool branchiopod populations.

5.9.1.2 Construction Phase – Indirect Effects

Indirect effects on this species will occur within the RSA. The RSA for this species includes the limit of direct effect plus a 250-foot limit of indirect effect.

During construction activities, indirect effects on CFS could result if:

- The impervious subsurface (claypan or hardpan layer) of a vernal pool is damaged, potentially compromising the hydrologic integrity of the pool(s).
- Sedimentation originating from the construction footprint reduces the minimum inundation period required by CFS to complete a full lifecycle(s).
- The disruption of upland areas surrounding vernal pool branchiopod habitat by construction activities may alter water retention and flow within the landscape that could influence the timing and intensity of inundation of CFS habitat.

5.9.1.3 Operations Phase – Direct Effects

The operation of the Merced to Fresno Section may contribute to long-term degradation and/or habitat modification through pollution or alteration of plant communities within 250 feet of the limit of direct effect. Operation of the Merced to Fresno Section would require maintenance activities including ground disturbance, clearing, or grubbing, any of which may cause erosion and sedimentation that may directly affect the hydrology of adjacent CFS habitat. As a passenger train, the Merced to Fresno Section would not carry cargo that would include substandard amounts of hazardous materials. The train would be powered by an electrical current and thus would not emit any fuels (oil, gasoline etc.). In the case of derailment, these materials should not be a risk to the environment. However, pollution from maintenance equipment or vehicles utilized in the HST primary right-of-way may be carried into adjacent shrimp habitat by storm runoff, causing direct mortality of CFS nauplii and adults. However, with the incorporation of the project design features and mitigation measures storm run-of will be managed and filtered prior to discharge. The long-term operation of the Merced to Fresno Section would cause some populations to fragment through loss of suitable habitat that may have been hierologically connected. Potential direct effects on CFS may occur within the RSA.

5.9.1.4 Operations Phase – Indirect Effects

Maintenance activities such as those described above may also indirectly affect the hydrology of adjacent pools. Further indirect effects include the introduction of invasive plant species that could potentially affect pool hydrology, and long-term degradation of both vernal pool and upland plant communities.

If operational maintenance involves the use of herbicides for weed abatement activities, these activities could alter pool vegetation in such a way as to affect CFS through alterations to water chemistry, shade cover, or an increase in predation. Chemical runoff from trucks or equipment along the right-of-way access road could leach into wetlands adjacent to the Merced to Fresno Section and harm or kill CFS. The extent of direct and indirect effects is expected to be restricted to within 250 feet of the Merced to Fresno Section.

All three vernal pool branchiopods have potential to occur in other sections of the HST System within the Central Valley. These species are not expected to occur in the HST sections outside the Central Valley. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on these species would be avoided and minimized by using strategies similar to those described in Section 2.7. Furthermore, each HST section would be required to consult with the USFWS under Section 7 of ESA.

5.9.1.5 Interrelated Effects

The Phase 1 San Jose to Merced Section may also affect the Conservancy Fairy Shrimp. As discussed previously. The HST is not considered interdependent. However the adverse effects on this species from the interrelated sections of the HST System would be similar in nature, but they have not been quantified yet at a project level. CFS is not expected to occur in remaining sections of the HST System.

The project-level effects on CFS have not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on this species are anticipated to be similar. The quality and quantity of habitat removed and potential

extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, each HST section would be required to consult with the USFWS under Section 7 of the ESA.

5.9.2 Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid effects of the Merced to Fresno Section to CFS and other vernal pool branchiopods. In addition, the measures listed below will be implemented to avoid and minimize direct effects on the species.

- Exclusion zones (Environmental Sensitive Areas and ERAs) will be maintained and monitored by a USFWS-approved biological monitor to ensure that no take of vernal pool branchiopods or their habitat occurs aside from those approved for removal within the limit of direct effect.
- If construction activities must occur during the October 15 through April 15 period, initial ground-disturbance activities will be scheduled to begin during the dry season, April 16 through October 14, to minimize the effects on vernal pool branchiopod habitat.

5.9.2.1 Compensatory Mitigation

Unavoidable adverse effects on the CFS and other vernal pool branchiopods will be determined by the acreages of direct and indirect effects on suitable habitat. These acreages of suitable habitat will be mitigated through compensation and/or creation that will be determined through consultation with USFWS. Compensation may be based on either or combination of the following:

5.9.2.2 Preservation

- For every acre of habitat directly or indirectly affected, two vernal pool credits will be dedicated from a USFWS-approved bank.
- Based on an evaluation of site-specific conservation values, vernal pool habitat may be preserved at a non-bank location at a 3:1 ratio as approved by USFWS.

5.9.2.3 Creation

- For every acre of habitat directly affected, one vernal pool creation credit will be dedicated within a USFWS-approved habitat mitigation bank.
- Based on an evaluation of site-specific conservation values, 2 acres of vernal pool habitat will be created and monitored at a non-bank location as approved by USFWS.
- The total number of credits or acres to be compensated for will be determined through negotiations with the USFWS during the natural resource permitting processes.

5.9.3 Net Project Effects on the Species

The Merced to Fresno Section may affect and is likely to adversely affect CFS. Total effects on CFS would range from a minimum of 7.52 acres to a maximum of 61.62 acres of potentially suitable habitat. The total effects are composed of 7.28 to 42.93 acres of direct effects and 0.24 to 18.69 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

CFS is not expected to be affected by other Central Valley sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System are not expected to result in interrelated or interdependent effects on this species.

5.10 Effects on Conservancy Fairy Shrimp Critical Habitat

Critical habitat for CFS that has been designated in Merced County occurs within the limit of direct effect. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.10.

5.10.1 Mechanism / Explanation of Possible Effects

Approximately 12 acres of the limit of direct effect occurs within CHU CONSFS 6. This area contains a maximum of 3 acres of PCEs listed in the critical habitat designation that will be subject to the same effects as discussed in Section 5.9.1 for CFS.

5.10.2 Net Project Effects on the Critical Habitat

Because PCEs within designated critical habitat are impacted, the Merced to Fresno Section will adversely affect 3 acres of critical habitat designated for CFS.

5.11 Effects on Vernal Pool Fairy Shrimp

VPFS have a high potential to occur within a spectrum of vernal pools and inundated nonwetlands. Shrimps of the genus *Branchinecta* were observed during reconnaissance field surveys but were not sampled per USFWS protocols to identify to a species level. Suitable soils for vernal pool hydrology were identified within California annual grassland and selected agricultural habitat types such as pastures and dry land grain crops where suitable pool(s) may be found (see Table 5-1).

VPFS and other vernal pool branchiopods have the potential to occur sporadically throughout the limit of direct effect where the land use is not altered for urban development.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies occurrences of this species.

5.11.1 Mechanism and Explanation of Possible Effects

The construction and operation of the Merced to Fresno Section may result in direct and indirect effects on VPFS through the degradation or loss of suitable vernal pool habitat. Direct and indirect effects will be similar to those described in section 5.9.1 for Conservancy fairy shrimp.

5.11.1.1 Interrelated Effects

The Phase 1 portions of the San Jose to Merced and Fresno to Bakersfield sections of the HST System may also affect the VPFS. As previously discussed, the HST is not considered interdependent. However, the adverse effects on this species from the interrelated sections of the HST System would be similar in nature, but they have not been quantified yet at a project level. This species is not expected to occur in remaining sections of the HST System.

The project-level effects on the VPFS have not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on this species are anticipated to be similar. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, each HST section would be required to consult with the USFWS under Section 7 of the ESA.

5.11.2 Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid effects of the Merced to Fresno Section to VPFS and other vernal pool branchiopods. In addition, the measures listed below will be implemented to avoid and minimize direct effects on federally listed branchiopods.

- Exclusion zones will be maintained and monitored by a USFWS-approved biological monitor to ensure that no take of VPFS and other vernal pool branchiopods or their habitat occurs aside from those approved for removal within the limit of direct effect.
- If construction activities must occur during the October 15 through April 15 period, initial ground-disturbance activities will be scheduled to begin during the dry season, April 16 through October 14, to minimize the effects on VPFS habitat.

5.11.2.1 Compensatory Mitigation

Unavoidable adverse effects on VPFS and other vernal pool branchiopods will be determined by the acreages of direct and indirect effects on suitable habitats. These acreages of suitable habitat will be mitigated through compensation and/or creation that will be determined through consultation with USFWS.

5.11.2.2 Preservation

- For every acre of habitat directly or indirectly affected, two vernal pool credits will be dedicated from a USFWS-approved bank.
- Based on an evaluation of site-specific conservation values, vernal pool habitat may be preserved at a non-bank location at a 3:1 ratio as approved by USFWS.

5.11.2.3 Creation

- For every acre of habitat directly affected, one vernal pool creation credit will be dedicated within a USFWS-approved habitat mitigation bank.
- Based on an evaluation of site-specific conservation values, 2 acres of vernal pool habitat will be created and monitored at a non-bank location as approved by USFWS.

The total number of credits or acres to be compensated for will be determined through negotiations with the USFWS during the natural resource permitting processes.

5.11.3 Net Project Effects on the Species

The Merced to Fresno Section may affect and is likely to adversely affect VPFS. Total effects on VPFS would range from a minimum of 9.64 acres to a maximum of 66.23 acres of potentially suitable habitat. The total effects are composed of 9.16 to 45.18 acres of direct effects and 0.48 to 21.05 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

VPFS is also expected to be affected by both the San Jose to Merced and the Fresno to Bakersfield sections of the HST System; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System may result in interrelated effects on this species. However, the other Central Valley sections of the HST System are not anticipated to result in interdependent effects on this species.

5.12 Effects on Vernal Pool Fairy Shrimp Critical Habitat

Critical habitat for VPFS that has been designated in Merced County occurs within the limit of direct effect. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.12.

5.12.1 Mechanism / Explanation of Possible Effects

Approximately 12 acres of the limit of direct effect occurs within designated CHU VERFS 22. This area contains a maximum of 3 acres of PCEs listed in the critical habitat designation (mapped as seasonal wetlands/vernal pools) that will be subject to the same effects as discussed in Section 5.9.1 for CFS.

5.12.2 Conservation Measures

The general conservation measures discussed in Section 2.7 and Section 5.9.2 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on critical habitat for VPFS. In addition, the measures listed below will be implemented to avoid and minimize effects on VPFS critical habitat:

- Exclusion zones will be maintained and monitored by a USFWS-approved biological monitor to ensure that no take of VPFS PCEs occurs aside from those approved for removal within the limit of direct effect.
- If construction activities must occur during the October 15 through April 15 period, initial ground-disturbance activities will be scheduled to begin during the dry season, April 16 through October 14, to minimize the effects on VPFS PCEs.

5.12.3 Net Project Effects on Critical Habitat

Because PCEs within designated critical habitat are impacted, the Merced to Fresno Section will adversely affect a maximum of 3 acres of PCEs within critical habitat designated for VPFS.

5.13 Effects on Vernal Pool Tadpole Shrimp

VPTS have potential to occur within larger vernal pools and inundated non-wetlands with the limit of direct effect. No shrimps of the genus *Lepidurus* were observed during reconnaissance field surveys; however, VPTS has potential to occur sporadically throughout the limit of direct effect where the land use is not altered for urban development.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies occurrences of this species.

5.13.1 Mechanism and Explanation of Possible Effects

The construction and operation of the Merced to Fresno Section may result in direct and indirect effects on VPTS through the degradation or loss of suitable vernal pool habitat. Direct and indirect effects will be similar to those described in Section 5.9.1 for CFS.

5.13.1.1 Interrelated Effects

Phase 1 of the San Jose to Merced and Fresno to Bakersfield sections may also affect the VPTS. As previously discussed, the HST is not considered interdependent. However, adverse effects on this species from the interrelated sections of the HST System would be similar in nature, but they have not been quantified yet at a project level. This species is not expected to occur in remaining sections of the HST System.

The project-level effects on the Vernal Pool Tadpole Shrimp have not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on this species are anticipated to be similar. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, each HST section would be required to consult with the USFWS under Section 7 of the ESA.

5.13.2 Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid effects of the Merced to Fresno Section to VPTS and other vernal pool branchiopods. In addition, the measures listed below will be implemented to avoid and minimize direct effects on VPTS.

- Exclusion zones will be maintained and monitored by a USFWS-approved biological monitor to ensure that no take of vernal pool branchiopods or their habitat occurs aside from those approved for removal within the limit of direct effect.
- If construction activities must occur during the October 15 through April 15 period, initial ground-disturbance activities will be scheduled to begin during the dry season, April 16 through October 14, to minimize the effects on VPTS and other vernal pool branchiopod habitat.

5.13.2.1 Compensatory Mitigation

Unavoidable adverse effects on VPTS and other vernal pool branchiopods will be determined by the acreages of direct and indirect effects on habitats that support the lifecycle of VPTS. These acreages of suitable habitat will be mitigated through compensation and/or creation that will be determined through consultation with USFWS.

5.13.2.2 Preservation

- For every acre of habitat directly or indirectly affected, two vernal pool credits will be dedicated from a USFWS-approved bank.
- Based on an evaluation of site-specific conservation values, vernal pool habitat may be preserved at a non-bank location at a 3:1 ratio as approved by USFWS.

5.13.2.3 Creation

- For every acre of habitat directly affected, one vernal pool creation credit will be dedicated within a USFWS-approved habitat mitigation bank.
- Based on an evaluation of site-specific conservation values, 2 acres of vernal pool habitat will be created and monitored outside the limit of direct effect but within the RSA, or on another non-bank location as approved by USFWS.

The total number of credits or acres to be compensated for will be determined through negotiations with the USFWS during the natural resource permitting processes.

5.13.3 Net Project Effects on the Species

The Merced to Fresno Section may affect and is likely to adversely affect VPTS. Total effects on VPTS would range from a minimum of 7.52 acres to a maximum of 57.89 acres of potentially suitable habitat. The total effects are composed of 7.28 to 40.18 acres of direct effects and 0.24 to 17.71 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

VPTS is also expected to be affected by both the San Jose to Merced and the Fresno to Bakersfield sections; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System may result in interrelated effects on this species. However, the other Central Valley sections of the HST System are not anticipated to result in interdependent effects on this species.

5.14 Effects on Vernal Pool Tadpole Shrimp Critical Habitat

Critical habitat for VPTS that has been designated in Merced and Madera counties occurs within the limit of direct effect. Critical habitat designation and primary constituent elements for this species are discussed in Section 4.4.14.

5.14.1 Mechanism/Explanation of Possible Effects

Approximately 170 acres of the limit of direct effect occurs within designated CHU VERTS 15 for VPTS. This area contains a maximum of 12 acres of PCEs listed in the critical habitat designation that will be subject to the same adverse effects as discussed in Section 5.9.1 for Conservancy fairy shrimp.

5.14.2 Net Project Effects on the Critical Habitat

Because PCEs within designated critical habitat will be adversely modified or destroyed, the Merced to Fresno Section may affect and is likely to adversely affect 12 acres of critical habitat designated for VPTS.

5.15 Effects on Valley Elderberry Longhorn Beetle

The limit of direct effect contains three known Mexican elderberry shrubs, with potential stands occurring along the San Joaquin River and other tributaries. As the host plant for VELB, effects on Mexican elderberry shrubs directly affect the survival of this host-specific arthropod. VELB populations would be temporarily affected, both directly and indirectly, by construction activities within the limit of direct effect. Riparian and nonriparian occurring elderberry shrubs may occur in an area where permission to enter was not available. Due to extensive agricultural land use in the region, no elderberry shrubs are anticipated in those areas. Protocol-level surveys for VELB that identify stem diameters and grub exit holes were not conducted during botanical surveys.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies occurrences of, or potential effects on, this species.

5.15.1 Mechanism and Explanation of Possible Effects

Populations of VELB are closely associated with Mexican elderberries within the RSA. The removal and/or impairment of elderberries and the associated riparian vegetation, erosion, operation of construction equipment, dispersal of dust, and light disturbance are some of the mechanisms that may directly or indirectly affect VELB. Project construction and operational activities may result in direct effects on VELB through the removal or impairment of elderberry shrubs, while indirect effects may be caused by erosion, soil compaction, creation and dispersal of dust, destruction of riparian vegetation, and alteration of site hydrology, all of which may lead to the impairment of host shrubs. Direct effects on both VELB and the elderberry shrub host plant from construction and operation of the HST System where either VELB or occupied shrubs are present may include: harm, mortality, population fragmentation, host plant disturbance, or abandonment. Root exposure/compaction due to erosion and soil compaction, changes in site hydrology (alterations in water flow patterns, inundation patterns, ground water, or water quality) due to project construction.

5.15.1.1 Construction Phase – Direct Effects

The movement of heavy construction equipment and placement of permanent structures in the limit of direct effect will require the removal of an undetermined number of elderberry shrubs. Where the VELB host plant is present, construction activities may lead to VELB or host plant species mortality, and to habitat modification. Mortality may occur if vehicles, equipment, or humans remove or disturb elderberry shrubs occupied by VELB, or destroy native riparian vegetation or riparian habitat. Habitat modification may occur through the reduction, degradation, clearing/removal, compaction, fill, loss, or conversion of suitable native riparian vegetation, or changes to site hydrology. The exact effects of construction activities will depend on the final placement of piers, construction technique, and the level of permanent and temporary disturbance. Impacts that reduce the fitness or that destroy, elderberry shrubs occupied by VELB, their larvae, or their eggs would be considered an effect on VELB.

5.15.1.2 Construction Phase – Indirect Effects

Indirect effects on VELB would occur within the RSA, which encompasses the limit of direct effect plus a 100-foot limit of indirect effect.

Construction of the Merced to Fresno Section may stress and affect the survivorship of elderberry shrubs by increasing windborne dust that can coat elderberry leaves, effectively clogging the stomata necessary for transpiration. Erosion, siltation, and soil compaction may result in the alteration of the abiotic conditions within the root zone, reducing the long-term vigor of the shrub. Pile driving, excavation, rail bed build up, placement of permanent and temporary structures, and vehicle traffic may result in changes to the site hydrology which elderberry shrubs utilize during their growing season. These changes that may affect the long-term survival of elderberry shrubs include alterations in water flow, inundation cycles, and groundwater levels.

5.15.1.3 Operations Phase – Direct Effects

Direct effects on VELB are not expected from long-term operations and maintenance activities. The Merced to Fresno Section would operate on bridges or viaducts elevated above major riparian corridors. Immature VELB are confined to their host plant, and adult beetles are generally found close to host plants (USFWS 1984); therefore, collisions between elevated trains and riparian-dwelling VELB are not expected.

As a passenger train, the Merced to Fresno Section would not carry cargo that would be hazardous in the event of a derailment. The train would be powered by an electrical current and thus would not emit any fuels (e.g., oil, gasoline) in the case of derailment. Potential effects may occur within the RSA.

5.15.1.4 Operations Phase – Indirect Effects

Operations of the train and maintenance vehicles may distribute particulate matter or cause other habitat alterations which could stress VELB within a 100-foot limit of indirect effect of at-grade HST right-of-way.

5.15.1.5 Interrelated Effects

The Phase 1 San Jose to Merced and Bakersfield to Palmdale sections of the HST System may also affect the VELB. As previously discussed, the HST is not considered interdependent. However, the adverse effects on this species from the interrelated sections of the HST System would be similar in nature, but they have not been quantified yet at a project level. This species is not expected to occur in remaining sections of the HST System.

The project-level effects on the Valley Elderberry Longhorn Beetle have not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and

minimized utilizing strategies similar to those described in this BA. Furthermore, these sections would be required to consult with the USFWS under Section 7 of the ESA.

5.15.1.6 Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid the effects of the Merced to Fresno Section on this species. In addition, the measures following the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a) will be implemented to avoid and minimize potential adverse effects on VELB. These measures include the following:

- Pre-construction presence/absence surveys for elderberry shrubs and VELB exit holes, per *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999b), conducted year-round, no more than 1 year prior to construction.
- If protocol level surveys determine that VELB may occur within the RSA, then:
  - In temporarily affected areas, a 100-foot non-disturbance exclusion zone will be established during construction around all elderberry shrubs with stems at ground level 1 inch in diameter or greater; fencing will be comprised of Environmentally Sensitive Area high-visibility construction fencing.
- If encroachment within the 100-foot non-disturbance zone is unavoidable, a 20-foot non-disturbance exclusion zone will be provided from the drip line of each elderberry shrub; fencing will be comprised of Environmentally Sensitive Area high-visibility construction fencing.
- Dust control procedures, such as regular watering of disturbed soils and soil piles, and covering of soil piles, are to be used throughout the construction period.
- No insecticides, herbicides, fertilizer, or other chemicals that might harm the beetle or its host plant are to be used in the 100-foot non-disturbance zone.

5.15.1.7 Compensatory Mitigation

The Authority will implement compensatory mitigation measures following *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a). The extent of compensation will be based on the number of elderberry shrubs affected by the Merced to Fresno Section. Compensatory mitigation measures will be implemented following the conservation guidelines as summarized below:

Compensatory mitigation ratios will be based on the diameter and location of the affected elderberry shrub(s). The presence of exit bore holes left by emerging VELB will also be factored into mitigation ratios. Compensatory mitigation focuses on the establishment of individual elderberries from container stock as well associated native plants. Table 5-2 summarizes the compensatory mitigation ratios identified in the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a).

Table 5-2
Summary of Compensatory Mitigation Ratios for Impacts on Suitable Habitat for the Valley Elderberry Longhorn Beetle [a]

Stem Size Class (maximum diameter at ground level, in inches)	Exit Holes on Shrub [b]	Elderberry Seedling/ Cutting Ratio [c]	Associated Native Plant Ratio [d]
Riparian Habitat			
Stems 1 to 3	Yes	1:1	1:1
	No	2:1	2:1
Stems 3 to 5	Yes	2:1	1:1
	No	4:1	2:1
Stems > 5	Yes	3:1	1:1
	No	6:1	2:1
Non-Riparian Habitat			
Stems 1 to 3	Yes	2:1	1:1
	No	4:1	2:1
Stems 3 to 5	Yes	3:1	1:1
	No	6:1	2:1
Stems > 5	Yes	4:1	1:1
	No	8:1	2:1

[a] Mitigation ratios were determined following the guidelines in the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a), established in July 1999.

[b] All stems measuring at least 1inch in diameter at ground level on a single shrub are considered occupied when exit holes are present anywhere on the shrub.

[c] Ratios in the *Elderberry Seedling Ratio* column correspond to the number of cuttings or seedlings to be planted per elderberry stem (at least 1 inch in diameter at ground level) affected by the proposed project.

[d] Ratios in the *Associated Native Plant Ratio* column correspond to the number of associated native species to be planted per elderberry (seedling or cutting) planted.

Elderberry shrubs with a diameter of 1 inch or greater that cannot be avoided during project construction will be transplanted according to the methods outlined in the *ANSI A300 standards for tree care operations* for arboriculture. Shrubs will be transplanted to a USFWS-approved conservation area during the dormancy period (November 1 to February 15). Each USFWS-approved conservation area will be a minimum of 1,800 square feet per each transplanted shrub.

Where access was permitted within the limit of direct effect, three Mexican elderberries were identified. Additional Mexican elderberries could occur within suitable riparian habitat where access was not granted during botanical surveys. Due to the presence of VELB host plants within the Action Area that is within the known range of the species, the Merced to Fresno Section is likely to result in the removal of individual Mexican elderberry shrubs for at-grade structures and viaducts. The Merced to Fresno Section may affect and is likely to adversely affect VELB.

Total effects on VELB would range from a minimum of 11.72 acres to a maximum of 31.57 acres of potentially suitable habitat. The total effects are composed of 6.11 to 13.03 acres of direct effects and 5.61 to 18.54 acres of indirect effects associated with construction and operation of the Merced to Fresno Section (see Table 5-1).

VELB is also expected to be affected by both the San Jose to Merced and the Fresno to Bakersfield sections; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System may result in interrelated effects on this species. However, the other Central Valley sections of the HST System are not anticipated to result in interdependent effects on this species.

5.16 Effects on Central Valley Steelhead

In the portion of the RSA that intersects the San Joaquin River, no natal populations of CVS are known to currently occur. The continuous interim flows within San Joaquin River since 2009 provide a moderate potential for straying CVS from other populations, particularly from spawning areas with similar hydrological parameters such as the Stanislaus River (NMFS 2008). Figure 5-1 illustrates the San Joaquin River hydrological connectivity. As discussed in Section 3.2.4, all other waterways that intersect the RSA lack hydrologic connectivity and/or accessibility to suitable habitat due to dams, storage reservoirs, diversion dams, canals, and groundwater pumping associated with agricultural irrigation.

5.16.1 Mechanism and Explanation of Possible Effects

The known range of CVS encompasses the entire limit of direct effect; however, within the RSA, there are no known natal populations of CVS currently present. With the reinundation of San Joaquin River in 2009, there is potential for straying CVS from other populations to enter the RSA, particularly from spawning areas in adjacent watersheds with similar hydrological parameters such as the Stanislaus River (NMFS 2008). No breeding populations of CVS are currently verified to be utilizing the reinundated segment of the San Joaquin River from Friant Dam to Mendota Pool. However, it is anticipated that species could begin utilizing the river from adjacent established population(s) (e.g., Stanislaus River) by the initiation of HST construction activities in fall 2012. Direct effects on CVS could include the mortality of eggs, fingerlings, smolts, or adults during the HST bridge piers potentially within a portion of the median high water mark. Indirect effects include the alteration of the adjacent floodplain and riparian habitat. Other potential indirect effects could include the release and exposure of sediment and other pollutants during the construction period dependent upon if there are listed salmonids present during construction activities.

