BIOLOGICAL ASSESSMENT

Grassland Bypass Project, 2001-2009

Madera, Merced and Fresno Counties, California

U. S. Bureau of Reclamation
Sacramento and Fresno, California

Biological Assessment for Grassland Bypass Project, 2001-2009

and

San Luis and Delta-Mendota Water Authority
Los Banos, California

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Biological Assessment for Grassland Bypass Project, 2001-2009

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LIST OF ACRONYMS

CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CNDDB	California National Diversity Data Base
EIS/EIR.	Environmental Impact Statement/Environmental Impact Report
ESA	Federal Endangered Species Act
GAF	Grassland Area Farmers
GBP	Grassland Bypass Project
GDA	Grassland Drainage Area
IVT	In Valley Treatment facility
NEPA	Federal National Environmental Policy Act
NWR	National Wildlife Refuge
Reclamation, USBR	U.S. Bureau of Reclamation
Regional Board	California Regional Water Quality Control Board, Central Valley Region
Service, USFWS	U.S. Fish and Wildlife Service
SWRCB	State Water Resources Control Board
TMML	total maximum monthly load
VELB	Valley elderberry longhorn beetle
WDR	Waste Discharge Requirement

LIST OF ABBREVIATIONS

cfs	cubic feet per second
mg/kg	milligrams per kilogram
Φg/L	micrograms per Liter
lbs	pounds

STATUS OF LISTED SPECIES

(C)	Federal candidate for listing
(E)	Federally listed as endangered
(PT)	Proposed for Federal listing as threatened
(T)	Federally listed as threatened

Insert figure 1

Insert figure 2

Insert figure 3

1.0 INTRODUCTION

The purpose of this biological assessment is to review the proposed Grassland Bypass Project in sufficient detail to determine whether the proposed action may affect any federally-listed, proposed for listing and candidate species described in Section 2.0. This biological assessment is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)).

The Proposed Action is the continuation of the Grassland Bypass Project from October 1, 2001 through December 31, 2009. The purposes of the Project are:

(1) To continue separation of unusable agricultural drainwater discharged from the Grassland Drainage Area (GDA) from wetland water supply conveyance channels for the period 2001 B 2009; and

(2) To facilitate drainage management that maintains the viability of agriculture in the GDA and promotes continuous improvement in water quality in the San Joaquin River.

Features of the Proposed Action are described in Section 5 of this Biological Assessment. Project activities that may affect federally listed species include construction of Phases 1 and 2 of the In-Valley Treatment (IVT) facility, possible inclusion of 1,100 acres of farmland into the GDA with connections to Project facilities, and the discharge of subsurface agricultural drainwater into Mud Slough (north). The action will be subject to a revised Waste Discharge Requirement (WDR) that sets diminished annual loads and concentrations of selenium in the Mud Slough by 2005 and 2010. A Compliance Monitoring Plan will be implemented to monitor impacts of the Project on biological resources in the region.

Project History

In 1985, the San Luis Drain (the Drain) was closed due to deaths and developmental abnormalities of waterbirds at Kesterson Reservoir, a 1,200-acre water body located in the Kesterson National Wildlife Refuge (NWR) at the terminus of the Drain. The Drain, constructed by the U.S. Bureau of Reclamation (Reclamation), had been conceived as a means to dispose of agricultural drainwater generated from irrigation with water supplied by the Federal Central Valley Water

Project. However, due to environmental concerns and budget constraints, the Drain was not completed as originally planned. The constructed portion of the Drain was only used to convey subsurface agricultural drainwater from the Westlands Water District in the western San Joaquin Valley. Farms in the adjacent Grassland Drainage Area (GDA) never used the Drain, but discharged subsurface drainwater through wetland channels in the Grassland Water District, San Luis NWR Complex, and the Los Banos and North Grasslands Wildlife Management Areas (Refuges) to the San Joaquin River. This drainwater contains elevated concentrations of selenium, boron, chromium, and molybdenum, and high concentrations of various salts (Regional Board, 2000a) that disrupt the normal ionic balance of affected aquatic ecosystems (Moore *et