5.16.1.1 Construction Phase – Direct Effects

Direct effects on CVS could occur through the installation of bridge support piers within and/or immediately adjacent to the wetted channel of the San Joaquin River. These effects are generally temporary in nature and could include water quality effects, loss of shaded riverine aquatic habitat, and direct disturbance to fish and aquatic habitats. Each of the effects is described below.

Temporary Construction-related Water Quality Effects

If construction activities take place when CVS are present, indirect effects could temporarily reduce the amount and quality of fish habitat. Construction of bridge piers and footers would disturb soils on the floodplain and along the bankline of the river. Any resulting erosion or runoff could temporarily increase turbidity and sedimentation downstream of the construction sites if soils are transported in waterways or runoff. Fish population levels and survival have been linked to levels of turbidity and siltation in a watershed (Waters 1995). Prolonged exposure to high levels of suspended sediment can create a loss of visual capability, leading to a reduction in feeding and growth rates; a thickening of the gill epithelium, potentially causing the loss of respiratory function; clogging and abrasion of gill filaments; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995).

In addition, high levels of suspended sediments cause movement and redistribution of Chinook salmon, steelhead, and other fish populations and can affect physical habitat. Once suspended sediment is deposited, it can alter habitat, decreasing the water's physical carrying capacity for juvenile and adult fish (Waters 1995). Increased sediment loading can also degrade food-producing habitat immediately downstream of the project area. Sediment loading can interfere with photosynthesis of aquatic flora and displace aquatic fauna. Chinook salmon, Central Valley steelhead, and many other fish species are sight feeders; turbid waters reduce the efficiency of these fish in locating and feeding on prey. Some fish, particularly juveniles, can become disoriented, and leave areas where primary food sources are concentrated, ultimately reducing growth rates. Increases in turbidity and sedimentation commonly result in fish avoiding an area. Fish will not occupy areas that are not suitable for survival unless they have no other option. Therefore, habitat can become limited in systems where high turbidity precludes a species from occupying habitat required for specific life stages.

The potential exists for contaminants such as concrete, fuels, oils, and other petroleum products used in construction activities to be introduced into the water system directly or through surface runoff. Contaminants may be acutely toxic to fish or alter oxygen diffusion rates, reducing growth and survival.

Measures designed into the project to avoid and minimize degradation of water quality for both turbidity/sedimentation and contaminant release and exposure will be implemented, as described above in Section 2.7, Conservation Measures to Be Incorporated into Project Design. Because implementation of these measures will substantially avoid and/or minimize water quality-related effects on CVS potentially occurring adjacent to the repair sites, temporary effects on water quality and associated habitat are not anticipated to result in adverse effects on these species/races.

Temporary Loss of Shaded Riverine Aquatic Habitat

Small amounts of riparian vegetation, potentially providing overhead cover for fish or contributing instream woody material (i.e., shaded riverine aquatic habitat) to the San Joaquin River channel, may need to be removed or cleared from the bankline and/or adjacent floodplain to accommodate bridge support pier construction activities. Removal of riparian vegetation or woody material along the existing bankline or otherwise in the floodplain would be minor and temporary, and disturbed areas would be required to be restored with native vegetation (see Section 2.7). As a result, this activity is not anticipated to result in adverse effects on CVS.

Temporary Direct Disturbance to Fish and Aquatic Habitats

Construction of the bridge pier supports occurs within and outside of the wetted channel of the San Joaquin River; however, depending on water surface levels and exact construction footprints, construction activities will require a portion of the wetted channel to be isolated with sheet pile cofferdams in order to be dewatered. As a direct result of the construction of the proposed San Joaquin River crossing, potential entrapment of individual CVS fingerlings, smolts, or adults may occur within the sheet pile cofferdam constructed specifically to dewater the construction sites for the bridge support pier(s).

One construction-related effect of particular concern is the direct effect on fish and other aquatic organisms resulting from increases in underwater sound pressure associated with cofferdam pile driving activities. Steel sheet piles would be used for cofferdam construction. Installation of the sheet pile cofferdam(s) would include using a vibration hammer.

An interagency working group, including members from NMFS and USFWS, has established interim criteria for evaluating underwater noise impacts from pile driving on fish. These criteria are defined in the document entitled "Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities," dated June 12, 2008 (Fisheries Hydroacoustic Working Group 2008). This agreement identifies a peak sound pressure level of 206 decibels (dB) and an accumulated sound exposure level (SEL) of 187 dB as thresholds for injury to fish. For fish weighing less than 2 grams, the accumulated SEL threshold is reduced to 183 dB. Although there has been no formal agreement on a "behavioral"

threshold, NMFS uses 150 dB as the threshold for adverse behavioral effects (NMFS 2009a). As described above under Section 2.7, “Conservation Measures to Be Incorporated into Project Design,”, the project contractor will be required to develop a plan for pile-driving activities in water to minimize effects on fish. The plan will include measures that will be implemented to minimize underwater sound pressure to levels below thresholds for peak pressure and accumulated sound exposure levels.

Construction of cofferdams could also increase the potential for fish to be trapped during dewatering. In order to avoid and/or minimize this potential effect, the contractors will be required to develop and implement a Fish Rescue Plan acceptable to CDFG, USFWS, and NMFS. The contractor will ensure that a qualified fisheries biologist designs and conducts the fish rescue and relocation effort to collect fish from within the cofferdam. The fish rescue effort would be implemented during the dewatering of the area behind the cofferdam and would involve capture and return of those fish to suitable habitat within adjacent waterways. To ensure compliance, a fisheries biologist will be present on-site during pumping (dewatering) activities.

5.16.1.2 Construction Phase – Indirect Effects

Indirect effects on CVS could occur within the RSA, an area that focuses on the San Joaquin River overpass and a limit of indirect effect of 400 feet downstream.

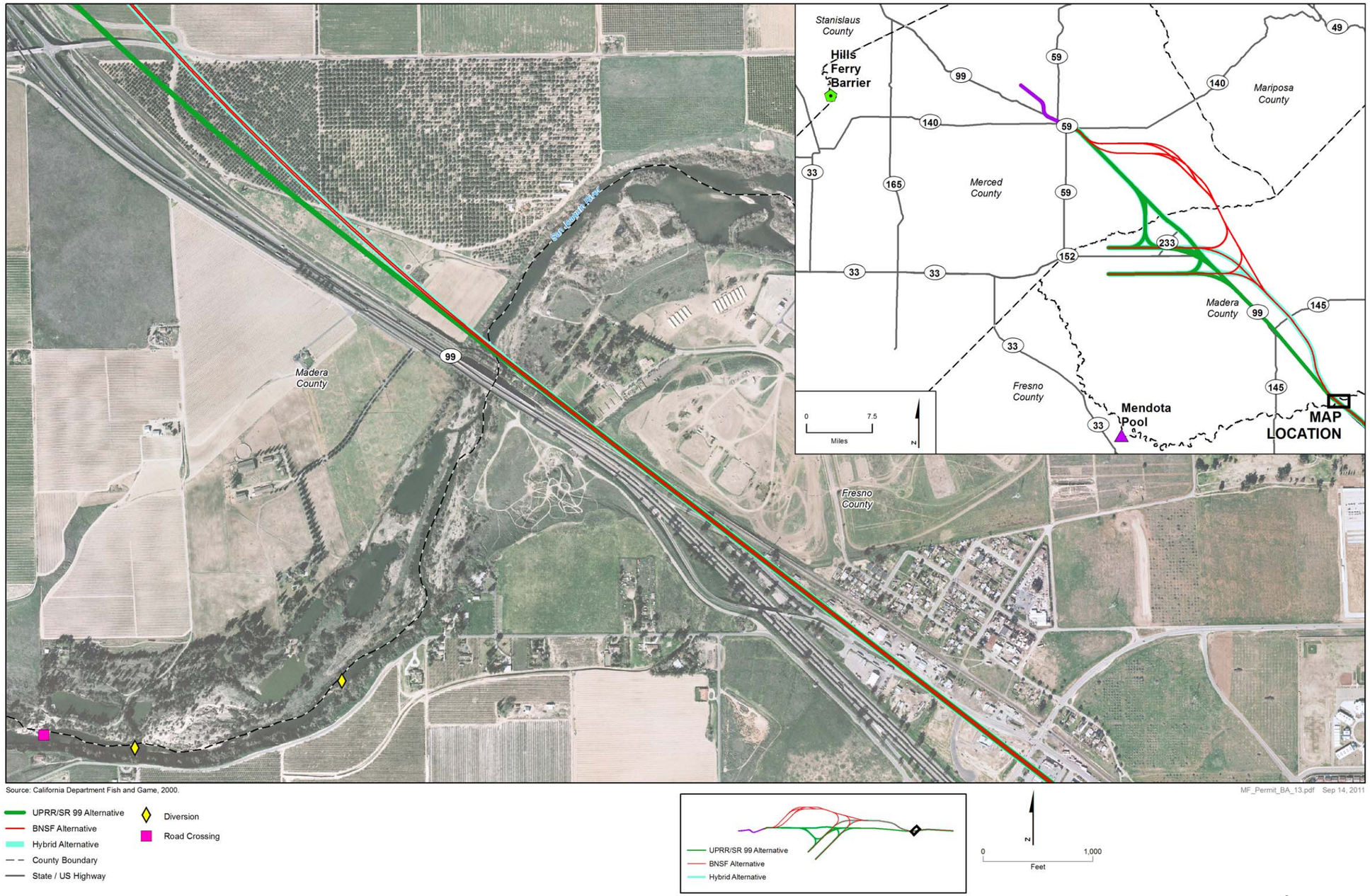

Figure 5-1
San Joaquin River Hydrological Connectivity

During construction activities, indirect effects on CVS could result if:

- Degradation of CVS fingerling and smolt foraging habitat through the removal of submerged driftwood and rock outcroppings.
- Removal of riparian vegetation adjacent to the streambed reduces shading required to maintain thermal refuges for CVS fingerlings and smolts during the summer period.

These indirect effects are expected to be associated with the bridge support pier(s); any additional effects along the banks would be avoided and/or minimized because disturbed areas would be required to be restored with native vegetation.

5.16.1.3 Operations Phase – Direct Effects

The piers and bridge abutments within the San Joaquin River will require periodic maintenance. Operation activities will require periodic maintenance activities including ground disturbance, clearing, or grubbing, any of which may cause interim erosion and sedimentation of adjacent CVS habitat. It is appropriate to recognize that, as a passenger train, the Merced to Fresno Section would not carry cargo with substandard amounts of hazardous materials. The train would be powered by an electrical current and thus would not emit any fuels (i.e., oil, gasoline, etc.). In the case of derailment, these materials should not be a risk to the environment. However, pollution from maintenance equipment or vehicles utilized in the HST primary right-of-way may be carried into adjacent CVS fingerling and yearling foraging habitat by storm runoff, potentially impairing recruitment levels for recovering populations of CVS. Therefore, potential direct effects on CVS may occur within the RSA.

5.16.1.4 Operations Phase – Indirect Effects

During project operations, stormwater runoff from railroad right-of-ways could potentially result in degradation of water quality. However, runoff from the right-of-ways would be directed as sheet flow into the adjacent drainage systems or directed through swales to infiltration basins. The basins are designed as a water quality control measure. No runoff from the Merced to Fresno Section would be discharged directly to any surface water bodies. Runoff from bridges, overpasses, underpasses, and aerial structures would be collected and discharged to infiltration basins or adjacent drainage systems.

Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid effects on CVS and other anadromous fish during the Merced to Fresno Section.

In addition, the measures listed below will be implemented to avoid and minimize direct effects on the species.

- Construction work window restrictions timed to minimize potential impacts on any migrating adults or juveniles (October 16 to June 14).
- Pre-construction fish surveys (snorkel surveys following CDFG Salmonid Restoration Manual techniques) conducted by qualified fisheries biologists to determine the presence and/or density of salmonids utilizing the RSA.
- Contractor education and environmental training about salmonid biology (life history and habitat requirements) and BMPs to minimize potential impacts on water quality and/or fish habitat.
- Biological monitoring during construction activities.
- Use of Environmentally Sensitive Areas and ERAs to protect EFH.
- Pile driving underwater sound pressure measures.

- Development and implementation of a Fish Rescue Plan inside cofferdam.
- Restoration of temporarily disturbed areas.
- San Joaquin River Plan and Final Design (refer to Section 2.7.1.12).
- Temporary construction sites, including staging areas, lay down and storage areas for equipment, materials, and construction vehicles, parking areas, and incidental stockpiling areas, will be assigned, as feasible, on the north side of the San Joaquin River in areas that do not include sensitive habitat for listed species or that affect riparian vegetation. These temporary construction sites may include areas that are within agriculture, pasture, barren or otherwise disturbed vegetation.

Construction work window restrictions would be determined through NMFS consultation. Since construction work window restrictions may not reduce effects on all federally listed anadromous fish, additional measures may be required, as determined through regulatory consultation. These measures may include provision of non-disturbance zones, additional site-or species-specific biological monitoring, or approved passive or active species relocation.

Construction work window restrictions for the San Joaquin River would include the following:

- Work within the wetted perimeter of the river channel will occur between June 15 and October 15 to minimize impacts on aquatic species and other aquatic resources.
- Work within the area of the designated floodway will be limited to the period from April 15 to October 31 for flood protection issues, unless otherwise authorized by the CVFPB.
- Material and equipment storage will not be permitted within the floodway and river channel areas after October 31 of each year. Equipment may enter into the floodway but will be removed daily and stored outside of the areas subject to flooding.

In the event that construction work window restrictions cannot be conducted, dewatering, water diversions or additional BMPs would be employed as determined through consultation with the USACE, NMFS, and RWQCB.

5.16.2 Net Project Effects on the Species

The Merced to Fresno Section may affect, likely to adversely affect CVS within the RSA. Based on established population(s) of CVS that occurs to the west of the Action Area (i.e. Stanislaus River) and the continuous reinundation of the San Joaquin River since 2009, the San Joaquin River that intersects the RSA may provide suitable habitat for straying CVS.

While the CVS have a moderate potential to occur within the RSA under current conditions, future restoration activities specified within the SJRRP (U.S. Bureau of Reclamation and California Department of Water Resources 2011) are expected to optimize habitat connectivity and quality for this species within the San Joaquin River.

As is outlined above, the Merced to Fresno Section may affect CVS through impacts on surface water quality and fish habitat through the construction and operational period. However, avoidance and minimization measures, project design features and conservation measures will be implemented in order to minimize any direct and/or indirect impact on CVS, including habitat designated as EFH for CVS, within the RSA.

As discussed previously in Section 3, the RSA for CVS is primarily predicated on indirect effects that could occur during construction activities. This is due primarily to construction effects having the most potential for effects on water quality since post construction activities confine and manage the onsite runoff and treat prior to discharge. The San Joaquin River pier placement would occupy habitat within the active river system, effecting fish habitat post construction. The runoff or potential for discharge for sediment

originating from the project during construction is anticipated to be controlled/minimized by BMPs, design features and mitigation measures as discussed in Section 2.7; however, without these features implemented in a timely manner, there is potential for discharge within the river during construction. It is also important to recognize that the Authority is committed to working closely with the SJRRP during the design-build process. The Authority, in partnership with the Design-Build Team, will design and conduct a hydraulics/hydrology analysis with appropriate modeling tools and incorporate site-specific data, including the needed geotechnical investigations to ensure the design, sizing, location and construction techniques are compatible with habitat conditions that support salmonoid utilization of the San Joaquin River crossing. The project crossing near the existing SR 99 will be designed so as not to be in conflict with the SJRRP or any actions under the SJRRP. The Authority will continue to coordinate with SJRRP and respect regulations regarding construction during the spawning and migration season. With the anticipated coordination, implementation of all minimization and avoidance measures, project design features and compensatory mitigation, the Merced to Fresno Section implementation will be consistent with the overall goals of the SJRRP and the re-establishment of the target species.

5.17 Effects on Spring-run Chinook Salmon

Populations of SRCS have been extirpated within the San Joaquin River since the 1950s. Prior to the interim flows in 2009, the San Joaquin River from the Friant Dam to Mendota Pool rarely sustained flows conducive to the lifecycle of Chinook salmon (U.S. Bureau of Reclamation and California Department of Water Resources 2011). Though stray FRCS have been observed moving past the Hills Ferry Barrier at the confluence of the Merced and San Joaquin Rivers, no spawning activity for any salmonid has been identified in the reinundated San Joaquin River (Sloan 2010). The extirpated SRCS is scheduled to be reintroduced to the San Joaquin River no later than December 2012 (U.S. Bureau of Reclamation 2010).

5.17.1 Mechanism and Explanation of Possible Effects

The known historic range of SRCS encompasses the main channel as well as the tributaries of the San Joaquin River from the confluence with the Merced River to the headwaters originating from the Friant Dam. The construction and operation of the Merced to Fresno Section may result in direct and indirect effects on populations of SRCS through the degradation to permanent loss of rearing habitat which requires consistently cool aquatic habitats with riffles, pools, and mature riparian corridors (see Table 5-1).

5.17.1.1 Construction Phase – Direct Effects

Direct effects on SRCS could occur through the installation of bridge support piers within the median high water mark of the San Joaquin River. As a direct result of the construction of the proposed San Joaquin River crossing, potential entrapment of individual SRCS fingerlings, yearlings, or adults may occur within the coffer dams constructed specifically to dewater the construction sites for the bridge support pier(s).

Runoff from the limit of direct effect could potentially contain pollutants (chemical laden runoff, petroleum products, pesticides, or herbicides) into suitable habitat that may adversely impact potentially recovering populations of SRCS within the San Joaquin River.

Construction phase – direct effects on SRCS would be similar to those described above for CVS; please refer to discussion provided above.

5.17.1.2 Construction Phase – Indirect Effects

Indirect effects on SRCS could occur within the RSA, an area that focuses on the San Joaquin River overpass and a limit of indirect effect of 400 feet downstream. Construction phase – indirect effects on SRCS would be similar to those described above for CVS; please refer to discussion provided above.

During construction activities, indirect effects on SRCS could result if:

- Degradation of SRCS fingerling foraging habitat occurs through the removal of submerged driftwood and rock outcroppings.
- Construction of the Merced to Fresno Section alters or removes habitats (e.g., foraging stations, shaded stream bank eddies) that are potentially occupied by recovering populations of SRCS within the San Joaquin River. Removal of riparian vegetation adjacent to the streambed reduces shading required to maintain thermal refuges for SRCS fingerlings during the summer period.
- Excavation, buildup of the rail bed, placement of permanent and temporary roads, structures, and staging areas, and other equipment operation may introduce sediment, pollute, or otherwise degrade or destroy aquatic habitats.

5.17.1.3 Operations Phase – Direct Effects

The operation of the Merced to Fresno Section would result in permanent piers and bridge abutments within the San Joaquin River that require periodic maintenance but is not anticipated to contribute to the long-term degradation and/or habitat modification of potentially recovering populations SRCS. Operation of the Merced to Fresno Section will require periodic maintenance activities including ground disturbance, clearing, or grubbing, any of which may cause interim erosion and sedimentation of adjacent SRCS habitat. It is appropriate to recognize that as a passenger train, the Merced to Fresno Section would not carry cargo with substandard amounts of hazardous materials. The train would be powered by an electrical current and thus would not emit fuels (i.e., oil, gasoline etc.). In the case of derailment these materials should not be at risk to the environment. However, pollution from maintenance equipment or vehicles utilized along the HST primary right-of-way may be carried into adjacent SRCS fingerling and yearling foraging habitat by storm runoff, potentially impairing recruitment levels for recovering populations of SRCS. Therefore, potential direct effects on SRCS may occur within the RSA.

5.17.1.4 Operations Phase – Indirect Effects

During project operations, stormwater runoff from railroad right-of-ways could potentially result in degradation of water quality. However, runoff from the right-of-ways would be directed as sheet flow into the adjacent drainage systems or directed through swales to infiltration basins. The basins are designed as a water quality control measure. No runoff from the Merced to Fresno Section would be discharged directly to any surface water bodies. Runoff from bridges, overpasses, underpasses, and aerial structures would be collected and discharged to infiltration basins or adjacent drainage systems.

5.17.2 Conservation Measures

The general conservation measures discussed in Section 2.7 and in this section will be implemented to minimize and avoid effects on SRCS and other anadromous fish during the Merced to Fresno Section. In addition, the measures listed below will be implemented to avoid and minimize direct effects on the species.

- Construction work window restrictions timed to minimize potential impacts on any migrating adults or juveniles (October 16 to June 14).
- Pre-construction fish surveys (snorkel surveys following CDFG Salmonid Restoration Manual techniques) conducted by qualified fisheries biologists to determine the presence and/or density of salmonids utilizing the RSA.
- Contractor education and environmental training about salmonid biology (life history and habitat requirements) and BMPs to minimize potential impacts on water quality and/or fish habitat.
- Biological monitoring during construction activities.
- Use of Environmentally Sensitive Areas and ERAs to protect EFH.

- Pile driving underwater sound pressure measures.
- Development and implementation of a Fish Rescue Plan inside cofferdam.
- Restoration of temporarily disturbed areas.
- San Joaquin River Plan and Final Design (refer to Section 2.7.1.12).
- Temporary construction sites, including staging areas, lay down and storage areas for equipment, materials, and construction vehicles, parking areas, and incidental stockpiling areas, will be assigned, as feasible, on the north side of the San Joaquin River in areas that do not include sensitive habitat for listed species or that affect riparian vegetation. These temporary construction sites may include areas that are within agriculture, pasture, barren or otherwise disturbed vegetation.

Construction work window restrictions would be determined through NMFS consultation. Since construction work window restrictions may not reduce effects on all federally listed anadromous fish, additional measures may be required, as determined through regulatory consultation. These measures may include provision of non-disturbance zones, additional site-or species-specific biological monitoring, or approved passive or active species relocation.

Construction work window restrictions for the San Joaquin River would include the following:

- Work within the wetted perimeter of the river channel will occur between June 15 and October 15 to minimize impacts on aquatic species and other aquatic resources.
- Work within the area of the designated floodway will be limited to the period from April 15 to October 31 for flood protection issues, unless otherwise authorized by the CVFPB.
- Material and equipment storage will not be permitted within the floodway and river channel areas after October 31 of each year. Equipment may enter into the floodway but will be removed daily and stored outside of the areas subject to flooding.

In the event that construction work window restrictions cannot be conducted, dewatering, water diversions or additional BMPs would be employed as determined through consultation with the USACE, NMFS, and RWQCB.

5.17.3 Net Project Effects on the Species

The Merced to Fresno Section may affect, likely to adversely affect SRCS within the RSA based on a reintroduced population(s) of SRCS that is specified by fall 2012.

While SRCS currently do not inhabit the San Joaquin River, restoration activities specified within the SJRRP (U.S. Bureau of Reclamation and California Department of Water Resources 2011) are expected to optimize habitat connectivity and quality for this species within the San Joaquin River.

As is outlined above, the Merced to Fresno Section may affect SRCS through impacts on surface water quality and fish habitat through the construction and operational period for the Merced to Fresno Section. However, project design features and mitigation measures will be implemented in order to minimize any direct and/or indirect impact on SRCS, including habitat designated as EFH for SRCS, within theRSA.

As discussed previously in Section 3.0, the RSA for SRCS is primarily predicated on indirect effects that could occur during construction activities. This is due primarily to construction effects having the most potential for effects on water quality because post construction activities confine and manage the onsite runoff and treat prior to discharge. The San Joaquin River pier placement would occupy habitat within the active river system, effecting fish habitat after construction. The runoff or potential for discharge for sediment originating from the project during construction is anticipated to be controlled/minimized by BMPs, design features, and mitigation measures as discussed in Section 2.7; however, without these

features implemented in a timely manner, there is potential for discharge within the river during construction. It is also important to recognize that the Authority is committed to working closely with the SJRRP during the design-build process. The Authority, in partnership with the Design-Build Team, will design and conduct a hydraulics/hydrology analysis with appropriate modeling tools and incorporate site-specific data, including the needed geotechnical investigations to ensure the design, sizing, location and construction techniques are compatible with habitat conditions that support salmonoid utilization of the San Joaquin River crossing. The project crossing near the existing SR 99 will be designed so as not to be in conflict with the SJRRP or any actions under the SJRRP. The Authority will continue to coordinate with SJRRP and respect regulations regarding construction during the spawning and migration season. With the anticipated coordination, implementation of all minimization and avoidance measures, project design features, and compensatory mitigation, the Merced to Fresno Section implementation will be consistent with the overall goals of the SJRRP and the re-establishment of the target species.

5.18 Effects on Essential Fish Habitat

The Action Area lies within legally designated freshwater EFH for SRCS. A detailed discussion of SRCS habitat requirements and distribution can be found in Section 4.4.17.6, EFH Assessment.

EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (NMFS 2007). Freshwater EFH for SRCS consists of four major components: (1) spawning and incubation, (2) juvenile rearing, (3) juvenile migration corridors, and (4) adult migration corridors and adult holding habitat (PSMFC 1996). Important features of essential habitat for spawning, rearing, and migration include adequate substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food, cover and habitat complexity; space; access and passage; and flood plain and habitat conductivity (PFMC 2000). SRCS essential freshwater habitat includes all those streams, lakes, ponds, wetlands, tributaries, and other water bodies currently viable and most of the habitat historically accessible to SRCS within Washington, Oregon, Idaho, and California.

NMFS has designated most water bodies that were historically accessible to SRCS as EFH. This designation includes the Middle San Joaquin-Lower Chowchilla hydrologic unit (18040001) (PFMC 2003). Within the Merced to Fresno Section, EFH has been designated for SRCS within the San Joaquin River up to the boundary of hydraulic unit 18040001 at Friant Dam (Federal Register 73:60987-60994).

Although EFH has been designated within the Middle San Joaquin-Lower Chowchilla hydraulic unit, completion of the Central Valley Project in the late 1940s and early 1950s has resulted in only intermittent surface water flows within the Middle San Joaquin River. The approximately 25-mile-long segment of the river between the Gravelly Ford gauging station and Mendota Pool is commonly without surface water due to diversions and infiltration losses, and conveys surface water only as a result of flood flow releases from Friant Dam. Since 1992, the CDFG has erected a diversion barrier at the Merced River confluence with the Middle San Joaquin River from mid-September to mid-December to stop salmonids from moving up the river above this location (CH2M HILL 2003, 2005). EFH above the Merced River confluence, while potentially suitable for SRCS, is largely if not entirely unoccupied due to habitat degradation and this managed fish barrier.

SRCS has been specifically targeted for recovery within the Action Area as a key implementation feature of the SJRRP (U.S. Bureau of Reclamation et al. 2009). The SJRRP intends to restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from restoration flows. Prior to interim flows that were initiated in 2009, the San Joaquin River from the Friant Dam to Mendota Pool rarely sustained flows conducive to the lifecycle of SRCS (U.S. Bureau of Reclamation and California Department of Water Resources 2011). The currently extirpated SRCS are scheduled to be reintroduced to the San Joaquin River no later than December 2012 (U.S. Bureau of Reclamation 2010).

5.18.1 Mechanism/Explanation of Possible Effects

Project operational impacts on all current and future anadromous fish runs would constitute a minor amount of permanent habitat conversion, resulting from bridge pilings within the San Joaquin River channel. Other impacts could result from changes in local hydrology and connectivity of surface waters, decreased habitat quality from stormwater runoff, and/or sensory disturbance from train operation (e.g. increased noise/vibration).

There are no plans to modify the physical characteristics of the San Joaquin River channel in the area of the Merced to Fresno Section crossing. The HST crossing would be designed with the planned increase in river flows and would not conflict with the goals of the restoration flows. The location of the Project crossing is in Reach 1, which has been identified as the reach where spawning may occur. A program-level environmental document on the SJRRP has been prepared (U.S. Bureau of Reclamation and California Department of Water Resources 2011). During an initial coordination meeting with the Bureau of Reclamation and the Department of Water Resources on June 6, 2011, it was determined that the project design would not conflict with the SJRRP. The Authority will continue to coordinate with SJRRP.

5.18.2 Net Project Effects on Essential Fish Habitat

Potential project impacts (i.e., indirect from runoff/water-quality related) could hinder re-establishment of special-status fish along the San Joaquin River without specific runoff management activities during construction and operation of the Merced to Fresno Section. Although these potential impacts are being considered during the project design, potential impacts on EFH during construction may occur; however, BMPs and project design features would be executed to avoid and minimize any potential substantive effects on EFH. The BMPs and project design features are discussed in Section 2 and are further discussed in the effects on SRCS in Section 5.17.

Although SRCS are specified to be reintroduced within the Action Area during the anticipated fall 2012 construction period, project activities will unlikely adversely affect this species through a combination of minimized activity within the median high water mark, water quality BMPs, and riparian restoration. The freshwater EFH for SRCS within the Action Area would not be substantially reduced nor would the overall extent of SRCS EFH within the Pacific Coast region of North America be diminished.

As a passenger train, the Merced to Fresno Section would not carry any cargo that would be hazardous in the event of a derailment. The train would be powered by an electrical current and thus would not emit any fuels (oil, gasoline etc.) in the case of derailment. Potential effects may occur within the Action Area.

5.18.3 Project Design Features to Minimize Effects on Special-status Fish Species and EFH

The Authority and FRA have considered avoidance and minimization measures consistent with the Statewide and Bay Area to Central Valley Program EIR/EIS commitments (Authority and FRA 2005, 2008). During project design and construction, the Authority and FRA would implement measures to reduce effects on water resources, special-status fish, and EFH. These measures are considered to be part of the Merced to Fresno Section. Additionally, the Merced to Fresno Section would require an Individual Section 404 Permit from USACE. This permit would have conditions to further minimize water quality effects. The Authority, in partnership with the Design-Build Team, will also design and conduct a hydraulics/hydrology analysis with appropriate modeling tools and incorporate site-specific data, including the needed geotechnical investigations to ensure the design, sizing, location and construction techniques are compatible with habitat conditions that support salmonoid utilization of the San Joaquin River crossing.

Project Design Features for Stormwater Management and Treatment. During the detailed design phase, evaluate each receiving stormwater system's capacity to accommodate project runoff. As necessary, design onsite stormwater management measures, such as detention or selected upgrades to the receiving system, to provide adequate capacity. Design and construct onsite stormwater management

facilities to capture runoff and provide treatment prior to discharge for pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways. Consider the use of constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated systems (biofilters) such as vegetated swales and grass filter strips. Use portions of the HMF site for onsite infiltration of runoff, if feasible, or for stormwater detention, if not. Incorporate vegetated set-backs from streams, such as Canal Creek and Berenda Creek.

Project Design Features for Flood Protection. Design the Project both to remain operational during flood events and to minimize increases in 100-year flood elevations, including the following:

- In SFHAs, raise the track at least 4 feet above the 100-year flood elevation.
- Minimize development within the floodplain as appropriate. Avoid placement of facilities in the floodplain (e.g., at the Castle Commerce Center HMF site and the Gordon-Shaw HMF) or raise the ground with fill above the base-flood elevation.
- Design of the crossings to maintain a floodwater surface elevation of no greater than 0.1 foot above current levels (zero rise within designated floodways). The following design considerations would minimize the effects of pier placement in the floodways.
- Design site crossings to be as nearly perpendicular to the channel as feasible to minimize bridge length.
- Orient piers to be parallel to the expected high water flow direction to minimize flow disturbance.
- Elevate bridge crossings at least 3 feet above the high water surface elevation to provide adequate clearance for floating debris or as required by local agencies. (The CVFPB requires that the bottom members [soffit] of a proposed bridge be at least 3 feet above the design floodplain. The required clearance may be reduced to 2 feet on minor streams at sites where significant amounts of stream debris are unlikely.).
- Conduct engineering analyses of channel scour depths at each crossing to evaluate the depth for burying the bridge piers. Implement scour-control measures to reduce erosion potential.
- Use quarry stone, cobblestone, or their equivalent for erosion control along rivers and streams, complemented with native riparian plantings or other natural stabilization alternatives that would restore and maintain a natural riparian corridor, where feasible.
- Place bedding materials under the stone protection at locations where the underlying soils require stabilization resulting from streamflow velocity.

5.19 Effects on California Tiger Salamander

CTS have the potential to occur throughout the limit of direct effect in association with vernal pools and inundated non-wetlands in California annual grassland and selected agricultural areas such as pastures and dryland grain crops (see Table 5-1). An incidental observation of CTS larvae was made within the RSA during 2011 special-status plant surveys. Protocol surveys for CTS were not conducted during botanical surveys.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USFWS official species list identifies occurrences of, or potential effects on, this species.

5.19.1 Mechanism and Explanation of Possible Effects

The construction and operation of the Merced to Fresno Section may result in direct and indirect effects on populations of CTS through the degradation or loss of seasonally inundated depressions such as vernal pools that maintain a minimum inundation period of 3 months (AmphibiaWeb 2010), or to suitable upland dispersal and refugia habitat such as grasslands and pastures.

Direct effects on CTS would include the impairment or removal of breeding pools, reduction or removal of upland refugia, and the mortality of eggs, larvae, and/or adults. Indirect effects include the alteration of migrating and breeding behavior of CTS and an alteration of hydrological cycles through polluted runoff, sedimentation, and erosion.

5.19.1.1 Construction Phase – Direct Effects

Where habitat is appropriate for CTS within the RSA, ground-disturbing activities may modify upland and breeding habitat as well as cause direct mortality of eggs, juveniles, and adults. Mortality could occur from the following:

- Construction vehicles crushing individuals or collapsing occupied aestivation refugias in upland habitat.
- Construction activities resulting in the degradation or destruction of a breeding pool containing CTS adults, juveniles or eggs.
- Migrating CTS becoming entrapped in construction materials or in excavation(s).
- Habitat loss will occur through the permanent or temporary removal, degradation, fill, or pollution of aquatic breeding habitat or upland burrows or other refugia.

5.19.1.2 Construction Phase – Indirect Effects

Indirect effects on CTS will occur within the RSA which includes the limit of direct effect plus a 250-foot limit of indirect effect. Suitable habitat utilized by this species could be temporarily effected by construction activities. Specifically, indirect effects on CTS may occur through:

- Construction-related changes in hydrology, including disruption or penetration of seasonal pools, water pollution, tire ruts, erosion, increased siltation/sedimentation, fractures in the hardpan soils, destruction of native vegetation, and alteration of pool hydrology.
- Habitat fragmentation caused by the HST corridor, which could disrupt the breeding season migration patterns from upland habitat to breeding pools.
- Noise, vibration, or light pollution from construction activities which would inhibit the nocturnal activity of CTS.
- Construction-related reduction/displacement of burrowing host species (ground squirrels and other burrowing mammals).

Indirect construction effects are expected to occur separately from the total area as direct construction effects.

5.19.1.3 Operations Phase – Direct Effects

Operation of the Merced to Fresno Section may result in injury or mortality to CTS within the right-of-way. Security fencing is not designed or expected to prohibit CTS from accessing the right-of-way where tracks are at-grade. CTS may access tracks or track ballast during either daily movements or seasonal migrations between aquatic and upland habitats. Operation of the train and routine maintenance activities on the right-of-way will occur through the night—the core period of activity for CTS. Trains may

kill migrating CTS on or near at-grade tracks. Maintenance vehicles may also harm or kill migrating CTS when traveling on associated maintenance access roads.

At-grade linear project components such as security fencing and rail beds may result in increased injury or mortality to CTS if they encounter predators while traveling parallel to the rail line, which is this species' typical behavior when encountering an obstacle during its migration. Tall or elevated project components such as security fencing, electrical infrastructure, and viaducts will provide artificial perch sites for avian predators, and may increase predation rates upon CTS by these species.

Potential effects may occur within the RSA.

5.19.1.4 Operations Phase – Indirect Effects

Project operations will continue to fragment remaining habitat and have the potential to interfere with daily and seasonal dispersal movements of CTS. Any maintenance activities that involve pesticides or herbicides may reduce the arthropod prey base of CTS or reduce the availability of upland refugia via the reduction of ground squirrel density. Operations may alter the composition and dynamics of surface and groundwater through pollution, erosion, siltation/sedimentation, and fractures in vernal pool hardpans. Operation activities will produce noise, vibration and light spillage that may inhibit normal nocturnal activities of CTS.

5.19.1.5 Interrelated Effects

Phase 1 of the San Francisco to San Jose, San Jose to Merced, and Fresno to Bakersfield sections of the HST System may also affect the CTS. As previously discussed, the HST is not considered interdependent. However, the adverse effects on this species from the interrelated sections of the HST system would be similar in nature, but they have not been quantified yet at a project level. This species is not expected to occur in remaining sections of the HST System.

The project-level effects on the CTS has not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, these sections would be required to consult with the USFWS under Section 7 of the ESA.

5.19.2 Conservation Measures

The general conservation measures discussed in Section 2.7 will be implemented to minimize and avoid the effects of the Merced to Fresno Section on CTS. In addition, the measures listed below will be implemented in areas of overlap between the limit of direct effect and the known geographic range of CTS to avoid and minimize potential adverse effect on this species:

- Construction activities within 250 feet of potential CTS breeding habitat will be restricted during the wet season (October 15 through April 15).
- Establish 250-foot non-disturbance exclusion zones around all potential CTS breeding habitat during the wet season; fencing will be comprised of a combination of both (i) Environmentally Sensitive Area high-visibility construction fencing, and (ii) WEF.
- Non-disturbance exclusion zones will be maintained and monitored by a qualified biologist(s) to ensure that no take of CTS or destruction of suitable habitat occurs outside of the limit of direct effect.
- If construction activities within 250 feet of potential CTS breeding habitat cannot be avoided during the wet season, the following steps will be taken:

- Pre-construction wet season surveys of potential breeding habitat within the limit of direct effect.
- If CTS are found onsite, adults/juveniles/egg masses will be relocated from affected areas to USFWS-approved locations.

5.19.2.1 Compensatory Mitigation

The total number of credits or acres provided for compensatory mitigation will be determined by the amount of upland and aquatic breeding habitat affected by project activities. Unavoidable effects on habitat that supports CTS will be compensated through the following purchases:

- Credits at an agency-approved mitigation bank.
- Fee title acquisition of occupied habitat.
- A conservation easement of lands selected to preserve sensitive resource habitats and habitat linkages in the region.
- In-lieu fee to appropriate agencies.

The credits or acres will be compensated for at a ratio of 3:1 for permanent effects on aquatic or upland habitat, and 1:1 for temporary effects on aquatic or upland habitat, or as determined through negotiations with the USFWS.

5.19.2.2 Net Project Effects on the Species

The Merced to Fresno Section may affect and is likely to adversely affect CTS. Total effects on CTS would range from a minimum of 9.64 acres to a maximum of 66.23 acres of aquatic breeding habitat, and from 180.29 to 680.54 acres of upland dispersal habitat. The total effects are composed of 9.16 to 45.18 acres of direct effects on aquatic breeding habitat, 103.00 to 405.85 acres of direct effects on upland dispersal habitat, 0.48 to 21.05 acres of indirect effects on aquatic breeding habitat, and 77.29 to 274.69 acres of indirect effects on upland dispersal habitat (see Table 5-1).

CTS is also expected to be affected by both the San Jose to Merced and the Fresno to Bakersfield sections; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System may result in interrelated effects on this species. However, the other Central Valley sections of the HST System are not anticipated to result in interdependent effects on this species.

5.20 Effects on San Joaquin Kit Fox

SJKF potentially occurs where annual grassland, agricultural and barren habitats are present within the Action Area. The Action Area is within the historic and current range of the species, which centers on the central and eastern portions of the San Joaquin Valley. The species is well documented in the vicinity of the Action Area, with nine recorded occurrences within a 10-mile radius of the Action Area

The Merced to Fresno Section avoids all three of the SJKF core recovery areas identified in the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998) and the San Joaquin Kit Fox (*Vulpes macrotis mutica*) 5-Year Review (USFWS 2010b). As described in Section 4.4.19.3, the Merced to Fresno Section will pass through linkage areas, including the Eastman Lake-Bear Creek ECA (Sandy Mush Road) where populations of the SJKF are known to occur.

The Eastman Lake-Bear Creek ECA largely follows the spatial arrangement of the Madera-Merced Linkage reported by Penrod et al. (2001). Portions of the Merced to Fresno Section that are within this ECA are co-located with the Sandy Mush Road Area, which is promoted in the *Recovery Plan for Upland Species of the San Joaquin Valley*, *California* (USFWS 1998) for its high biological function and value to SJKF and other species.

Specific conservation goals presented in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) for the Sandy Mush Road Area include the following:

- Protect natural land between the Alkali Sink Ecological Reserve and the San Joaquin River to the north (Sandy Mush Road/South Grasslands Area).
- Create a chain of habitat islands on the San Joaquin Valley floor that, together with establishing valley floor linkages through agricultural lands, links Merced County National Wildlife Refuges and state areas and other natural lands with the northwestern and northeastern portions of the San Joaquin Valley and to natural areas to the south.
- Maintain and enhance movement of SJKF between the Mendota area, Fresno County, natural lands in western Madera County, and natural lands along Sandy Mush Road and in the wildlife refuges and easement lands of Merced County. Specifically, maintain and enhance the Chowchilla or Eastside Bypass and natural lands along this corridor through acquisition, easement, or safe harbor initiatives.
- Link natural lands in the Sandy Mush Road Area with the population of SJKF on natural lands to the east by a safe harbor initiative on farmland.
- Later work by conservation biologists recommended that SJKF be conserved aggressively in southwestern Merced County, which is currently understood to be the northern-most limit of self-sustaining populations of this species (Constable et al. 2009).

Elevated crossings will maintain the permeability recommended by the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998). All of the crossings within the ECA include single-span or multi-span bridges at natural watercourses, such as Deadman Creek and Dutchman Creek.

In areas of the Merced to Fresno Section that are outside of linkage areas, populations of SJKF are not expected to occur frequently; however, dispersing or foraging individuals may be present on occasion. In general, habitats that are not disturbed on a regular basis may provide suitable long-term habitat for breeding, denning, foraging, and dispersing activities. By contrast, agricultural and developed areas provide limited opportunity for denning; however, SJKF individuals may forage or disperse in these areas.

Effects on this species are calculated by summing potentially suitable habitat within the USGS 7.5-minute quadrangles in which the USWS official species list identifies occurrences of this species.

5.20.1 Mechanism and Explanation of Possible Effects

Where suitable habitat exists for this species, construction and operation activities may contribute to direct or indirect effects on SJKF that may include population fragmentation, changes in habitat connectivity, loss of foraging habitat, and entrapment.

5.20.1.1 Construction Phase – Direct Effects

Where suitable habitat exists for SJKF, construction activities may lead to direct mortality and habitat modification. Mortality may occur through vehicles, or heavy equipment hit individual or destroy dens; or alternatively SJKF may become entrapped in excavated areas, pipes, or other equipment used for construction. Habitat modification may occur through the reduction, degradation, fill, pollution, loss or conversion of suitable habitat, loss of vegetative cover, collapse of occupied dens, and the placement of hardscape over areas that are potentially suitable denning habitat. Each of these mechanisms could decrease the amount of refuge available in an area, making the SJKF more vulnerable to predation. In addition, construction activities may result in the trapping of SJKF in trenches, excavated holes, pipes, or other equipment used for construction, which could lead to injury or mortality.

5.20.1.2 Construction Phase – Indirect Effects

Indirect effects on SJKF may occur from long-term changes in structure vegetation, the reduction or fragmentation of suitable habitat, or an increase in predation due to loss of refuge habitat. Other indirect effects on the species may include construction-related reduction of prey availability, or sound and vibration-related disruptions of breeding, feeding, or sheltering behaviors.

Although the Merced to Fresno Section will incorporate structures that facilitate wildlife movement (e.g., overpasses and viaducts), the linear nature of the Project will change existing movement patterns and will potentially constrain future wildlife dispersal in the long term. This may affect, likely to adversely affect individual viability by increasing the cost and risk of activities necessary for continued survival of SJKF populations, particular the genetic exchange between disjunct populations, foraging, and colonization of new habitats.

5.20.1.3 Operations Phase – Direct Effects

The operation of the Merced to Fresno Section may contribute to population fragmentation or habitat modification through noise or light disturbance and the reduction, degradation and loss of suitable habitat. SJKF could be directly affected because significant habitat modifications in the right-of-way may adversely impair the behavioral patterns of this species.

Fragmentation of existing SJKF populations may occur as a result of operation of the Merced to Fresno Section in southern Merced and northern Madera Counties. Penrod et al. (2001) identified the area near Deadman Creek and Dutchman Creek, near Sandy Mush Road and Le Grand, as the “Madera-Merced Linkage”. This linkage is ranked both as a high-priority choke-point (a narrow, effected, or otherwise tenuous habitat linkage) and as a missing link (a highly effected area that currently provides limited connectivity, but that is critical to restoring connectivity). It is reportedly severely threatened, with only moderate conservation potential, reflecting existing functional impairments due to development.

Operation and maintenance activities would not result in entrapment or mortality of SJKF on tracks or within equipment areas. Project design components, such as security fencing, will exclude SJKF from entering the right-of-way where the tracks are at-grade. However, there may be an increase in mortality if SJKF are ambushed by predators (e.g. coyotes, domestic/wild dogs) while traveling parallel to the rail line. Where tracks are on viaduct, the elevated structures will provide ample opportunity for species to cross under the HST System. Operation and maintenance activities throughout the Merced to Fresno Section could result in increased noise, light and vibration. These disturbances may cause displacement of the species in areas of at-grade track, where SJKF have reduced ability to avoid these disturbances.

Potential effects may occur within the Action Area.

5.20.1.4 Operations Phase – Indirect Effects

Operational indirect effects on SJKF may occur from the long-term changes in vegetation structure; the fragmentation of suitable habitat; or a reduction of prey availability and density that impairs breeding, feeding, or sheltering behaviors. Any maintenance activities that involve pesticides or herbicides may alter and/or reduce prey species composition.

FRA has established noise exposure limits for all wildlife at a sound exposure level (SEL) of 100 decibels (dBA) from passing trains. Assuming no intervening structures and maximum speeds of 220 mph, the 100 dBA SEL is forecast to occur an estimated 100 feet from the trackway centerline for at-grade crossings, and estimated 15 feet from the centerline for elevated sections on structures. Noise exposure on adjacent wildlife habitat approaching or exceeding the 100 dBA SEL threshold are considered to elicit a negative response from mammals and would result in an adverse effect. It is expected that the 100 dBA SEL would be exceeded consistently throughout all alternatives for an estimated 50 feet outside the at-grade crossings on both sides. All areas that are at-grade and include substantive wildlife habitat, primarily the Eastman Lake-Bear Creek ECA and riparian corridors, are expected to experience noise

exposure that exceed the 100 dBA SEL threshold and may potentially elicit a temporary startle, avoidance or negative behavior from wildlife, including the SJKF.

Operational activities may result in changes in habitat connectivity for the SJKF. Because the Merced to Fresno Section would contain a combination of bridges, viaducts, and at-grade tracks, the degree to which habitat connectivity may be affected would vary throughout the Action Area. Tracks would be at-grade through potential SJKF habitat, and elevated on a viaduct in other areas. To minimize effects on habitat connectivity in at-grade locations, the Merced to Fresno Section is designed to include wildlife undercrossing structures (Section 2.7.1). Depending on the HST alternative, there are multiple undercrossing opportunities based on hydraulic locations for each alternative within the ECA and modeled wildlife corridors. The anticipated indirect effects as a result of changes in habitat connectivity include possible shifts in SJKF home range location or size, and possible changes in overall species community composition. Species community composition changes include altered prey densities and availability increase in overall shrub cover, as well as the increase in mesopredator presence.

5.20.1.5 Interrelated Effects

Phase 1 of the San Jose to Merced, Fresno to Bakersfield, and Bakersfield to Palmdale sections may also affect SJKF. As previously discussed, the HST is not considered interdependent. However, the adverse effects on this species from the interrelated sections of the HST System would be similar in nature, but they have not been quantified yet at a project level. This species is not expected to occur in remaining sections of the HST System.

The project-level effects on the SJKF have not formally been studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, these sections would be required to consult with the USFWS under Section 7 of the ESA.

5.20.2 Conservation Measures

The general conservation measures discussed in Section 2.7 will be implemented to minimize and avoid effects of the project on SJKF. In addition, the *Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance* (USFWS 1999b) will be implemented to avoid and minimize direct effects on this species, and are summarized below.

- Pre-construction surveys will be conducted between May 1 and September 30 within the limit of direct effects in suitable areas (i.e., annual grassland, agriculture and barren) to identify known/potential SJKF dens. Pre-construction surveys will be conducted by a qualified, agency-approved biologist(s) within 30 days prior to the start of construction or ground-disturbing activities, and will be phased with project build-out.
- If SJKF or individuals, burrows, or diagnostic signs are detected, the following steps will be taken:
  - Disturbance to all SJKF dens will be avoided to the maximum extent possible.
  - During the breeding season (December 1 through July 31), all construction activities will be prohibited within the following limits:
    - Non-natal den exclusion zone of 100 feet surrounding occupied/non-occupied non-natal dens.
    - Natal den exclusion zone of 200 feet for SJKF (or as determined in consultation with USFWS) surrounding occupied/non-occupied natal dens.

  - Non-exclusion zone fencing will be comprised of Environmentally Sensitive Area high-visibility construction fencing within the limit of direct effects.
  - All construction activities near any occupied dens will cease one-half hour before sunset and will not begin earlier than one-half hour before sunrise, when feasible.
  - Vacant natal dens may be excavated only between August 15 and November 1 AND after pups have vacated the den.

- If SJKF is observed at the den during this period and construction activities within the non-disturbance exclusion zone of active SJKF burrows cannot be avoided, a qualified biologist(s) will initiate relocation efforts in accordance with the *Standardized Recommendations for Protection of the San Joaquin kit fox Prior to or During Ground Disturbance* (USFWS 1999b):
  - Destruction of any known or natal/pupping kit fox den requires take authorization/permit from USFWS and CDFG, respectively.
  - A minimum of 5 days of den-monitoring is required to allow animals to relocate, during which time passive harassment measures (i.e., partially blocking den entrances with soil) may be pursued to encourage relocation.
  - After a non-natal den is determined to be unoccupied, it may be excavated under the direction of a qualified biologist(s) year-round.
- All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored at a construction site for one or more overnight periods will be thoroughly inspected for SJKF individuals before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a SJKF is discovered inside a pipe, that section of pipe will not be moved until USFWS has been consulted. If necessary, and under the direct supervision of the USFWS-approved biological monitor, the pipe may be moved once to remove it from the path of construction activity, until the SJKF has escaped.

5.20.2.1 Compensatory Mitigation

As proposed in Section 2.7, compensatory mitigation will be provided for direct effects on SJKF (including destruction of natal dens, if necessary). Compensation will be pursued in weighted ratios between 3:1 and 0.1:1 according to the priority status of habitats discussed in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998) and the type of affected habitat.

Compensation for direct effects on California annual grassland will be mitigated at a ratio ranging between 2:1 and 3:1, depending on whether the land is located in or outside of an identified recovery plan area (i.e., Sandy Mush Road Area). Mitigation for effects on California annual grassland will be established in-kind, meaning that other suitable California annual grasslands will be preserved, enhanced, or created for the SJKF.

Compensation for direct effects on disturbed habitats (e.g., agricultural, barren) will be provided at a ratio ranging between 0.1:1 and 0.5:1. Mitigation for direct effects on these land uses will be mitigated out-of-kind, through the preservation, enhancement, or creation of suitable habitat for the SJKF.

Furthermore, effects on agricultural lands protected under the Williamson Land Act (prime farmland, farmland of state importance, unique farmland, and farmland of local importance) are proposed for preservation at a ratio of no less than 1:1 in the Agricultural Lands section of the *Merced to Fresno Section Draft Project EIR/EIS* (Authority and FRA 2011e). Currently, the agricultural effects and associated mitigation to Williamson Land Act are estimated to be between 119 to 721 acres. Preservation of agricultural lands will maintain foraging and dispersal habitat for the SJKF in existing agricultural production.

5.20.3 Net Project Effects on the Species

The Merced to Fresno Section would result in effects on habitat suitable for SJKF in seminatural and agricultural lands (see Table 5-1). The majority of the suitable habitat for SJKF within the Action Area is associated with lands located outside of the Eastman Lake-Bear Creek ECA/Sandy Mush Road Area and other areas identified in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998a) and *5-year Review for the SJKF* (USFWS 1998). The natural lands outside of these areas are fragmented and in many cases small in size, and as a result do not likely support large populations of SJKF. However, individuals of the species may disperse, forage, or den in these areas and could be affected by project activities.

Within the Eastman Lake-Bear Creek ECA, direct and indirect effects could occur to SJKF that potentially use this area to breed, den, forage, or disperse. The number of SJKF in this ECA would be expected to be higher (i.e., population level) as compared to areas outside of the ECA. Populations of SJKF are known from the ECA and effects on the species in this area ranges from individual level (i.e. mortality of individuals, destruction of dens) to population level (i.e., genetic exchange between dispersed populations) direct and indirect effects.

Within the Eastman Lake-Bear Creek ECA, direct and indirect effects on natural lands are small in size and would not likely result in effects on denning SJKF given the highly developed and disturbed nature of the surrounding agricultural lands. However, the extensive agricultural areas, and the fragmented natural areas within the Linkage areas, provide suitable foraging and dispersal habitat for SJKF individuals that could be directly or indirectly affected.

Agricultural lands, including those located within the Recovery Plan for Upland Species of the San Joaquin Valley, California, and 5-year Review Satellite and Linkage areas, do not likely provide suitable habitat for denning activities; however, this species may forage or disperse through these areas. SJKF are more likely to use agricultural lands in Satellite or Linkage areas than agricultural lands outside of these areas. Where SJKF use agricultural lands, direct and indirect effects may occur to this species.

Due to the direct and indirect effects on SJKF from habitat modifications, which are significant and quantifiable, and based on the known range of the species, documented occurrences near the Action Area, and the removal of suitable habitat within the limit of direct effect, the Merced to Fresno Section is likely to adversely affect SJKF.

San Joaquin kit fox is also expected to be affected by both the San Jose to Merced and the Fresno to Bakersfield sections; therefore, the Merced to Fresno Section and the other Central Valley sections of the HST System may result in interrelated effects on this species. However, the other Central Valley sections of the HST System are not anticipated to result in interrelated effects on this species.

5.21 Effects from Interrelated Actions

The Merced to Fresno Section is not an interdependent project but is a part of a statewide HST system. In addition to the project activities that will be implemented as part of the Merced to Fresno Section, interrelated activities that will be implemented in other Phase 1 sections of the HST System may also affect the federally listed species affected by the proposed action: CFS along three Phase 1 segments, VPTS along three Phase 1 segments, VPFS along three Phase 1 segments, VELB along four Phase 1 segments, Central Valley SRCS along three Merced to Fresno segments only, CTS along four Phase 1 segments, and SJKF along four Phase 1 segments.

Effects from the interrelated activities include many possible effects during construction and operation of the HST project in these other segments. These effects include habitat loss, fragmentation, mortality during construction, and indirect effects from surface runoff and incremental single event noise.

The adverse effects on the federally listed species from the interrelated sections of the HST System have not all been formally studied; however, based on species range and similarities in the project elements

(e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar in nature and magnitude to those in the Merced to Fresno Section. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on these species would be avoided and minimized utilizing strategies similar to those described in this BA. Furthermore, these sections would be required to consult with the USFWS under Section 7 of the ESA.

A summary of listed species that may be subject to adverse effects from interrelated Phase 1 sections is provided in Table 5-3.

Table 5-3
Listed Species with Potential to Occur in other Interrelated Actions

Species Name	Phase 1*						
	San Francisco to San Jose	San Jose to Merced	Merced to Fresno	Fresno to Bakersfield	Bakersfield to Palmdale	Palmdale to Los Angeles	Los Angeles to Anaheim
Succulent owl's clover	N/A	N/A	✓	N/A	N/A	N/A	N/A
Conservancy Fairy Shrimp	N/A	✓	✓	N/A	N/A	N/A	N/A
Vernal Pool Tadpole Shrimp	N/A	✓	✓	✓	N/A	N/A	N/A
Vernal Pool Fairy Shrimp	N/A	✓	✓	✓	N/A	N/A	N/A
Valley Elderberry Longhorn Beetle	N/A	✓	✓	✓	✓	N/A	N/A
Central Valley Steelhead	N/A	✓	✓	N/A	N/A	N/A	N/A
Central Valley Spring Run Chinook Salmon	N/A	N/A	✓	N/A	N/A	N/A	N/A
California Tiger Salamander	✓	✓	✓	✓	N/A	N/A	N/A
San Joaquin Kit Fox	N/A	✓	✓	✓	✓	N/A	N/A

5.22 Cumulative Effects

Under Section 7 consultation, the cumulative effects analysis are for actions that are likely to adversely affect listed resources, including any future state or private activities, not involving federal activities that are reasonably certain to occur within the Action Area. The combination of the HST project with other proposed projects in the San Joaquin Valley could result in cumulative effects on federally listed species. Cumulative projects in the region include various transportation, residential, agricultural, commercial, and industrial projects.

Cumulative effects are considered for the Action Area for the HST Project as 1,000 feet on either side of the construction footprint. Indirect effects are expected to be within the geographic limits contained inside the Action Area. Listed plant species include the limit of direct effect of a 100-foot area; vernal pool species include the limit of direct effect of a 250-foot area; listed fish species include the limit of direct

effect and a 400-foot area; and listed wildlife species include a 1,000-foot area. As previously noted, all of these distances are from the edge of the construction footprint.

Cumulative effects are considered within the context of the existing landscape and land use projections. Historical development patterns show that the Central Valley has lost 99% of its native grasslands and valley oak savanna, 95% of its wetlands, 66% of the vernal pools, and 89% of its riparian woodlands (CDFG 2007). The natural landscape has been converted into agricultural land, rural residential areas, and urban areas, which has reduced and fragmented the available wildlife habitat and limited the movement of wildlife between remaining habitat areas. Even under existing regulations that protect resources and mitigate potential impacts, these trends could persist under the No Project Alternative.

Projections show that the San Joaquin Valley will grow at a higher rate than any other region in California. Projections also show that Merced, Madera, and Fresno counties will continue to grow an average of 3% per year. By 2035, the cumulative study area will grow from a population of 1,366,000 to 2,298,000, which is a net increase of 932,000 people, or 68%. This increase could result in approximately 93,200 acres in new development to support the increased population. Accommodating this new population will require land and the construction of new roadways, electric power generation facilities, utilities, schools, hospitals, and commercial and industrial facilities. The combined environmental influence of these future changes is referred to as the “cumulative condition” for 2035. The cumulative project list discussed below indentified the known projects that will become a part of the cumulative condition. The projects that are listed are only those that have been reported to effect biological resources.

There are a few projects within the Action Area. Table 5.4 lists these projects by jurisdiction as applicable for biological resources.

Table 5-4
Major Foreseeable Projects (Action Area)

Project	Cumulative Effect
U.S. Bureau of Reclamation	
San Joaquin River Restoration Program	Comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from Interim and Restoration flows.
City of Chowchilla	
Chowchilla General Plan Update	Sensitive wildlife habitat lost including reported impacts on SJFX, succulent owl’s clover, San Joaquin Valley Orcutt grass, Greene’s tuctoria, conservancy fairy shrimp, vernal pool fairy shrimp, California tiger salamander, Valley elderberry longhorn beetle, and Central Valley steelhead.
City of Madera	
Madera General Plan Update	Wildlife habitat will be lost

As shown in Table 5-4, there are two projects that occur as city-wide projects that overlay the Action Area. Both of these projects are General Plan updates for the City of Chowchilla and the City of Madera. Specific locations of potential effects that may occur city-wide in most cases are located outside of the Action Area, depending on the general plan modification. In addition, the San Joaquin River Restoration Project is a long-term plan that will provide beneficial effects. It should be noted that there are a total estimated 14 projects that occur within several miles of the Action Area that have reported effects on biological resources.

In summary, although limited to two general plan updates, cumulative effects from these projects will contribute to the overall loss or degradation of wildlife resources. Disturbances will be direct and indirect, temporary and permanent, and will include the following:

- Impairment to federally listed wildlife species populations, dynamics, behavior, and ability to carry out species lifecycle.
- Impairment of wildlife movement.
- Adverse effects on the various functions and values provided by federally listed plant and wildlife species habitats.
- Potential adverse modification of federally listed wildlife species habitat.

The successful implementation of the general avoidance and minimization measures discussed in Section 2.7, along with any specific avoidance and minimization discussed for each federally listed plant and wildlife species, will considerably reduce the nature and magnitude of cumulative effects on federally listed plant and wildlife species. Additionally, the Merced to Fresno Section will comply with federal, state, and local regulations through USFWS and NMFS consultation and permitting, which will result in further development of specific avoidance and minimization measures, BMPs, and compensatory mitigation options to be implemented. Other cumulative projects will be required to comply with similar regulatory requirements (e.g., federal, state, and local government laws and regulations) that protect federally listed wildlife species and wildlife movement and migration corridors. Therefore, cumulative effects will be mitigated through the appropriate regulatory process for each project.

6.0 Conclusion and Determination of Effects for Federally Listed Species and Their Designated Critical Habitat

This BA has been prepared to evaluate the potential adverse effects of the proposed HST system from Merced to Fresno on species federally listed as endangered or threatened in compliance with Section 7 of the ESA. The criteria used to determine which federally listed species were considered for this BA and the potential adverse effects on listed species from the Merced to Fresno Section were presented in the preceding sections. In addition, this BA proposes measures to avoid and minimize take to listed species. The Merced to Fresno Section has utilized design alternatives, including elevated viaducts and realignment of the HST system, to avoid and minimize effects on listed species to the maximum extent practicable.

To further avoid and minimize adverse effects of the Merced to Fresno Section on federally listed species, a number of conservation measures will be implemented. These measures, proposed in Section 2.7.1, are intended to reduce direct and indirect effects from project construction and operation (including maintenance activities) to listed species.

6.1 Conclusions

The construction and operation of the Merced to Fresno Section will create permanent effects on suitable habitat and may result in direct and indirect effects on five plant species and eight wildlife species protected under ESA. Direct effects on federally listed species may include significant habitat modification or degradation, loss or destruction of breeding habitat, or individual species mortality. The mechanism of these direct effects will come from the fill and removal of soils, vegetation clearing, the construction of new railway tracks, road overcrossings, and associated railway support facilities. In areas where temporary vegetation clearing occurs for storage, stockpiling, or other temporary construction needs, the native vegetation may be reestablished.

Indirect effects on the federally listed species are reasonably expected to occur due to the potential changes in hydrology, increased dust and shading, habitat fragmentation, and possible changes in dispersal or migration patterns. These indirect effects may be caused by ground disturbance, barriers and/or fencing, visual disturbance, and operational noise and/or vibration.

The species that were recognized as having potential to occur on the Merced to Fresno Section were evaluated based on three criteria: (1) the known distribution of the species, (2) the presence of suitable habitat within the Action Area, and (3) documented occurrences of the species within each species' accepted dispersal distance of the limit of direct effect. Designated critical habitats for federally listed species were also evaluated as having potential to occur in the Merced to Fresno Section. The federally listed species and designated critical habitats considered as meeting these criteria are discussed in Table 4-1.

The range of potential effects on federally listed species in the limit of direct effect is presented in Table 5-1. Many of the listed species in the BA share the same wildlife habitat types. Due to this overlap of habitat, it is anticipated that the listed species will be limited to the areas where suitable habitats (e.g., vernal pools, annual grassland, etc.) exist. Therefore, the total acreage of effects presented in Table 5-1 would not be accurately reflected by summing the minimum or maximum acreages of all of the species presented.

A substantial majority of the Merced to Fresno Section Action Area is dominated by intensively managed agriculture, urban development, and other modified land uses that do not provide suitable habitat for species listed under ESA. As demonstrated in Section 4 and Section 5, construction and operation of the HST project is expected to result in adverse direct and indirect effects on five listed plants and eight listed animals that are presumed to be present in portions of the Action Area where potentially suitable habitat

is present. Although the total acreage of suitable habitat within the range of these species is unknown, the acreage of potentially suitable habitat that will be adversely affected by the Merced to Fresno Section is proportionally small relative to areas of suitable habitat that remain outside the Action Area.

Project design features, BMPs, monitoring, reporting, and other protective measures will be used to avoid and minimize adverse effects on potentially suitable habitat. Unavoidable adverse effects as a result of the Merced to Fresno Section will be offset with appropriate compensatory mitigation and are not anticipated to result in a substantial reduction of local populations.

6.2 Effects from Interrelated and Interdependent Actions

The Merced to Fresno Section is not an interdependent project but is a part of a statewide HST system. In addition to the project activities that will be implemented as part of the Merced to Fresno Section, interrelated activities that will be implemented in other sections of Phase 1 may also affect the federally listed species affected by the proposed action: CFS along three Phase 1 segments, VPTS along three Phase 1 segments, VPFS along three Phase 1 segments, VELB along four Phase 1 segments, Central Valley SRCS along three Merced to Fresno segments only, CTS along four Phase 1 segments, and SJKF along four Phase 1 segments.

Effects from the interrelated activities include many possible effects during construction and operation of the HST project in these other segments. These effects include habitat loss, fragmentation, mortality during construction, and indirect effects from surface runoff and incremental single event noise.

The adverse effects on the federally listed species from the interrelated sections of the HST System have not all been formally studied; however, based on species range and similarities in the project elements (e.g., infrastructure and facilities), the direct and indirect effects on the species are anticipated to be similar in nature and magnitude to those in the Merced to Fresno Section. The quality and quantity of habitat removed and potential extent of take would vary between the identified sections of the statewide HST System. The direct and indirect effects on this species would be avoided and minimized utilizing strategies similar to those as described in this BA. Furthermore, these sections would be required to consult with the USFWS under Section 7 of the ESA.

6.3 Cumulative Effects

Under Section 7 consultation, the cumulative effects analyses are for actions that are likely to adversely affect listed resources including any future state or private activities, not involving federal activities that are reasonably certain to occur within the Action Area. The combination of the HST project with other proposed projects in the San Joaquin Valley could result in cumulative effects on federally listed species. Cumulative projects in the region include various transportation, residential, agricultural, commercial, and industrial projects. Projects that could affect federally listed species include the General Plan updates for the City of Chowchilla and the City of Madera. Other projects that are represented in the vicinity and region are located outside of the Action Area.

In summary, cumulative effects from these projects will contribute to the overall loss or degradation of wildlife resources. Disturbances will be direct and indirect, and temporary and permanent and will include the following:

- Impairment to federally listed wildlife species populations, dynamics, behavior, and ability to carry out species lifecycle.
- Impairment of wildlife movement.
- Adverse effects on the various functions and values provided by federally listed plant and wildlife species habitats.
- Potential adverse modification of federally listed wildlife species habitat.

The successful implementation of the general avoidance and minimization measures discussed in Section 2.7, along with any specific avoidance and minimization discussed for each federally listed plant and wildlife species, will considerably reduce the nature and magnitude of cumulative effects on federally listed plant and wildlife species. Additionally, the Merced to Fresno Section will comply with federal, state, and local regulations through USFWS and NMFS consultation and permitting, which will result in further development of specific avoidance and minimization measures, BMPs, and compensatory mitigation options to be implemented. Other cumulative projects will be required to comply with similar regulatory requirements (e.g., federal, state, and local government laws and regulations) that protect federally listed wildlife species and wildlife movement and migration corridors. Therefore, cumulative effects will be mitigated through the appropriate regulatory process for each project.

6.4 Determination

The Authority and FRA have proposed general conservation measures to reduce the direct and indirect effects on listed species and their habitats. In addition to the general conservation measures, Sections 5.1 through 5.21 propose species-specific conservation measures to further avoid and minimize project effects on listed plant and wildlife species. Compensatory mitigation is proposed for unavoidable direct effects on federally listed species. Suitable compensation will be determined through consultation with the USFWS and NMFS and completed with implementation of the compensatory mitigation plan.

Given implementation of these measures, the Authority and FRA have determined that the Merced to Fresno Section **may affect, is likely to adversely affect** two federally listed species under the jurisdiction of NMFS. The Authority and FRA have also determined that the Merced to Fresno Section **may affect, is likely to adversely affect** 11 federally listed species under the jurisdiction of USFWS. Finally, the Authority and FRA have determined that the Merced to Fresno Section **may affect, is likely to adversely affect** designated critical habitat for six species administered through USFWS. The effects determinations are summarized in Table 6-1.

Table 6-1
Determination of Effects for Federally Listed Species and their Designated Critical Habitat

Species	Federal Status	Determination
Colusa grass (Neostapfia colusana)	FT	MA/LAA
San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*)	FT	MA/LAA
Designated Critical Habitat, San Joaquin Valley Orcutt grass	Designated	MA/LAA Critical Habitat
hairy Orcutt grass (*Orcuttia pilosa*), global	FE	MA/LAA
Greene's tuctoria (*Tuctoria greenei*)	FE	MA/LAA
Designated Critical Habitat, Greene's tuctoria	Designated	MA/LAA Critical Habitat
succulent owl's-clover (Castilleja campestris ssp. succulenta)	FT	MA/LAA
Designated Critical Habitat, succulent owl's-clover	Designated	MA/LAA Critical Habitat
Conservancy fairy shrimp (*Branchinecta conservatio*)	FE	MA/LAA

Species	Federal Status	Determination
Designated Critical Habitat, Conservancy fairy shrimp	Designated	MA/LAA Critical Habitat
Vernal pool fairy shrimp (*Brachinecta lynchi*)	FT	MA/LAA
Designated Critical Habitat, Vernal pool fairy shrimp	Designated	MA/LAA Critical Habitat
Vernal pool tadpole shrimp (*Lepidurus packardi*)	FE	MA/LAA
Designated Critical Habitat, Vernal pool tadpole shrimp	Designated	MA/LAA Critical Habitat
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT	MA/LAA
Central Valley Steelhead (*Oncorhynchus mykiss*)	FT	MA/LAA
Central Valley spring-run Chinook Salmon (*Oncorhynchus tshawytscha*)	FT	MA/LAA
California tiger salamander, central population (*Ambystoma californiense*)	FT	MA/LAA
San Joaquin kit fox (*Vulpes macrotis mutica*)	FE	MA/LAA

FT (Federally Threatened) = Listed as threatened under the ESA.

FE (Federally Endangered) = Listed as endangered under the ESA.

MA/LAA= May affect, Likely to adversely affect.

Designated (critical habitat): Habitat formally identified by the USFWS as essential to the survival of a species.

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8.0 Preparer Qualifications

This section summarizes theAECOM/CH2M HILL Project Team Staff, and provides a summary of their qualifications, roles, and responsibilities in the preparation of this Biological Assessment.

Michael Benner

Michael Benner has 34 years of experience preparing environmental documentation and conducting natural resources planning. This experience includes overseeing the preparation of biological resource studies compliant with requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) and supporting regulatory compliance activities. Mr. Benner earned his Bachelor of Arts in the Biological Sciences in 1976 and his Masters in Science in Environmental Studies in 1979 from California State University at Fullerton. He currently serves as a Vice President in AECOM's Orange Office.

Michael Clary

Michael Clary provides botanical, wildlife, and natural resource regulatory expertise for the natural resources planning and management group in CH2M HILL's Sacramento Office. Mr. Clary earned his Bachelor of Science degree in Ecology and Zoology from California State University at Humboldt in 1993 and has 16 years of professional experience conducting ecological studies throughout California and the desert southwest. He specializes in conducting studies in support of federal and state regulatory and permitting requirements including NEPA, CEQA, ESA and CWA.

Thomas Juhasz

Thomas Juhasz is a field biologist who has experience with endangered species in California, Hawaii, and the Caribbean. As a vernal pool specialist, Mr. Juhasz has USFWS protocol-level experience with California red legged frog, vernal pool branchiopods (fairy shrimp), and special-status vernal pool plants. His regulatory experience includes the implementation and coordination of federal and state compliance requirements such as Habitat Conservation Planning (HCP) documents, general biological assessments (GBA), and focus species reports. Mr. Juhasz has experience planning and implementing rare plant salvage programs, propagation protocol and sourcing, and comprehensive restoration plans. Mr. Juhasz is experienced in writing and coordinating environmental regulatory documents for NEPA and CEQA compliance for special-status plant and animal species as well as wetland resources.

Chris Fitzer

Chris Fitzer has 15 years of experience in aquatic ecology, fisheries assessments, and water resources planning, including conducting studies and preparing documents compliant with requirements of California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and Endangered Species Act (ESA). He holds a Masters degree in Watershed Planning from the University of Colorado and a Bachelor of Arts in Biogeography from Texas Tech University. He has previously worked for the Oregon Department of Fish and Wildlife in Florence, OR and the USDA Forest Service in Lowell, OR. Most recently, he has been working as a consulting aquatic ecologist and fisheries biologist, including the last 7 years at AECOM's Sacramento office.

Merrill Norrdin

Merrill Norrdin is a CEQA/NEPA Project Manager in the Environment Business Group in AECOM's Orange office. She has over ten years of professional experience in the Environmental field. Her specific expertise is planning, writing and coordinating comprehensive environmental regulatory documents for the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) compliance; specifically Environmental Impact Reports and Environmental Impact Statements. Specific expertise includes project management, tracking project budgets, preparing proposals and scopes of

work, staffing projects and maintaining client relationships. Ms. Norrdin has worked on various large-scale projects throughout California related to environmental planning and land management.

Andrea Stassi

Andrea Stassi is an Environmental/Regulatory Analyst in the Transportation Business Group in AECOM's Orange Office. She has over three years of experience in the environmental field, most recently three years related to fishery biological services. Her specific expertise includes aquatic grass mitigation and monitoring database management; GIS map development for marine habitat projects; side-scan sonar and mobile GIS technology implementation in ecological field studies; and assessment of population dynamics at habitat restoration sites in biological field studies. Prior to her most recent experience, Ms. Stassi has worked on various international projects related to environmental planning and land management.

Jeff Tupen

Jeff Tupen is an Ecosystem Planning and Restoration Senior Technologist in CH2M HILL's Sacramento, California, office. He has over 25 years of professional experience in natural resource management and environmental consulting, which has encompassed extensive experience in marine and freshwater fisheries issues, including baseline studies, habitat assessments, impact evaluations, and mitigation and enhancement planning. He is experienced in wetland characterization, delineation, and Section 404 permitting; stream ecology and fluvial geomorphology studies; riparian and aquatic habitat characterization and restoration; federal and California ESA compliance and permitting; and water quality monitoring.

APPENDIX A

HST Alternatives

1.0 High-Speed Train Alternatives

As shown in Figure 1-1, there are three HST alignment alternatives proposed for the Merced to Fresno Section of the HST System: the UPRR/SR 99 Alternative, which would primarily parallel the UPRR railway; the BNSF Alternative, which would parallel the BNSF railway for a portion of the distance between Merced and Fresno; and the Hybrid Alternative, which combines features of the UPRR/SR 99 and BNSF alternatives. In addition, there is an HST station proposed for both the City of Merced and the City of Fresno, there is a wye connection (see text box on page A-3) west to the Bay Area, and there are five potential sites for a proposed HMF.

Tables A-1 through A-18 at the end of this appendix show potential impacts by HST alternative.

1.1 UPRR/SR 99 Alternative

This section describes the UPRR/SR 99 Alternative, including the Chowchilla design options, wyes, and HST stations.

1.1.1 North-South Alignment

The north-south alignment of the UPRR/SR 99 Alternative would begin at the HST station in Downtown Merced, located on the west side of the UPRR right-of-way. South of the station and leaving Downtown Merced, the alternative would be at-grade and cross under SR 99. Approaching the City of Chowchilla, the UPRR/SR 99 Alternative has two design options: the East Chowchilla design option, which would pass Chowchilla on the east side of town, and the West Chowchilla design option, which would pass Chowchilla 3 to 4 miles west of the city before turning back to rejoin the UPRR/SR 99 transportation corridor. These design options would take the following routes:

- **East Chowchilla design option:** This design option would transition from the west side of the UPRR/SR 99 corridor to an elevated structure as it crosses the UPRR railway and N Chowchilla Boulevard just north of Avenue 27, continuing on an elevated structure away from the UPRR corridor along the west side of and parallel to SR 99 to cross Berenda Slough. Toward the south side of Chowchilla, this design option would cross over SR 99 north of the SR 99/SR 152 interchange near Avenue 23½ south of Chowchilla. Continuing south on the east side of SR 99 and the UPRR corridor, this design option would remain elevated for 7.1 miles through the communities of Fairmead and Berenda until reaching the Dry Creek Crossing. The East Chowchilla design option connects to the HST sections to the west via either the Ave 24 or Ave 21 wyes (described below).

- **West Chowchilla design option:** This design option would travel due south from Sandy Mush Road north of Chowchilla, following the west side of Road 11¾. The alignment would turn southeast toward the UPRR/SR 99 corridor south of Chowchilla. The West Chowchilla design option would cross over the UPRR and SR 99 east of the Fairmead city limits to again parallel the UPRR/SR 99 corridor. The West Chowchilla design option would result in a net decrease of approximately 13 miles of track for the HST System compared to the East Chowchilla design option and would remain outside the limits of the City of Chowchilla. The West Chowchilla design option connects to the HST sections to the west via the Ave 24 Wye, but not the Ave 21 Wye.

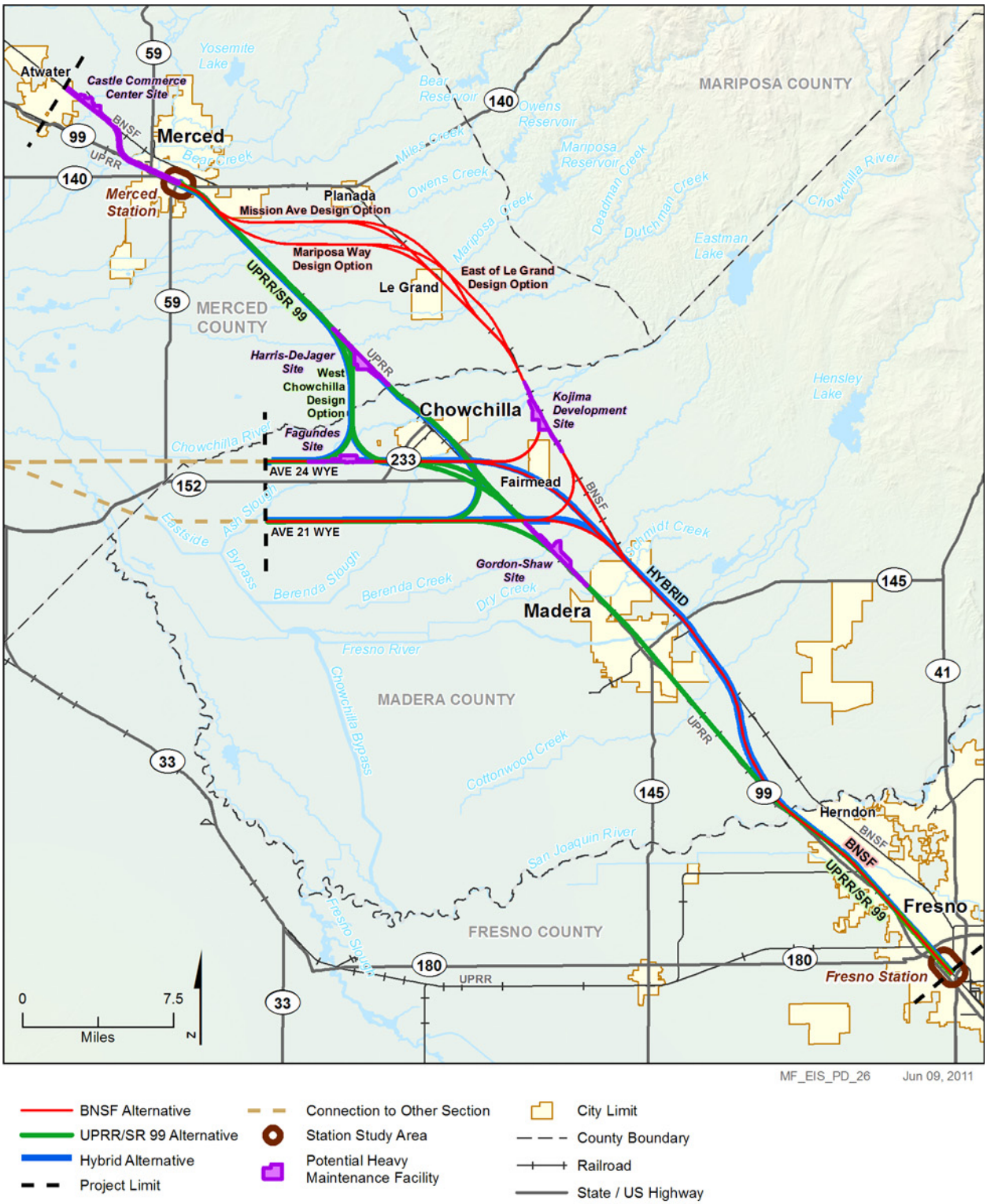


Figure 1-1
Merced to Fresno Section
HST Alternatives and Project Vicinities

The UPRR/SR 99 Alternative would continue toward Madera along the east side of the UPRR south of Dry Creek and remain on an elevated profile for 8.9 miles through Madera. After crossing over Cottonwood Creek and Avenue 12, the HST alignment would transition to an at-grade profile and continue to be at-grade until north of the San Joaquin River. After the alternative crosses the San Joaquin River, it would rise over the UPRR railway on an elevated guideway, supported by straddle bents, before crossing over the existing Herndon Avenue and again descending into an at-grade profile and continuing west of and parallel to the UPRR right-of-way. After elevating to cross the UPRR railway on the southern bank of the San Joaquin River, south of Herndon Avenue, the alternative would transition from an elevated to an at-grade profile. Traveling south from Golden State Boulevard at-grade, the alternative would cross under the reconstructed Ashlan Avenue and Clinton Avenue overhead structures. Advancing south from Clinton Avenue between Clinton Avenue and Belmont Avenue, the HST guideway would run at-grade adjacent to the western boundary of the UPRR right-of-way and then enter the HST station in Downtown Fresno. The HST guideway would descend in a retained-cut to pass under the San Joaquin Valley Railroad spur line and SR 180, transition back to at-grade before Stanislaus Street, and continue to be at-grade into the station. As part of a station design option, Tulare Street would become either an overpass or undercrossing at the station.

1.1.2 Wye Design Options

The following text describes the wye connection from the San Jose to Merced Section to the Merced to Fresno Section. There are two variations of the Ave 24 Wye for the UPRR/SR 99 Alternative because of the West Chowchilla design option. The Ave 21 Wye does not connect to the West Chowchilla design option and therefore does not have a variation.

1.1.2.1 Ave 24 Wye

The Ave 24 Wye design option would travel along the south side of eastbound Avenue 24 toward the UPRR/SR 99 Alternative and would begin diverging onto two sets of tracks west of Road 11 and west of the City of Chowchilla. Under the East Chowchilla design option, the northbound set of tracks would travel northeast across Road 12, joining the UPRR/SR 99 north-south alignment on the west side of the UPRR right-of-way just north of Sandy Mush Road. Under the West Chowchilla design option, the northbound set of tracks would travel northeast across Road 12 and would join the UPRR/SR 99 north-south alignment just south of Avenue 26. The southbound HST guideway would continue east along Avenue 24, turning south near SR 233 southeast of Chowchilla, crossing SR 99 and the UPRR railway to connect to the UPRR/SR 99 Alternative north-south alignment on the east side of the UPRR near Avenue 21½. Under the West Chowchilla design option, the southbound tracks would turn south near Road 16 south of Chowchilla, crossing SR 99 and the UPRR to connect to the UPRR/SR 99 north-south alignment on the east side of the UPRR adjacent to the city limits of Fairmead.

What is a "Wye"?

The word "wye" refers to the "Y"-like formation that is created where train tracks branch off the mainline to continue in different directions. The transition to a wye requires splitting two tracks into four tracks that cross over one another before the wye "legs" can diverge in opposite directions to allow bidirectional travel. For the Merced to Fresno Section of the HST System, the two tracks traveling east-west from the San Jose to Merced Section must become four tracks—a set of two tracks branching to the north and a set of two tracks branching to the south.

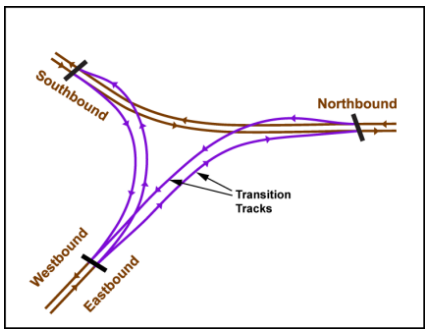


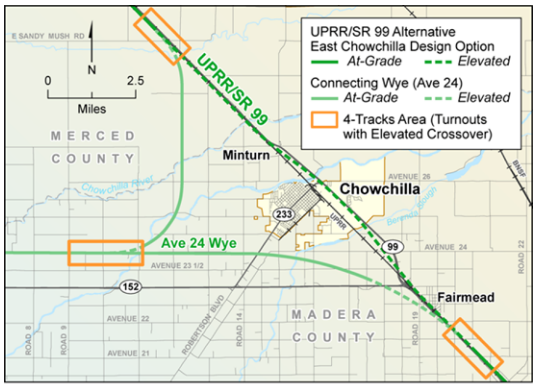
Figure 1-2a shows the wye alignment for the East Chowchilla design option and Figure 1-2b shows the alignment for the West Chowchilla design option. Together, the figures illustrate the difference in the wye triangle formation for each design option connection. The north-south alignment of the West Chowchilla design option between Merced and Fresno diverges along Avenue 24 onto Road 12, on the north branch of the wye, allowing the HST alternative to avoid traveling through Chowchilla and to avoid constraining the city within the wye triangle.

1.1.2.2 Ave 21 Wye

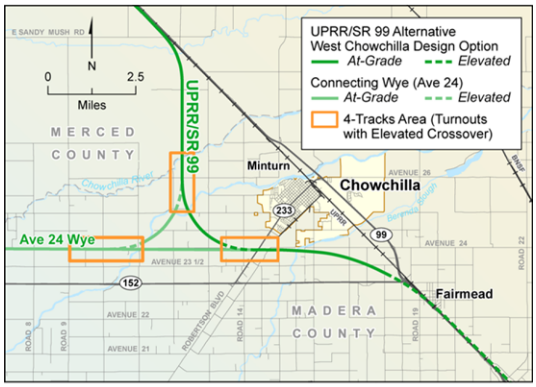
The Ave 21 Wye would travel along the north side of Avenue 21. Just west of Road 16, the HST tracks would diverge north and south to connect to the UPRR/SR 99 Alternative, with the north leg of the wye joining the north-south alignment at Avenue 23½ and the south leg at Avenue 19½.

1.1.3 HST Stations

The Downtown Merced and Downtown Fresno station areas would each occupy several blocks, to include station plazas, drop-offs, a multimodal transit center, and parking structures. The areas would include the station platform and associated building and access structure, as well as lengths of platform tracks to accommodate local and express service at the stations. As currently proposed, both the Downtown Merced and Downtown Fresno stations would be at-grade, including all trackway and platforms, passenger services and concessions, and back-of-house functions.



(a) Ave 24 Wye with the East Chowchilla Design Option



(b) Ave 24 Wye with the West Chowchilla Design Option

Figures 1-2a and b
Ave 24 Wye and Chowchilla Design Options

1.1.3.1 Downtown Merced Station

The Downtown Merced Station would be between Martin Luther King Jr. Way to the northwest and G Street to the southeast. The station would be accessible from both sides of the UPRR, but the primary station house would front 16th Street. The major access points from SR 99 include V Street, R Street, Martin Luther King Jr. Way, and G Street. Primary access to the parking facility would be from West 15th Street and West 14th Street, just one block east of SR 99. The closest access to the parking facility from the SR 99 freeway would be R Street, which has a full interchange with the freeway. The site proposal includes a parking structure that would have the potential for up to 6 levels with a capacity of approximately 2,250 cars and an approximate height of 50 feet.

1.1.3.2 Downtown Fresno Station Alternatives

There are two station alternatives under consideration in Fresno: the Mariposa Street Station Alternative and the Kern Street Station Alternative.

<u>Mariposa Street Station Alternative</u>

The Mariposa Street Station Alternative is located in Downtown Fresno, less than 0.5 mile east of SR 99. 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 60 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. Entrances would be located at both G and H Streets. The eastern entrance would be at the intersection of H Street and Mariposa Street, with platform access provided via the pedestrian overcrossing. The main western entrance would be located at G Street and Mariposa Street.

The majority of station facilities would be located east of the UPRR tracks. The station and associated facilities would occupy approximately 18.5 acres, including 13 acres dedicated to the station, bus transit center, surface parking lots, and kiss-and-ride accommodations. A new intermodal facility would be included in the station footprint 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. The site proposal includes the potential for up to 3 parking structures occupying a total of 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 have a slightly smaller footprint (1.5 acres), with 5 levels and a capacity of approximately 1,100 cars. Surface parking lots would provide approximately 300 additional parking spaces.

Kern Street Station Alternative

The Kern Street Station Alternative for the HST station would also be in Downtown Fresno and would be centered on Kern Street between Tulare Street and Inyo Street. This station would include the same components and acreage as the Mariposa Street Station Alternative, but 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. Two of the 3 potential parking structures would each sit on 2 acres and each would have a capacity of approximately 1,500 cars. The third structure would have a slightly smaller footprint (1.5 acres) and a capacity of approximately 1,100 cars. Like the Mariposa Street Station Alternative, the majority of station facilities under the Kern Street Station Alternative would be east of the HST tracks.

1.2 BNSF Alternative

This section describes the BNSF Alternative, including the Le Grand design options and wyes. It does not include a discussion of the HST stations, because the station descriptions are identical for each of the three HST alignment alternatives.

1.2.1 North-South Alignment

The north-south alignment of the BNSF Alternative would begin at the proposed Downtown Merced Station. This alternative would remain at-grade through Merced and would cross under SR 99 at the south end of the city. Just south of the interchange at SR 99 and E Childs Avenue, the BNSF Alternative would cross over SR 99 and UPRR as it begins to curve to the east, crossing over the E Mission Avenue interchange. It would then travel east to the vicinity of Le Grand, where it would turn south and travel adjacent to the BNSF tracks.

To minimize impacts on the natural environment and the community of Le Grand, the project design includes four design options:

- **Mission Ave design option:** This design option would turn east to travel along the north side of Mission Avenue at Le Grand and then would elevate through Le Grand adjacent to and along the west side of the BNSF corridor.
- **Mission Ave East of Le Grand design option:** This design option would vary from the Mission Ave design option by traveling approximately 1 mile farther east before turning southeast to cross Santa Fe Avenue and the BNSF tracks south of Mission Avenue. The HST alignment would parallel the BNSF for a half-mile to the east, avoiding the urban limits of Le Grand. This design option would cross Santa Fe Avenue and the BNSF railroad again approximately one-half mile north of Marguerite Road and would continue adjacent to the west side of the BNSF corridor.
- **Mariposa Way design option:** This design option would travel 1 mile farther than the Mission Ave design option before crossing SR 99 near Vassar Road and turning east toward Le Grand along the south side of Mariposa Way. East of Simonson Road, the HST alignment would turn to the southeast.

Just prior to Savana Road in Le Grand, the HST alignment would transition from at-grade to elevated to pass through Le Grand on a 1.7-mile-long guideway adjacent to and along the west side of the BNSF corridor.

- **Mariposa Way East of Le Grand design option:** This design option would vary from the Mariposa Way design option by traveling approximately 1 mile farther east before turning southeast to cross Santa Fe Avenue and the BNSF tracks less than one-half mile south of Mariposa Way. The HST alignment would parallel the BNSF to the east of the railway for a half-mile, avoiding the urban limits of Le Grand. This design option would cross Santa Fe Avenue and the BNSF again approximately a half-mile north of Marguerite Road and would continue adjacent to the west side of the BNSF corridor.

Continuing southeast along the west side of the BNSF tracks, the BNSF Alternative would begin to curve just before Plainsburg Road through a predominantly rural and agricultural area. One mile south of Le Grand, the HST alignment would cross Deadman and Dutchman creeks. The alignment would deviate from the BNSF corridor just southeast of S White Rock Road, where it would remain at-grade for another 7 miles, except at the bridge crossings, and would continue on the west side of the BNSF corridor through the community of Sharon. The HST alignment would continue at-grade through the community of Kismet until crossing at Dry Creek. The BNSF Alternative would then continue at-grade through agricultural areas along the west side of the BNSF corridor through the community of Madera Acres north of the City of Madera. South of Avenue 15 east of Madera, the alignment would transition toward the UPRR corridor, following the east side of the UPRR corridor near Avenue 9 south of Madera, then continuing along nearly the same route as the UPRR/SR 99 Alternative over the San Joaquin River to enter the community of Herndon. After crossing the San Joaquin River, the alignment would be the same as for the UPRR/SR 99 Alternative

1.2.2 Wye Design Options

The Ave 24 Wye and the Ave 21 Wye would be the same as described for the UPRR/SR 99 Alternative (East Chowchilla design option), except as noted below.

1.2.2.1 Ave 24 Wye

As with the UPRR/SR 99 Alternative, the Ave 24 Wye would follow along the south side of Avenue 24 and would begin diverging into two sets of tracks (i.e., four tracks) beginning west of Road 17. Two tracks would travel north near Road 20½, where they would join the north-south alignment of the BNSF Alternative on the west side of the BNSF corridor near Avenue 26½. The two southbound tracks would join the BNSF Alternative on the west side of the BNSF corridor south of Avenue 21.

1.2.2.2 Ave 21 Wye

As with the UPRR/SR 99 Alternative, the Ave 21 Wye would travel along the north side of Avenue 21. Two tracks would diverge, turning north and south to connect to the north-south alignment of the BNSF Alternative just west of Road 21. The north leg of the wye would join the north-south alignment just south of Avenue 24 and the south leg would join the north-south alignment just east of Frontage Road/Road 26 north of the community of Madera Acres.

1.3 Hybrid Alternative

This section describes the Hybrid Alternative, which generally follows the alignment of the UPRR/SR 99 Alternative in the north and the BNSF Alternative in the south. It does not include a discussion of the HST stations because the station descriptions are identical for each of the three HST alternatives.

1.3.1 North-South Alignment

From north to south, generally, the Hybrid Alternative would follow the UPRR/SR 99 alignment with either the West Chowchilla design option with the Ave 24 Wye or the East Chowchilla design option with the Ave 21 Wye. Approaching the Chowchilla city limits, the Hybrid Alternative would follow one of two options:

- In conjunction with the Ave 24 Wye, the HST alignment would veer due south from Sandy Mush Road along a curve and would continue at-grade for 4 miles parallel to and on the west side of Road 11¾. The Hybrid Alternative would then curve to a corridor on the south side of Avenue 24 and would travel parallel for the next 4.3 miles. Along this curve, the southbound HST track would become an elevated structure for approximately 9,000 feet to cross over the Ave 24 Wye connection tracks and Ash Slough, while the northbound HST track would remain at-grade. Continuing east on the south side of Avenue 24, the HST alignment would become identical to the Ave 24 Wye connection for the BNSF Alternative and would follow the alignment of the BNSF Alternative until Madera.

- In conjunction with the Ave 21 Wye connection, the HST alignment would transition from the west side of UPRR and SR 99 to an elevated structure as it crosses the UPRR and N Chowchilla Boulevard just north of Avenue 27, continuing on an elevated structure along the west side of and parallel to SR 99 away from the UPRR corridor while it crosses Berenda Slough. Toward the south side of Chowchilla, the alignment (with the Ave 21 Wye) would cross over SR 99 north of the SR 99/SR 152 interchange near Avenue 23½ south of Chowchilla. It would continue to follow along the east side of SR 99 until reaching Avenue 21, where it would curve east and run parallel to Avenue 21, briefly. The alignment would then follow a path similar to the Ave 21 Wye connection for the BNSF Alternative, but with a tighter 220 mph curve. The alternative would then follow the BNSF Alternative alignment until Madera.

Through Madera and until reaching the San Joaquin River, the Hybrid Alternative is the same as the BNSF Alternative. Once crossing the San Joaquin River, the alignment of the Hybrid Alternative becomes the same as for the UPRR/SR 99 Alternative.

1.3.2 Wye Design Options

The wye connections for the Hybrid Alternative follow Avenue 24 and Avenue 21, similar to those of the UPRR/SR 99 and BNSF alternatives.

1.3.2.1 Ave 24 Wye

The Ave 24 Wye is the same as the combination of the UPRR/SR 99 Alternative with the West Chowchilla design option, and the Ave 24 Wye for the BNSF Alternative.

1.3.2.2 Ave 21 Wye

The Ave 21 Wye is similar to the combination of the UPRR/SR 99 Alternative with the Ave 21 Wye on the northbound leg and the BNSF Alternative with the Ave 21 Wye on the southbound leg. However, the south leg under the Hybrid Alternative would follow a tighter, 220 mph curve than the BNSF Alternative, which follows a 250 mph curve.

1.4 Heavy Maintenance Facility Alternatives

The Authority is studying five HMF sites (see Figure 1-1) within the Merced to Fresno Section, one of which may be selected.

- **Castle Commerce Center HMF site** – A 370-acre site located 6 miles northwest of Merced, at the former Castle Air Force Base in northern unincorporated Merced County. It is adjacent to and on the east side of the BNSF mainline, 1.75 miles south of the UPRR mainline, off of Santa Fe Drive and Shuttle Road, 2.75 miles from the existing SR 99 interchange. The Castle Commerce Center HMF would be accessible by all HST alternatives.

- **Harris-DeJager HMF site** – A 401-acre site located north of Chowchilla adjacent to and on the west side of the UPRR corridor, along S Vista Road and near the SR 99 interchange under construction. The Harris-DeJager HMF would be accessible by the UPRR/SR 99 and Hybrid alternatives if coming from the Ave 21 Wye and the UPRR/SR 99 Alternative with the East Chowchilla design option and the Ave 24 Wye.

- **Fagundes HMF site** – A 231-acre site, located 3 miles southwest of Chowchilla on the north side of SR 152, between Road 11 and Road 12. This HMF would be accessible by all HST alternatives with the Ave 24 Wye.

- **Gordon-Shaw HMF site** – A 364-acre site adjacent to and on the east side of the UPRR corridor, extending from north of Berenda Boulevard to Avenue 19. The Gordon-Shaw HMF would be accessible from the UPRR/SR 99 Alternative.

- **Kojima Development HMF site** – A 392-acre site on the west side of the BNSF corridor east of Chowchilla, located along Santa Fe Drive and Robertson Boulevard (Avenue 26). The Kojima Development HMF would be accessible by the BNSF Alternative with the Ave 21 Wye.

Tables

Table A-1
Permanent Direct Impacts to Federally Listed Species – UPRR/SR 99 Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	6	7	7	7	7	7	8	7	4	<0.5	<0.5	8	33	37
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	3	--	--	<0.5	<0.5	9
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	--	--	--	<0.5	1	17
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	6	7	7	7	7	7	9	7	7	<0.5	<0.5	9	26	38
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	2
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	6	7	7	7	7	7	8	7	4	1	1	8	33	37
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	3	--	--	<0.5	<0.5	9
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	--	--	--	<0.5	1	17
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	6	7	7	7	7	7	8	7	7	<0.5	<0.5	9	26	38
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	2
Total Range of Impacts for the UPRR/SR 99 Alternative[b]														
UPRR/SR 99 with East Chowchilla	6	7 to 8	7	7	7 to 8	7	9	7	6	<0.5	<0.5	9	33 to 34	62
UPRR/SR 99 with West Chowchilla	6	7	7	7	7	7	8	7	9	<0.5	<0.5	9	26	39

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-2
Temporary Direct Impacts to Federally Listed Species – UPRR/SR 99 Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	3	<0.5	<0.5	1	97	12
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	2	1
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	77	11
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	--
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	1	--	<0.5	1	<0.5	1	<0.5	3	<0.5	<0.5	1	97	12
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	2	1
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	77	11
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	--
Total Range of Impacts for the UPRR/SR 99 Alternative [b]														
UPRR/SR 99 with East Chowchilla	--	1	--	<0.5	1	<0.5	1	<0.5	3	<0.5	<0.5	1	98 to 100	13
UPRR/SR 99 with West Chowchilla	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	77	11

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-3
Total Direct Impacts to Federally Listed Species – UPRR/SR 99 Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	6	8	7	7	8	7	9	7	6	1	1	9	130	49
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	3.06	--	--	<0.5	<0.5	9
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	--	--	--	<0.5	3	18
UPRR/SR 99 with West Chowchilla DO Ave 24	6	8	7	7	8	7	9	7	9	1	1	9	103	48
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	0.03	--	2	--	--	<0.5	--	2
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
UPRR/SR 99 with East Chowchilla DO Ave 24	6	8	7	7	8	7	9	7	6	1	1	9	130	49
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	3	--	--	<0.5	<0.5	9
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	--	--	--	<0.5	3	18
UPRR/SR 99 with West Chowchilla DO Ave 24	6	8	7	7	8	7	9	7	9	1	1	9	103	48
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	2
Total Range of Impacts for the UPRR/SR 99 Alternative [b]														
UPRR/SR 99 with East Chowchilla	6	8	7	7	8	7	9	7	6 to 9	1	1	9	130 to 134	58 to 67
UPRR/SR 99 with West Chowchilla	6	8	7	7	8	7	9	7	11	1	1	9	103.00	50

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-4
Total Indirect Impacts to Federally Listed Species – UPRR/SR 99 Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	<0.5	1	<0.5	<0.5	1	<0.5	1	<0.5	8	7	7	1	98	444
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	4	--	--	--	--	35
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--	--	<0.5	2	29
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	12	7	7	<0.5	77	429
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	2	--	--	--	--	11
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	<0.5	1	<0.5	<0.5	1	<0.5	1	<0.5	8	7	7	1	98	444
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	4	--	--	--	--	35
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	<0.5	--	--	<0.5	2	29
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	12	7	7	<0.5	77	429
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	--	--	2	--	--	--	--	11
Total Range of Impacts for the UPRR/SR 99 Alternative [b]														
UPRR/SR 99 with East Chowchilla	<0.5	1	<0.5	<0.5	1	<0.5	1	<0.5	11	7	7	1	98 to 100	473 to 479
UPRR/SR 99 with West Chowchilla	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	15	7	7	<0.5	77	440

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-5
Total Effect to Federally Listed Species – UPRR/SR 99 Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	6	8	7	7	8	8	10	8	14	8	8	10	228	493
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	7	--	--	<0.5	<0.5	44
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	1	--	--	1	--	1	--	<0.5	--	--	1	6	47
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	6	8	7	7	8	8	10	8	21	8	8	10	180	478
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	<0.5	--	4	--	--	<0.5	--	12
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	6	8	7	7	8	8	10	8	14	8	8	10	228	493
UPRR/SR 99 with East Chowchilla DO Ave 24 Wye	--	<0.5	--	--	<0.5	--	<0.5	--	6.60	--	--	<0.5	<0.5	44
UPRR/SR 99 with East Chowchilla DO Ave 21 Wye	--	1	--	--	1	--	1	--	<0.5	--	--	1	6	47
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	6	8	7	7	8	8	10	8	21	8	8	10	180	478
UPRR/SR 99 with West Chowchilla DO Ave 24 Wye	--	--	--	--	--	--	<0.5	--	4	--	--	<0.5	--	12
Total Range of Impacts for the UPRR/SR 99 Alternative [b]														
UPRR/SR 99 with East Chowchilla	6	8 to 9	7	7	8 to 9	8	10 to 11	7	15 to 21	8	8	10 to 11	228 to 234	537 to 540
UPRR/SR 99 with West Chowchilla	6	8	7	7	8	8	10	8	26	8	8	10	180	490

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-6
Permanent Direct Impacts to Federally Listed Species – BNSF Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
BNSF north - south alignment Ave 24 Wye	--	13	14	10	3	13	15	10	4	<0.5	<0.5	15	53	82
BNSF north - south alignment Ave 24 Wye	--	1	1	1	--	1	1	1	3	--	--	1	2	16
BNSF north - south alignment Ave 21 Wye	--	1	1	1	<0.5	1	1	1	<0.5	--	--	1	1	9
Le Grand Design Options														
Mission Ave	2	24	2	24	24	24	24	24	1	--	--	24	69	73
Mission Ave East of Le Grand	2	28	2	28	28	28	28	28	1	--	--	28	55	59
Mariposa Way	--	19	--	19	19	19	19	19	3	--	--	19	75	77
Mariposa Way East of Le Grand	<0.5	17	--	17	17	17	17	17	4	--	--	17	36	37
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
BNSF Alternative, NS	<0.5 to 1	31 to 422	14 to 16	28 to 39	21 to 32	30 to 41	33 to 43	28 to 39	4 to 7	1	1	33 to 43	90 to 128	119 to 158
BNSF Alternative, Ave 24 Wye	--	1	1	1	--	1	1	1	3	--	--	1	2	16
BNSF Alternative, Ave 21 Wye	--	1	1	1	<0.5	1	1	1	<0.5	--	--	1	1	9
Total Range of Impacts for the BNSF Alternative [b]														
BNSF Alternative, Ave 24	0 to 2	32 to 43	15 to 17	29 to 39	21 to 32	31 to 42	34 to 44	29 to 39	7 to 10	1	1	34 to 44	92 to 130	135 to 175
BNSF Alternative, Ave 21	0 to 2	32 to 43	16 to 17	29 to 40	21 to 32	32 to 42	34 to 44	29 to 40	4 to 7	1	1	34 to 44	90 to 129	128 to 168

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-7
Temporary Direct Impacts to Federally Listed Species – BNSF Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
BNSF north - south alignment Ave 24 Wye	--	0.03	0.03	0.03	--	0.03	0.03	0.03	1.41	0.39	0.39	0.03	98.04	5.78
BNSF north - south alignment Ave 24 Wye	--	--	--	--	--	--	--	--	0.53	--	--	--	14.03	1.52
BNSF north - south alignment Ave 21 Wye	--	0.14	--	--	0.14	--	0.14	--	0.04	4.04	4.04	0.14	0.11	0.20
Le Grand Design Options														
Mission Ave	--	0.02	--	0.02	0.02	0.02	0.02	0.02	0.10	--	--	0.02	158.76	2.27
Mission Ave East of Le Grand	--	0.52	--	0.52	0.52	0.52	0.52	0.52	0.23	--	--	0.52	142.89	1.26
Mariposa Way	6.08	7.78	6.08	7.78	7.78	7.78	7.78	7.78	0.84	--	--	7.78	163.30	7.20
Mariposa Way East of Le Grand	6.08	6.21	6.08	6.21	6.21	6.21	6.21	6.21	1.04	--	--	6.21	140.22	4.53
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
BNSF Alternative, NS	0 to 6.08	0.04 to 7.80	0.03 to 6.10	0.04 to 7.80	0.02 to 7.78	0.04 to 7.80	0.04 to 7.80	0.04 to 7.80	1.50 to 2.45	0.39 to 0.39	0.39 to 0.39	0.04 to 7.80	238.26 to 261.34	7.04 to 12.99
BNSF Alternative, Ave 24 Wye	--	--	--	--	--	--	--	--	0.53	--	--	--	14.03	1.52
BNSF Alternative, Ave 21 Wye	--	0.14	--	--	0.14	--	0.14	--	0.04	4.04	4.04	0.14	0.11	0.20
Total Range of Impacts for the BNSF Alternative [b]														
BNSF Alternative, Ave 24	0 to 6.08	0.04 to 7.80	0.03 to 6.10	0.04 to 7.80	0.02 to 7.78	0.04 to 7.80	0.04 to 7.80	0.04 to 7.80	2.03 to 2.98	0.39 to 0.39	0.39 to 0.39	0.04 to 7.80	252.29 to 275.37	8.57 to 14.51
BNSF Alternative, Ave 21	0 to 6.08	0.19 to 7.95	0.03 to 6.10	0.04 to 7.80	0.16 to 7.92	0.04 to 7.80	0.19 to 7.95	0.04 to 7.80	1.54 to 2.48	4.43 to 4.43	4.43 to 4.43	0.19 to 7.95	238.37 to 261.45	7.24 to 13.19

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-8
Total Direct Impacts to Federally Listed Species – BNSF Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
BNSF north - south alignment Ave 24	--	13	14	10	3	13	15	10	5	1	1	15	151	88
BNSF north - south alignment Ave 24 Wye	--	1	1	1	--	1	1	1	3	--	--	1	16	18
BNSF north - south alignment Ave 21 Wye	--	1	1	1	<0.5	1	1	1	<0.5	4	4	1	1	9
Le Grand Design Options														
Mission Ave	2	24	2	24	24	24	24	24	1	--	--	24	228	76
Mission Ave East of Le Grand	2	29	2	29	29	29	29	29	1	--	--	29	198	60
Mariposa Way	6	27	6	27	27	27	27	27	3	--	--	27	238	84
Mariposa Way East of Le Grand	6	24	6	24	24	24	24	24	5	--	--	24	176	41
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
BNSF Alternative, NS	2 to 6	37 to 42	16 to 21	34 to 39	27 to 32	37 to 42	39 to 44	34 to 39	6 to 10	1	1	39 to 44	328 to 389	129 to 171
BNSF Alternative, Ave 24 Wye	--	1	1	1	--	1	1	1	3	--	--	1	16	18
BNSF Alternative, Ave 21 Wye	--	1	1	1	<0.5	1	1	1	<0.5	4	4	1	1	9
Total Range of Impacts for the BNSF Alternative [b]														
BNSF Alternative, Ave 24	2 to 6	38 to 43	17 to 21	35 to 40	27 to 32	38 to 43	40 to 45	35 to 40	9 to 13	1	1	40 to 45	344 to 406	147 to 189
BNSF Alternative, Ave 21	2 to 6	38 to 43	17 to 22	35 to 40	27 to 32	38 to 43	40 to 45	35 to 40	6 to 10	5	5	40 to 45	329 to 390	138 to 189

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-9
Total Indirect Impacts to Federally Listed Species – BNSF Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
BNSF north - south alignment Ave 24	--	3	3	2	2	5	6	4	6	7	7	6	98	970
BNSF north - south alignment Ave 24 Wye	--	<0.5	<0.5	<0.5	<0.5	<0.5	2	2	3	--	--	2	14	35
BNSF north - south alignment Ave 21 Wye	--	1	<0.5	<0.5	<0.5	1	3	1	<0.5	8	8	3	<0.5	41
Le Grand Design Options														
Mission Ave	<0.5	2	<0.5	2	2	4	4	4	2	--	--	4	159	697
Mission Ave East of Le Grand	<0.5	2	<0.5	2	2	4	4	4	2	--	--	4	143	704
Mariposa Way	<0.5	2	<0.5	2	2	4	4	4	8	--	--	4	163	735
Mariposa Way East of Le Grand	<0.5	2	<0.5	2	2	12	12	12	9	--	--	12	140	627
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
BNSF Alternative, NS	<0.5	5 to 6	3	4	4 to 4	8 to 17	9 to 18	7 to 16	8 to 15	7	7	9 to 18	238 to 261	1,597 to 1,705
BNSF Alternative, Ave 24 Wye	--	<0.5	<0.5	<0.5	<0.5	2	2	2	3	--	--	2	14	35
BNSF Alternative, Ave 21 Wye	--	1	<0.5	<0.5	<0.5	1	3	1	<0.5	8	8	3	<0.5	41
Total Range of Impacts for the BNSF Alternative [b]														
BNSF Alternative, Ave 24	<0.5	5 to 6	3	4	3 to 4	10 to 19	12 to 20	9 to 18	11 to 18	7	7	12 to 20	252 to 275	1,633 to 1,741
BNSF Alternative, Ave 21	<0.5	6	3	4	4	10 to 18	13 to 21	9 to 17	8 to 15	15	15	13 to 21	238 to 261	1,639 to 1,747

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-10
Total Effect to Federally Listed Species – BNSF Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
BNSF north - south alignment Ave 24	--	17	17	12	5	18	21	14	11	8	8	21	249	1057
BNSF north - south alignment Ave 24 Wye	--	1	1	1	<0.5	3	3	3	6	--	--	3	30	53
BNSF north - south alignment Ave 21 Wye	--	2	1	1	1	2	5	2	<0.5	12	12	5	1	51
Le Grand Design Options														
Mission Ave	2	26	2	26	26	28	28	28	3	--	--	28	386	773
Mission Ave East of Le Grand	2	30	2	30	30	33	33	33	3	--	--	33	341	765
Mariposa Way	6	29	6	29	29	31	31	31	12	--	--	31	401	819
Mariposa Way East of Le Grand	6	26	6	26	26	36	36	36	14	--	--	36	316	669
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
BNSF Alternative, NS	2 to 6	43 to 47	19 to 24	38 to 43	31 to 35	45 to 53	48 to 56	42 to 50	14 to 25	8	8	48 to 56	566 to 650	1,726 to 1,877
BNSF Alternative, Ave 24 Wye	--	1	1	1	<0.5	3	3	3	6	--	--	3	30	53
BNSF Alternative, Ave 21 Wye	--	2	1	1	1	2	5	1	<0.5	12	12	5	1	51
Total Range of Impacts for the BNSF Alternative [b]														
BNSF Alternative, Ave 24	2 to 6	44 to 48	20 to 25	39 to 44	31 to 36	48 to 56	52 to 59	45 to 53	21 to 31	8	8	52 to 59	596 to 680	1,780 to 1,930
BNSF Alternative, Ave 21	2 to 6	44 to 49	20 to 25	39 to 44	31 to 36	48 to 55	53 to 61	44 to 52	14 to 25	20 to 20	20 to 20	53 to 61	566 to 651	1,777 to 1,928

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-11
Permanent Direct Impacts to Federally Listed Species – Hybrid Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
Hybrid North-South Alignment Ave 21	6	18	19	15	10	18	20	15	3	1	1	20	68	103
Hybrid North-South Alignment Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	1	13
Hybrid North-South Alignment Ave 24	6	16	17	13	9	16	17	13	6	1	1	17	59	102
Hybrid North-South Alignment Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	1
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
Hybrid Alternative, Ave 21	6	18	19	15	10	18	20	15	3			20	68	103
Hybrid Alternative, Ave 21 Wye	--	--	--	--	--	--	--	--	--			--	1	13
Hybrid Alternative, Ave 24	6	16	17	13	9	16	17	13	6			17	59	102
Hybrid Alternative, Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2			<0.5	--	1
Total Range of Impacts for the Hybrid Alternative [b]														
Hybrid Alternative, Ave 21	6	18	19	15	10	18	20	15	3			20	69	116
Hybrid Alternative, Ave 24	6	16	17	13	9	16	17	13	7			17	59	104

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-12
Temporary Direct Impacts to Federally Listed Species – Hybrid Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
Hybrid North-South Alignment Ave 21	--	1	<0.5	<0.5	1	<0.5	1	<0.5	3	4	4	1	160	10
Hybrid North-South Alignment Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	2	1
Hybrid North-South Alignment Ave 24	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	124	9
Hybrid North-South Alignment Ave 24 Wye	--	--	--	--	--	--	--	--	0.19	--	--	--	--	--
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
Hybrid Alternative, Ave 21	--	1	<0.5	<0.5	1	<0.5	1	<0.5	3	4	4	1	160	10
Hybrid Alternative, Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	2	1
Hybrid Alternative, Ave 24	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	124.13	9
Hybrid Alternative, Ave 24 Wye	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	--
Total Range of Impacts for the Hybrid Alternative [b]														
Hybrid Alternative, Ave 21	--	1	<0.5	<0.5	1	<0.5	1	<0.5	3	4	4	1	162.32	11
Hybrid Alternative, Ave 24	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<0.5	<0.5	124.13	9

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-13
Total Direct Impacts to Federally Listed Species – Hybrid Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
Hybrid North-South Alignment Ave 21	6	19	19	16	10	18	20	16	7	5	5	20	228	113
Hybrid North-South Alignment Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	3	13
Hybrid North-South Alignment Ave 24	6	16	17	13	10	16	18	13	7	1	1	18	184	111
Hybrid North-South Alignment Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	1
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
Hybrid Alternative, Ave 21	6	19	19	16	10	18	20	16	7	5	5	20	228	113
Hybrid Alternative, Ave 21 Wye	--	--	--	--	--	--	--	--	--	--	--	--	3	13
Hybrid Alternative, Ave 24	6	16	17	13	10	16	18	13	7	1	1	18	184	111
Hybrid Alternative, Ave 24 Wye	--	--	--	--	--	--	<0.5	--	2	--	--	<0.5	--	1
Total Range of Impacts for the Hybrid Alternative [b]														
Hybrid Alternative, Ave 21	6	19	19	16	10	18	20	16	7	5	5	20	231	127
Hybrid Alternative, Ave 24	6	16	17	13	10	16	18	13	9	1	1	18	184	113

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-14
Total Indirect Impacts to Federally Listed Species – Hybrid Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
Hybrid North-South Alignment Ave 21	--	--	--	--	--	6	9	5	6	8	8	9	160	1,115
Hybrid North-South Alignment Ave 21 Wye	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5	2	31
Hybrid North-South Alignment Ave 24	<0.5	2	2	1	1	4	5	3	10	7	7	5	125	1,055
Hybrid North-South Alignment Ave 24 Wye	--	--	--	--	--	--	--	--	2	--	--	--	--	11
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
Hybrid Alternative, Ave 21	--	--	--	--	--	6	9	5	6	8	8	9	160	1,115
Hybrid Alternative, Ave 21 Wye	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5	2	31
Hybrid Alternative, Ave 24	<0.5	2	2	1	1	4	5	3	10	7	7	5	125	1,055
Hybrid Alternative, Ave 24 Wye	--	--	--	--	--	--	--	--	2	--	--	--	--	11
Total Range of Impacts for the Hybrid Alternative [b]														
Hybrid Alternative, Ave 21	--	--	--	--	--	6	9	5	6	8	8	9	163	1,146
Hybrid Alternative, Ave 24	<0.5	2	2	1	1	4	5	3	12	7	7	5	125	1,066

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-15
Total Effect to Federally Listed Species – Hybrid Alternative (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Impacts by Project Combination														
Hybrid North-South Alignment Ave 21	6	19	19	16	10	25	29	21	13	13	13	29	388	1228
Hybrid North-South Alignment Ave 21 Wye	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5	6	45
Hybrid North-South Alignment Ave 24	6	18	19	14	11	20	23	17	17	8	8	23	308	1166
Hybrid North-South Alignment Ave 24 Wye	--	--	--	--	--	--	<0.5	--	4	--	--	<0.5	--	12
Design Options to Fresno Station														
Mariposa Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kern Street Station	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Impact of Components Combined														
Hybrid Alternative, Ave 21	6	19	19	16	10	25	29	21	13	13	13	29	388	1,228.09
Hybrid Alternative, Ave 21 Wye	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5	6	45
Hybrid Alternative, Ave 24	6	18	19	14	11	20	23	17	17	8	8	23	308	1,166
Hybrid Alternative, Ave 24 Wye	--	--	--	--	--	--	<0.5	--	4	--	--	<0.5	--	12
Total Range of Impacts for the Hybrid Alternative [b]														
Hybrid Alternative, Ave 21	6	19	19	16	10	25	30	21	13	13	13	20	394	1,273
Hybrid Alternative, Ave 24	6	18	19	14	11	20	23	16	21	8	8	23	308	1,178

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

[b] Total range of impacts includes the least amount of habitat affected by the HST alternative to the most amount of impact by the HST alternative. For range of impacts, if the rounded values for the least amount of impact and for most amount of impact are the same, then the range is expressed as a single number.

Table A-16
Permanent Direct Impacts to Federally Listed Species – HMFs (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Castle Commerce Center	<0.5	--	--	--	--	<0.5	<0.5	<0.5	<0.5	--	--	<0.5	43	44
Harris-DeJaeger NoAlignment	--	--	--	--	--	--	--	--	<0.5	--	--	--	<0.5	<0.5
Fagundes NoAlignment	--	--	--	--	--	--	--	--	<0.5	--	--	--	--	<0.5
Gordon-Shaw NoAlignment	--	--	--	--	--	--	--	--	1	--	--	--	1	1
Kojima Development NoAlignment	--	1	--	1	1	1	1	1	1	--	--	1	55	75

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

Table A-17
Temporary Direct Impacts to Federally Listed Species – HMFs (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Castle Commerce Center	--	--	--	--	--	--	--	--	<0.5	--	--	--	25	<0.5
Harris-DeJaeger NoAlignment	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fagundes NoAlignment	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gordon-Shaw NoAlignment	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Kojima Development NoAlignment	--	--	--	--	--	--	--	--	<0.5	--	--	--	28	1

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

Table A-18
Indirect Impacts to Federally Listed Species – HMFs (acres)[a]

HST Alternative	Colusa Grass	San Joaquin Valley Orcutt Grass	Hairy Orcutt grass	Greene's tuctoria	Succulent owl's-clover	Conservancy fairy shrimp	Vernal pool fairy shrimp	Vernal pool tadpole shrimp	Valley elderberry longhorn beetle	Central Valley Steelhead	Central Valley spring-run Chinook Salmon	CTS aquatic	CTS Upland	San Joaquin Kit Fox
Castle Commerce Center	1	--	--	--	--	2	2	2	1	--	--	2	43	48
Harris-DeJaeger NoAlignment	--	--	--	--	--	--	--	--	--	--	--	--	--	6
Fagundes NoAlignment	--	--	--	--	--	--	--	--	0.19	--	--	--	--	2
Gordon-Shaw NoAlignment	--	--	--	--	--	--	--	--	`	--	--	--	<0.5	5
Kojima Development NoAlignment	--	<0.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	1	--	--	<0.5	55	189

[a] All values that are greater than 0.5 acre are rounded to the nearest whole number (e.g., 0.51 acre is reported as 1; 2.5 acres is reported as 2).Totals from 0.01 acre to 0.5 acre are stated as <0.5 acre. Totals below 0.01 acre are stated as <0.01 acre.

APPENDIX B

Suitable Habitat for Branchiopods and California Tiger Salamander

Page(s) redacted to protect
potentially sensitive information

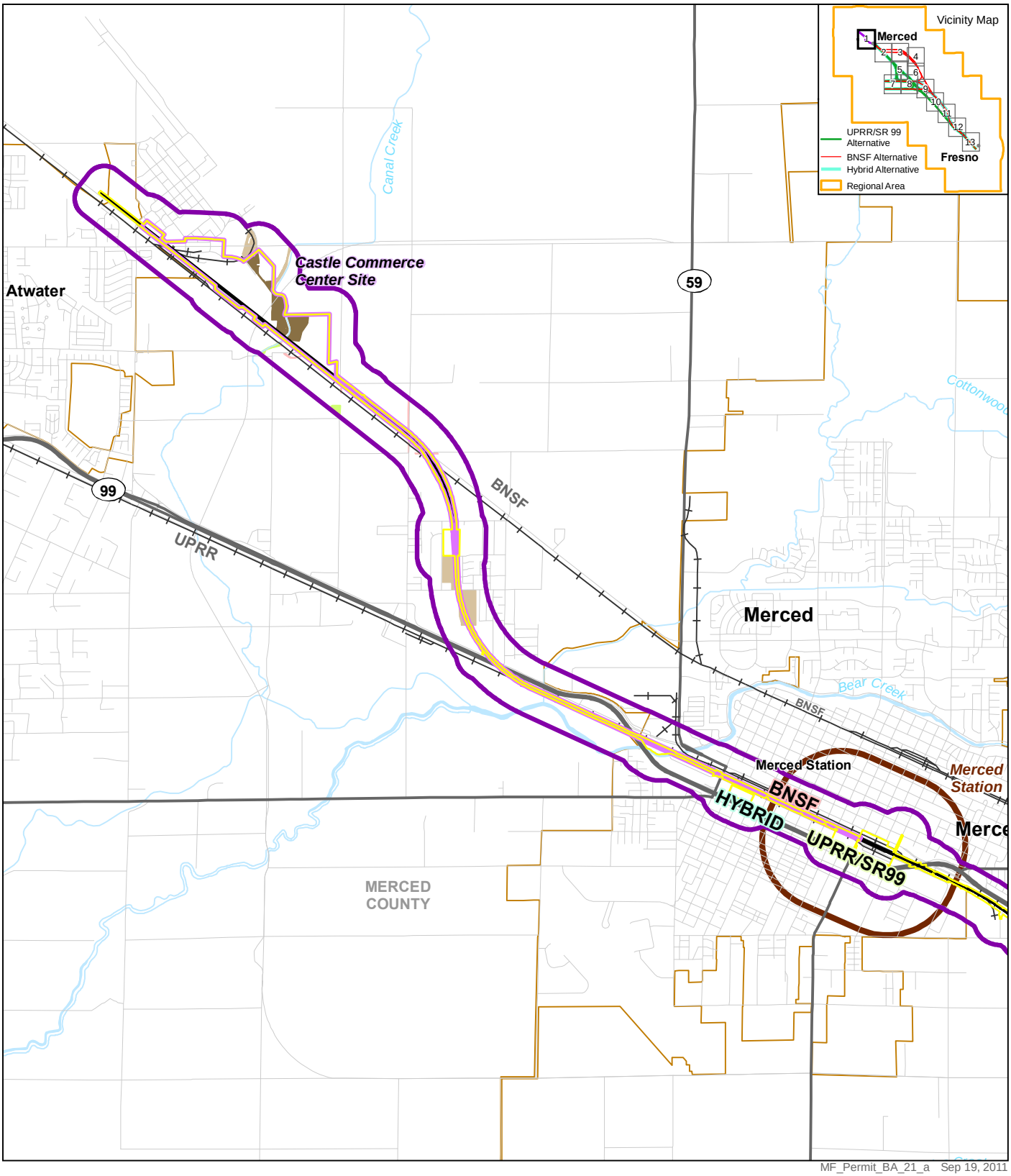
APPENDIX C

Suitable Habitat for Valley Elderberry Longhorn Beetle

Page(s) redacted to protect
potentially sensitive information

APPENDIX D

Suitable Habitat for San Joaquin Kit Fox



MF_Permit_BA_21_a Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat

Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat

Barren
Pasture
California Annual Grassland

N

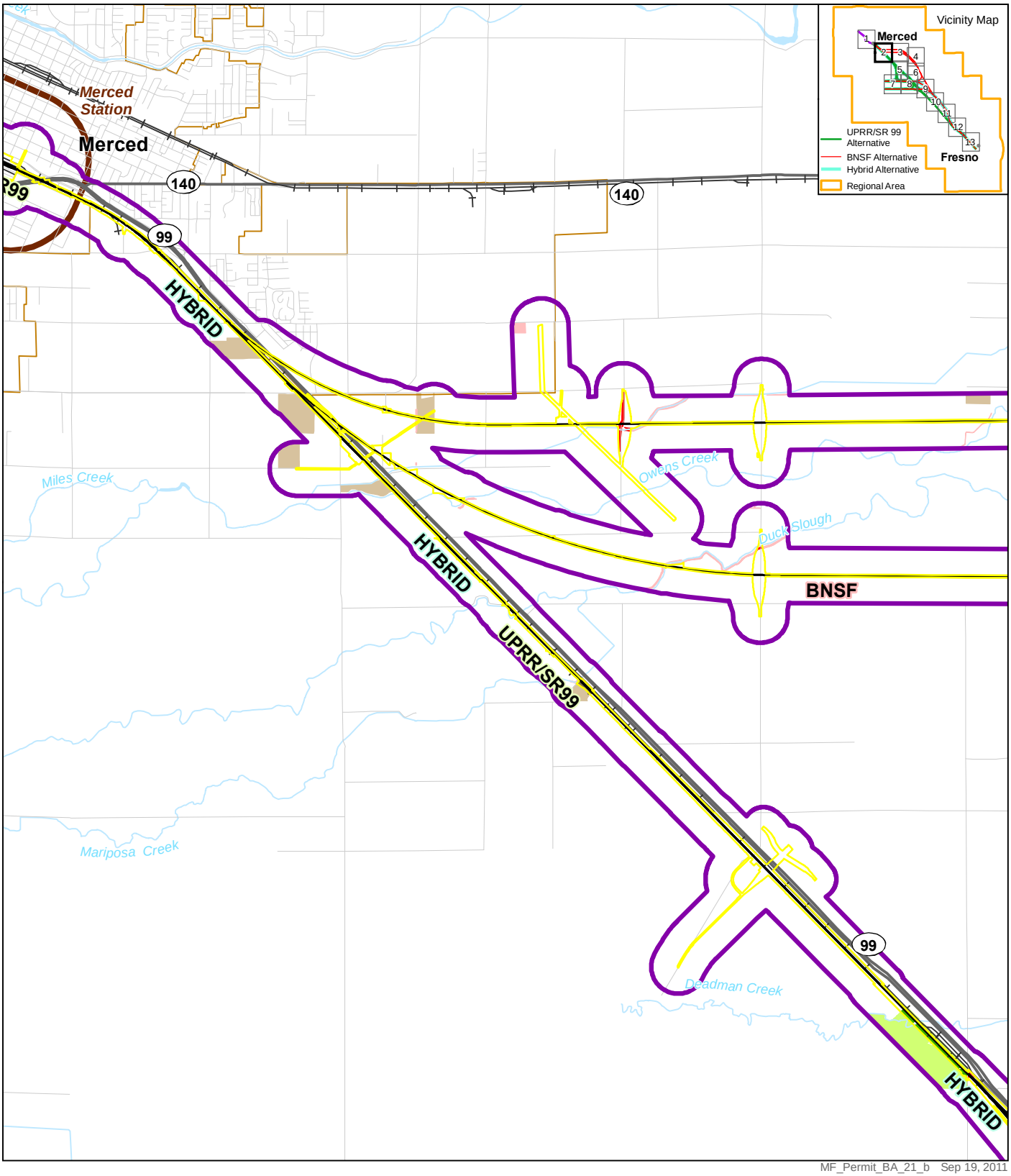
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 1 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_b Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

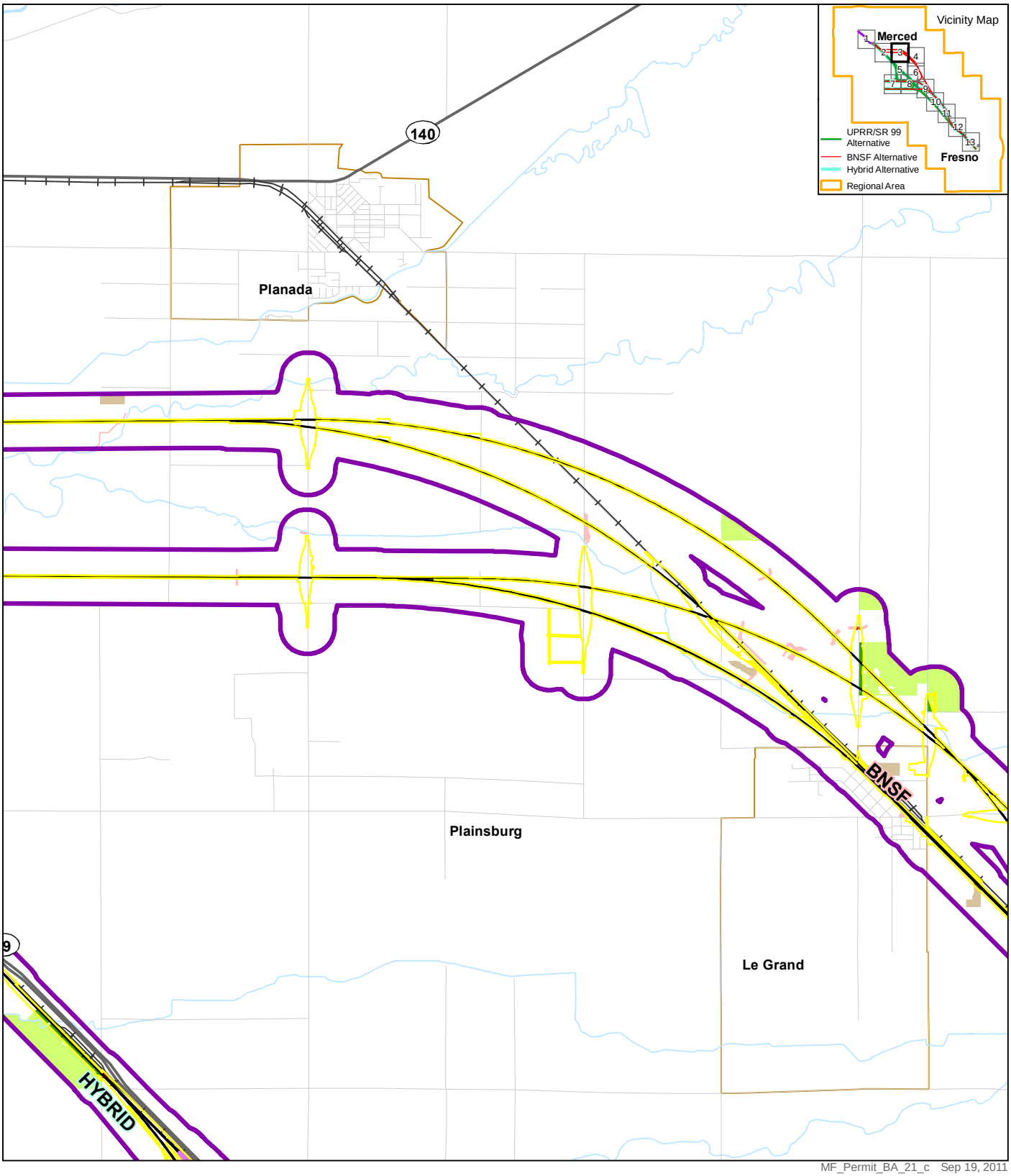
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 2 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_c Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

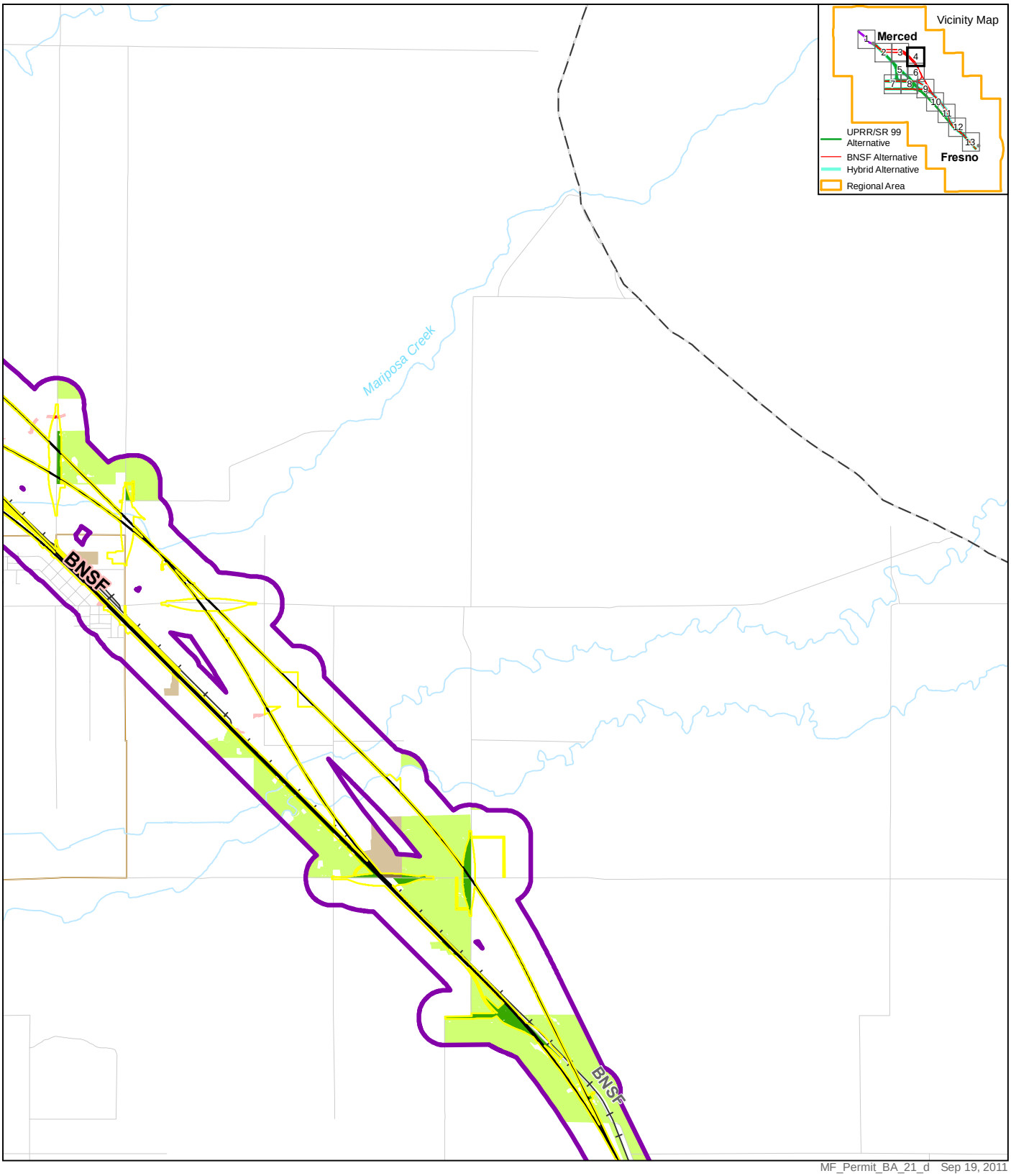
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 3 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_d Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

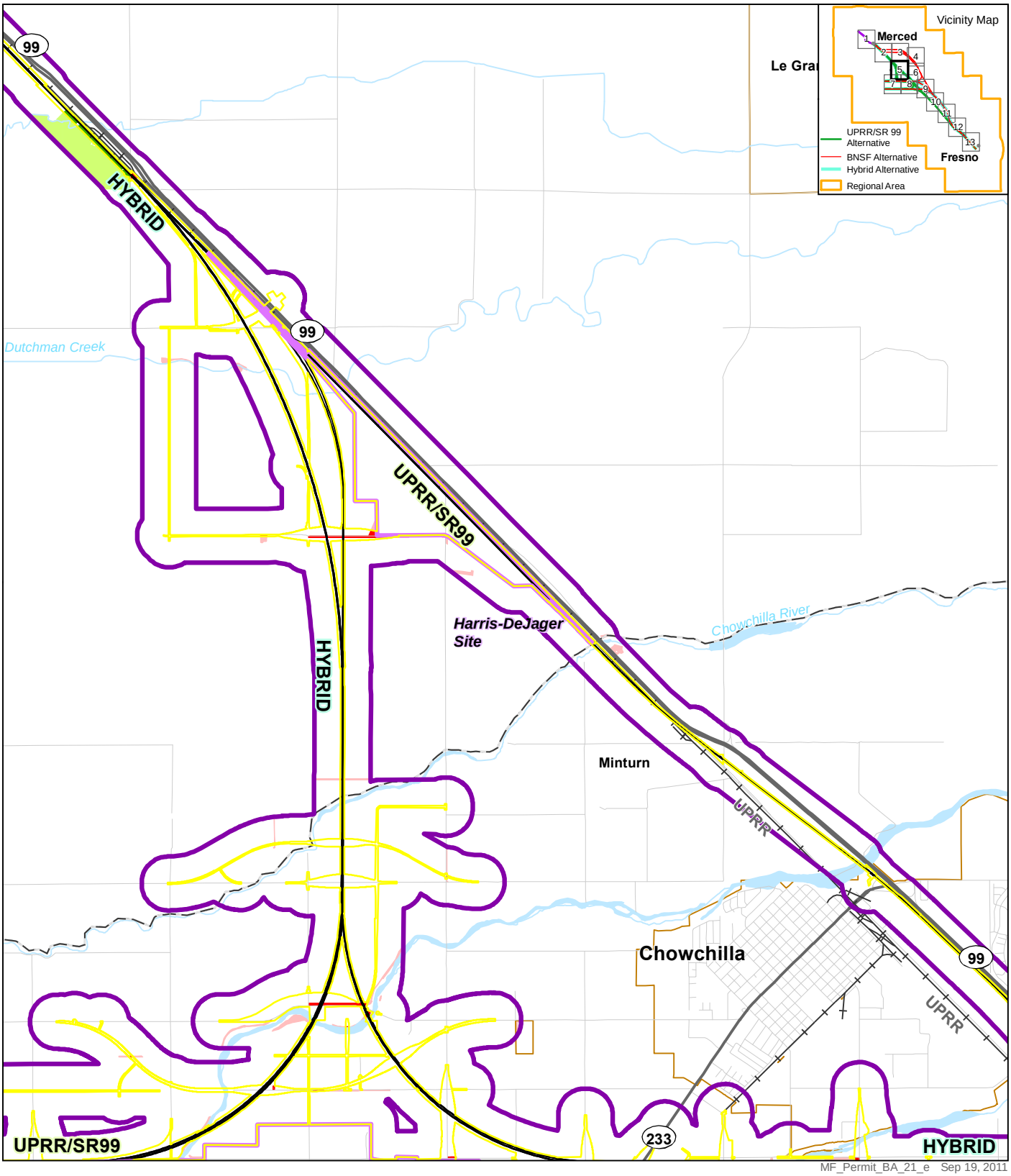
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 4 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_e Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

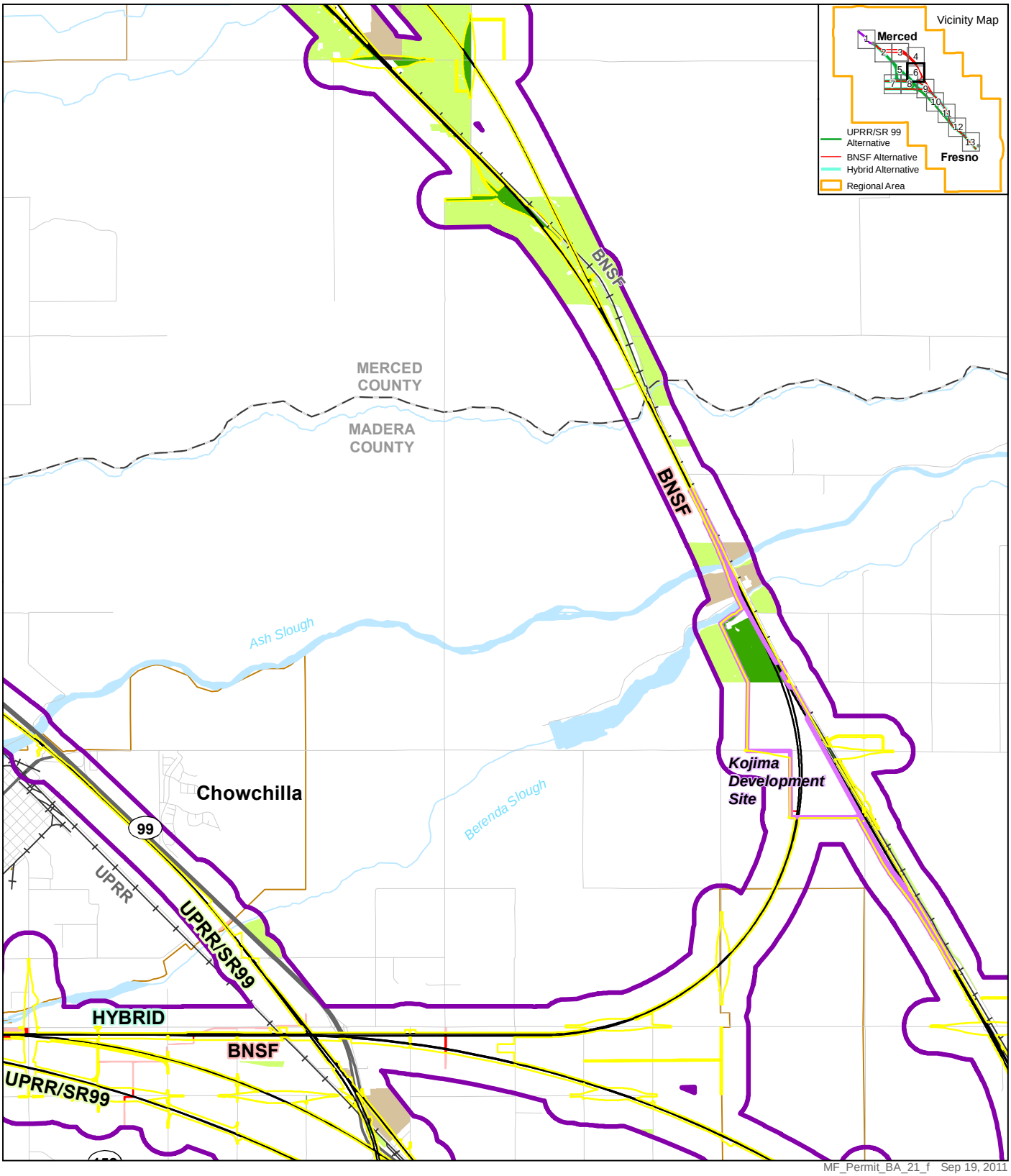
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 5 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_f Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

N

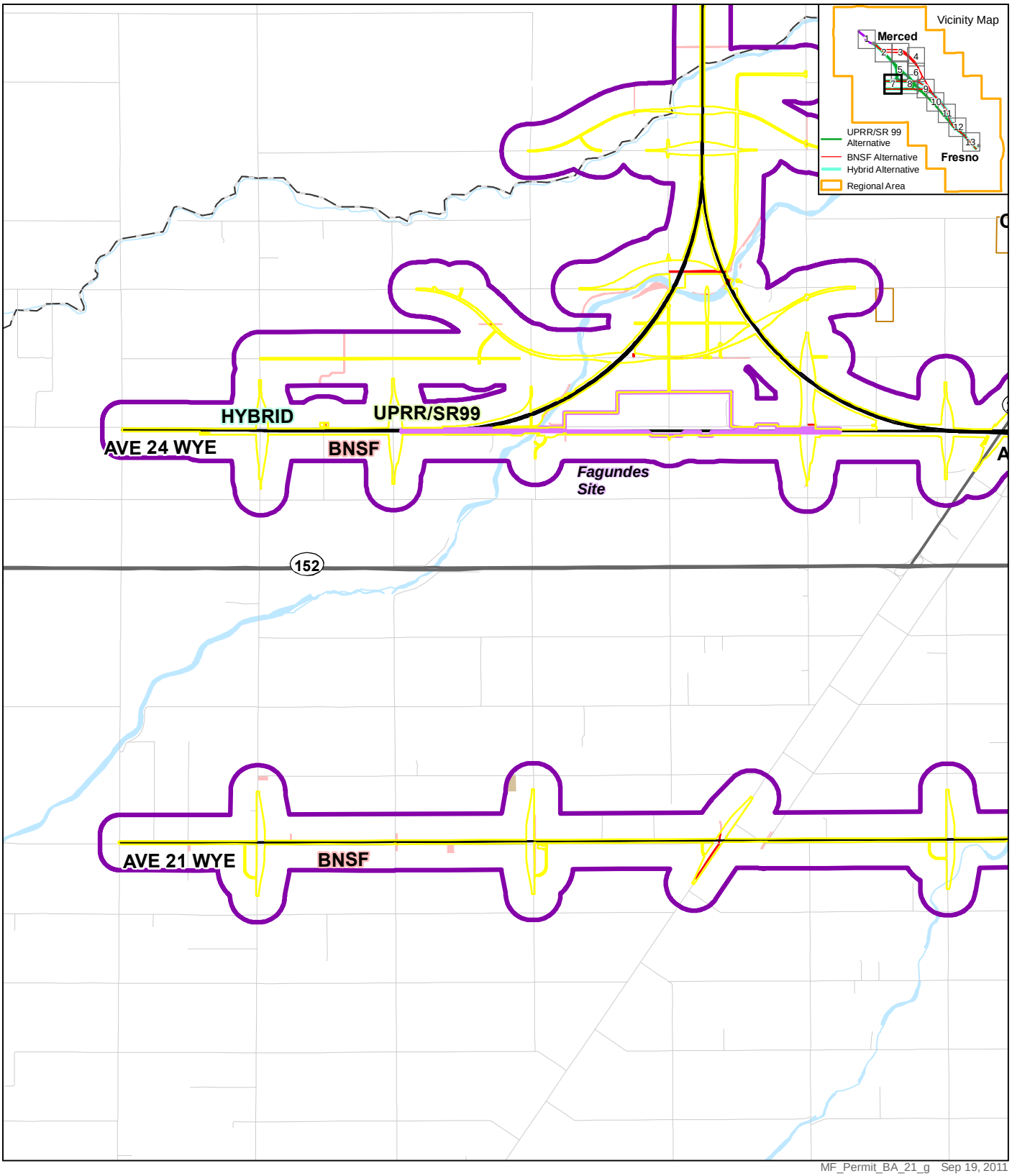
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 6 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_g Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

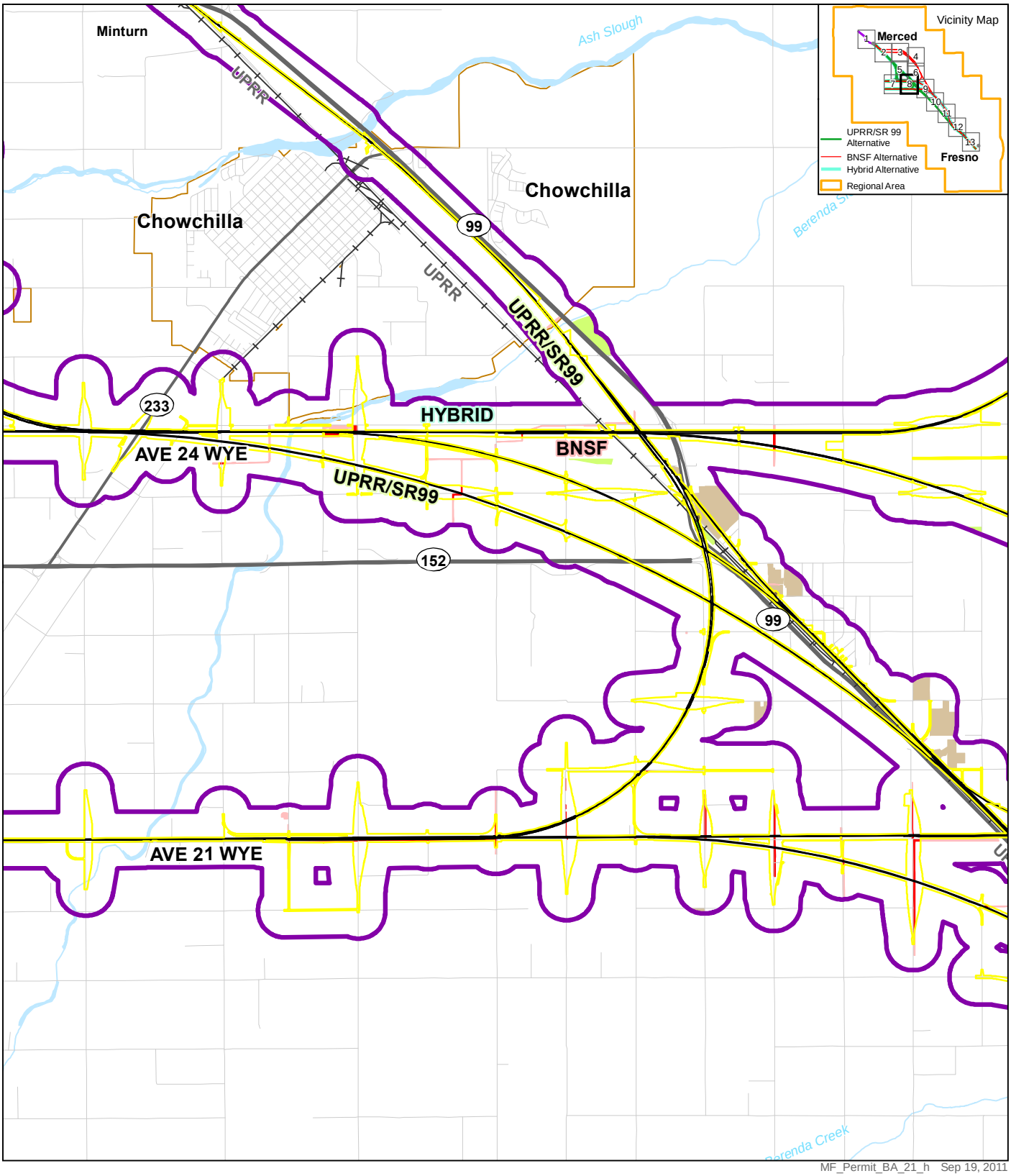
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 7 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_h Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

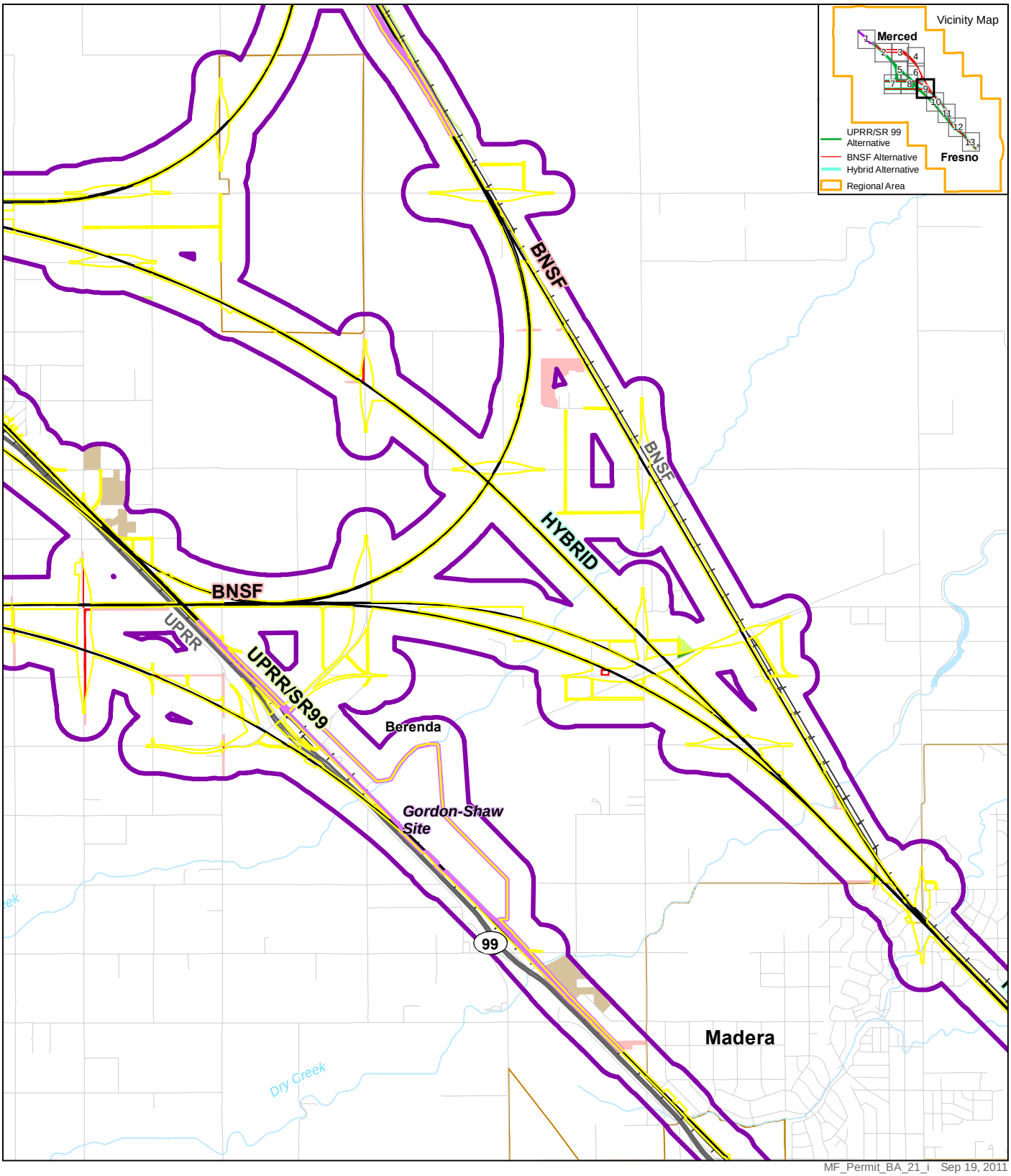
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 8 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_i Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

N

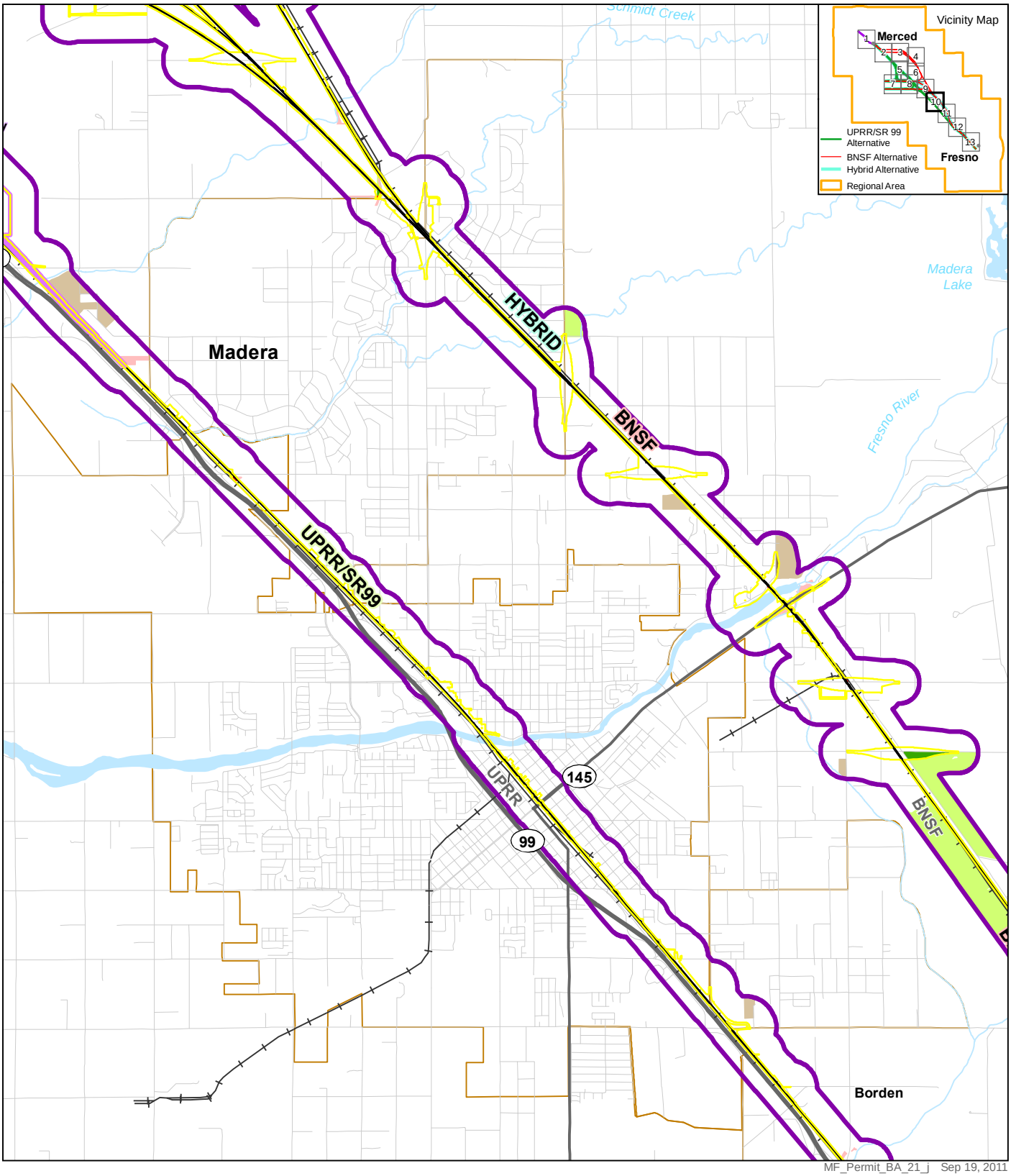
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 9 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

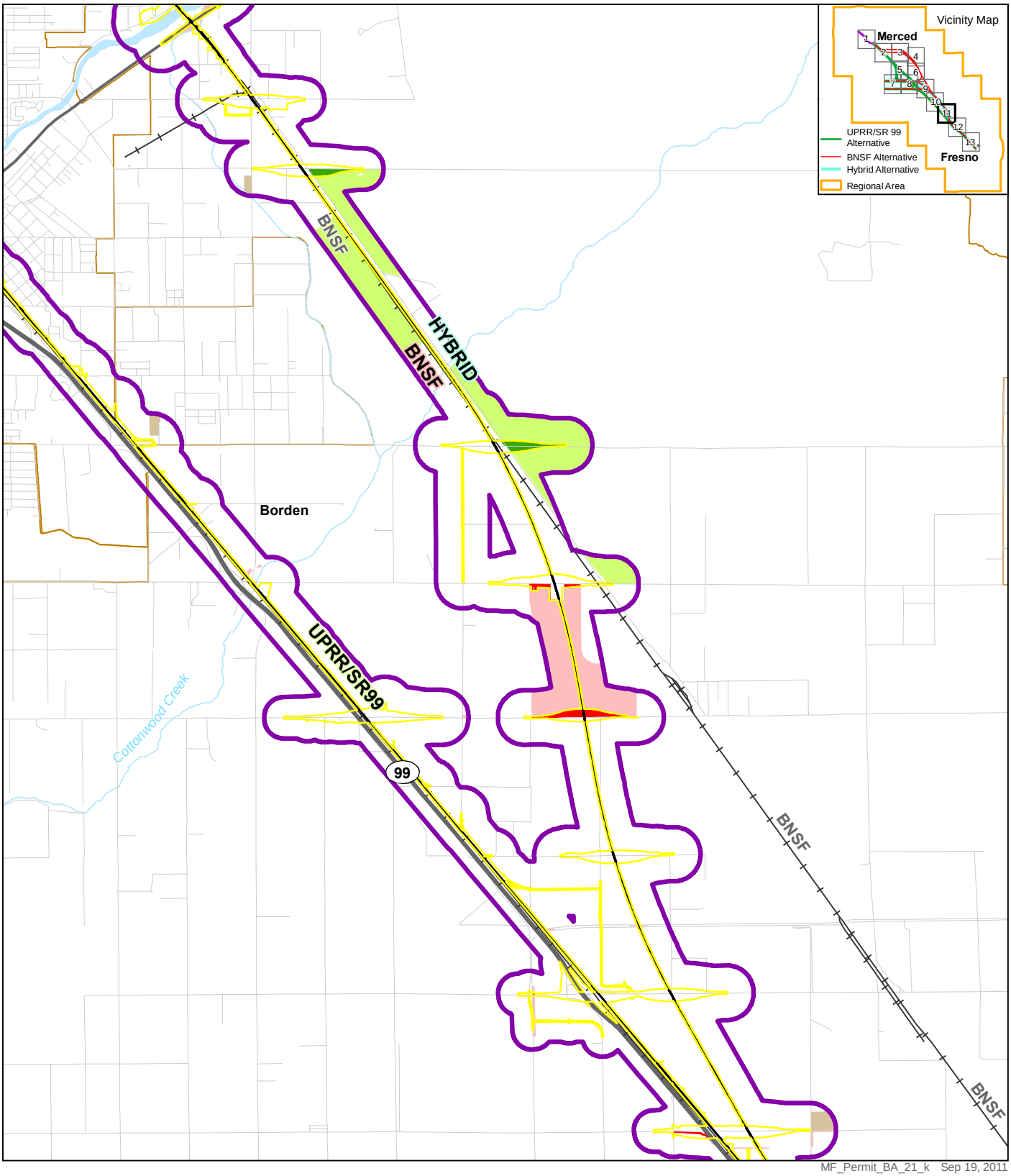
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 10 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_k Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

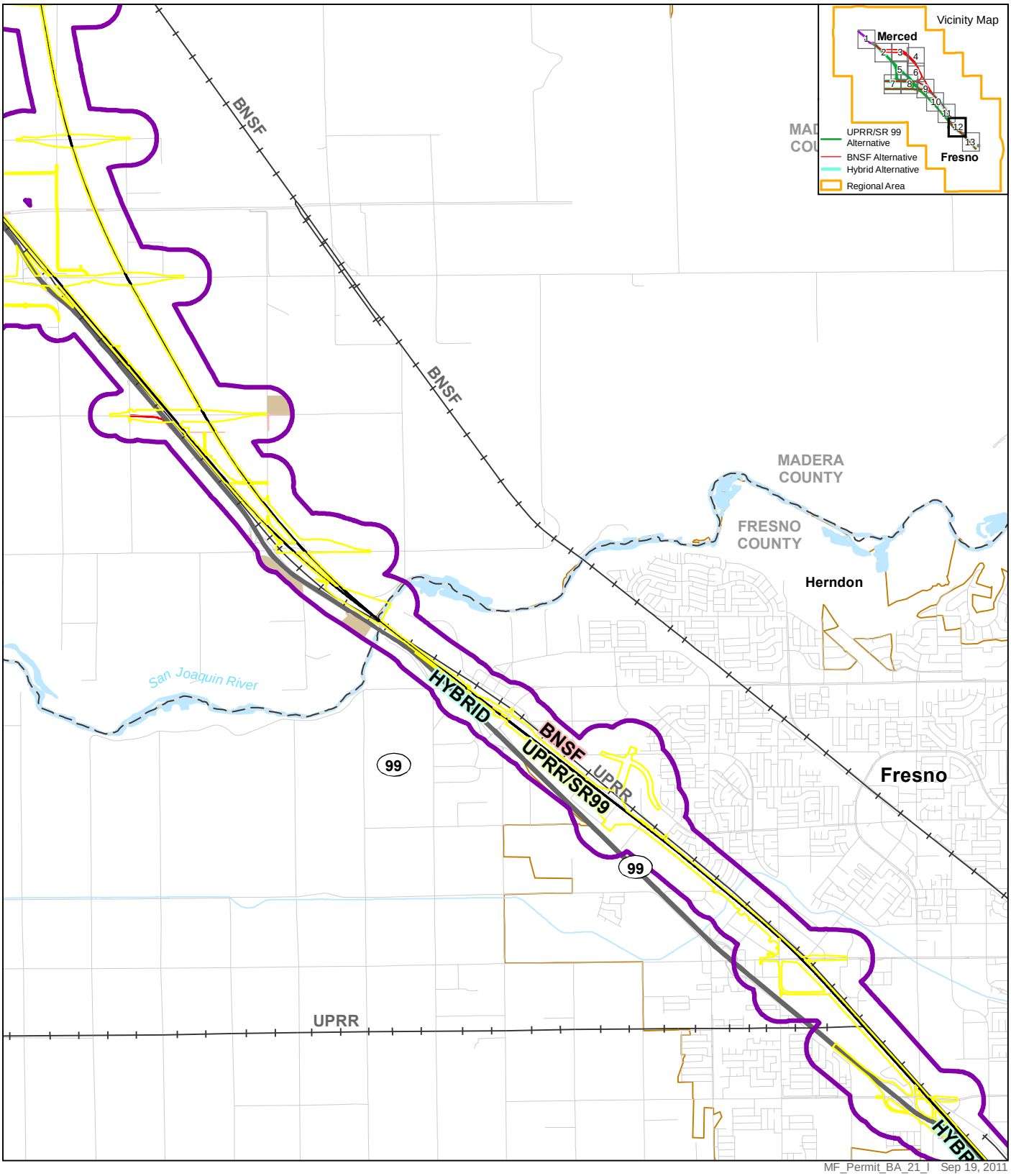
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 11 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_I Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat
Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat
Barren
Pasture
California Annual Grassland

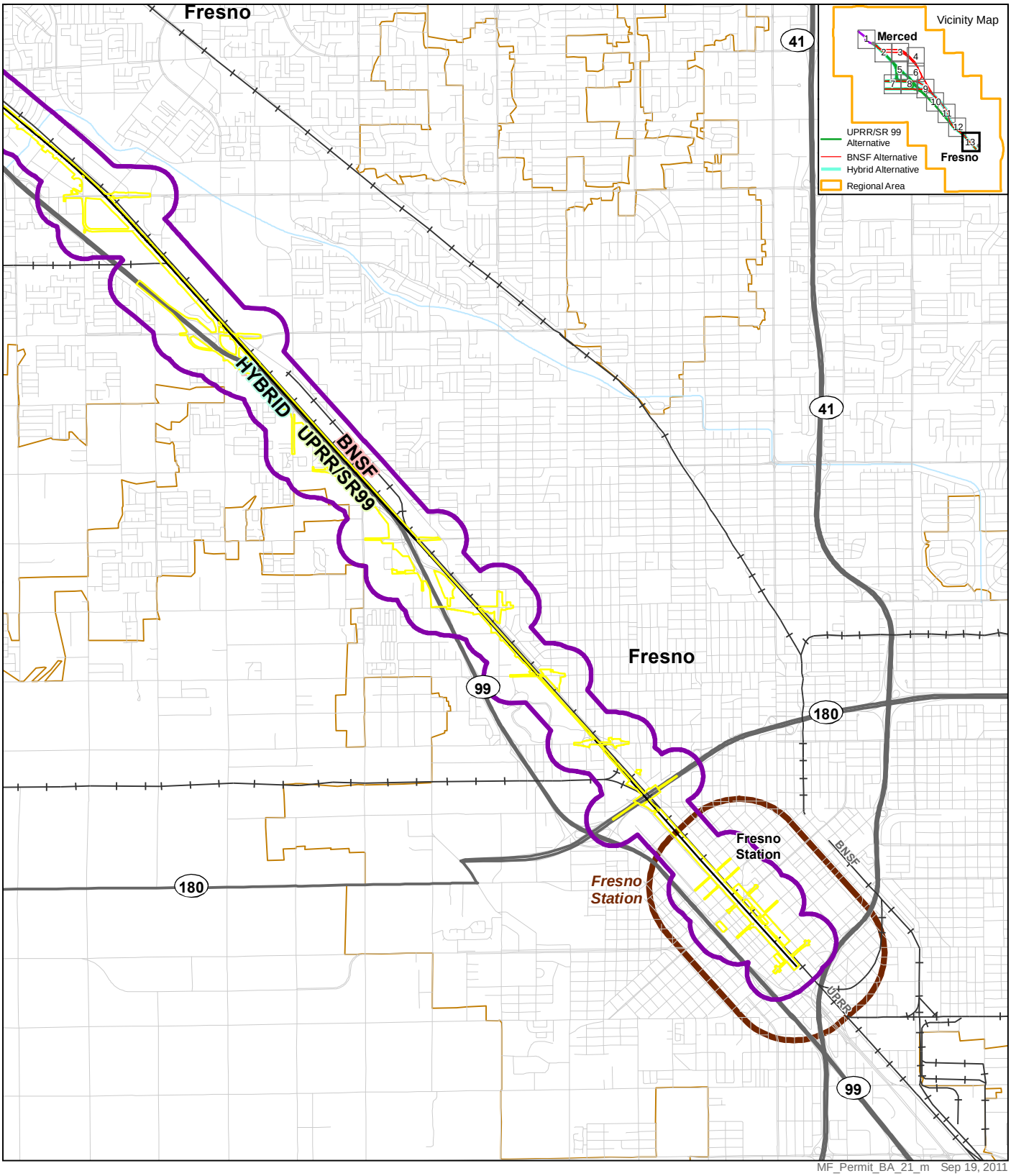
N
0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 12 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project



MF_Permit_BA_21_m Sep 19, 2011

HST Alignment
Station Study Area
Potential Heavy Maintenance Facility
City Limit
County Boundary
Railroad

Property Acquisition Footprint
Habitat Buffer Zone (1,000 feet)

Directly Affected Habitat

Barren
Pasture
California Annual Grassland

Indirectly Affected Habitat

Barren
Pasture
California Annual Grassland

N

0 1
Miles

PRELIMINARY DRAFT/SUBJECT TO CHANGE
HST ALIGNMENT IS NOT DETERMINED

U.S. Department of Transportation Federal Railroad Administration
CALIFORNIA High-Speed Rail Authority

Appendix D
Map 13 – Suitable Habitat for San Joaquin Kit Fox

Merced to Fresno Section
High-Speed Train Project

APPENDIX E

U.S. Fish and Wildlife Service Official Species List

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

September 20, 2011

Document Number: 110920115042

Michael Clary
CH2M HILL
2485 Natomas Park Dr.
Suite 600
Sacramento, CA 95833

Subject: Species List for Merced to Fresno High Speed Rail Project

Dear: 2485 Natomas Park Dr.

We are sending this official species list in response to your September 20, 2011 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be December 19, 2011.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division

U.S. Fish & Wildlife Service

Sacramento Fish & Wildlife Office

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the Counties and/or U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 110920115042

Database Last Updated: September 18, 2011

Quad Lists

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Critical habitat, Conservancy fairy shrimp (X)

Branchinecta longiantenna

longhorn fairy shrimp (E)

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardi

Critical habitat, vernal pool tadpole shrimp (X)

vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)

Oncorhynchus tshawytscha

Central Valley spring-run chinook salmon (T) (NMFS)

winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Critical habitat, CA tiger salamander, central population (X)

Rana draytonii

California red-legged frog (T)

Reptiles

Gambelia (=Crotaphytus) sila

blunt-nosed leopard lizard (E)

Thamnophis gigas

giant garter snake (T)

Mammals

Dipodomys nitratoides exilis

Fresno kangaroo rat (E)

Vulpes macrotis mutica

San Joaquin kit fox (E)

Plants

Castilleja campestris ssp. succulenta

Critical habitat, succulent (=fleshy) owl's-clover (X)
succulent (=fleshy) owl's-clover (T)

Caulanthus californicus

California jewelflower (E)

Neostapfia colusana

Colusa grass (T)
Critical habitat, Colusa grass (X)

Orcuttia inaequalis

Critical habitat, San Joaquin Valley Orcutt grass (X)
San Joaquin Valley Orcutt grass (T)

Orcuttia pilosa

Critical habitat, hairy Orcutt grass (X)
hairy Orcutt grass (E)

Tuctoria greenei

Critical habitat, Greene's tuctoria (=Orcutt grass) (X)
Greene's tuctoria (=Orcutt grass) (E)

Quads Containing Listed, Proposed or Candidate Species:

FRESNO SOUTH (358A)
GREGG (379B)
HERNDON (379C)
FRESNO NORTH (379D)
MADERA (380A)
LE GRAND (400B)
BERENDA (400C)
KISMET (400D)
PLAINSBURG (401A)
EL NIDO (401B)
BLISS RANCH (401C)
CHOWCHILLA (401D)
MERCED (421C)
PLANADA (421D)
ATWATER (422D)

County Lists

No county species lists requested.

Key:

(E) *Endangered* - Listed as being in danger of extinction.

(T) *Threatened* - Listed as likely to become endangered within the foreseeable future.

(P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.

(C) *Candidate* - Candidate to become a proposed species.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. More info

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland

habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be December 19, 2011.

APPENDIX F

Regulatory Correspondence

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814-4700

FEB 1 2011

Lupe Jimenez
Senior Environmental Planner
California High Speed Rail Authority
925 L Street
Sacramento, California 95814

Dear Ms. Jimenez:

This is in response to your November 17, 2010, letter requesting NOAA's National Marine Fisheries Service's (NMFS) species list for the proposed Merced to Fresno section of the California High-Speed Train (HST) project, located in Merced, Madera, and Fresno Counties, California. Please be advised that NMFS can only enter formal section 7 consultations with another Federal agency or its designee. Therefore, this response is provided as informal technical assistance with the California High-Speed Rail Authority (Authority). This response is not intended to take the place of formal comments or consultation as required under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) and does not provide incidental take authorization pursuant to section 7(b)(4) and section 7(o)(2) of the ESA. In addition, you should be aware any incidental take of listed species that may occur during the construction activities of the proposed project is not exempt from section 9 of the ESA.

The Authority proposes to construct, operate, and maintain an electric-powered HST system in California. When completed the HST would extend from San Francisco in the north to San Diego in the south. The Merced to Fresno section of the HST system would connect the central San Joaquin Valley region to the rest of the statewide HST system, specifically to the San Jose to Merced section via Pacheco Pass, Merced to Sacramento section to the north, and southern Central Valley and Southern California sections of the statewide HST system.

NMFS has reviewed the letter and enclosed document regarding the Merced to Fresno HST section. Available information indicates that the following listed species may occur in or downstream from the project areas:

Central Valley steelhead distinct population segment (*Oncorhynchus mykiss*)
threatened (January 5, 2006, 71 FR 834)

Additionally, the stipulation of the Settlement in NRDC, *et al.* v. Kirk Rogers *et al.* 2006 (Settlement) calls for the reintroduction of spring-run Chinook salmon to the San Joaquin River, no later than December 31, 2012. Authorization for implementing the Settlement is provided in Title X of the Omnibus Public Lands Management Act of 2009 identifies the Central Valley spring-run Chinook salmon (*O. tshawytscha*) evolutionarily significant unit re-introduced to the San Joaquin River below Friant Dam shall be designated as an experimental population. By definition, under section 10(j) of the ESA, all experimental populations are classified as threatened, and subject to section 9 of the ESA. The details of this designation are presently in development. NMFS can include the Authority on notifications relating to that project if requested.

You should also be aware that the proposed project may affect the Essential Fish Habitat for Chinook salmon as described in Amendment 14 of the Pacific Salmon Fishery Management Plan pursuant to the Magnuson-Stevens Fishery Conservation and Management Act.

Please contact Monica Gutierrez at (916) 930-3657, or via e-mail at Monica.Gutierrez@noaa.gov, if you have any questions regarding this project or require additional information.

Sincerely,

For Maria Rea
Supervisor, Sacramento Area Office

cc: Copy to file – ARN 151422SWR2010SA00502
NMFS-PRD, Long Beach, CA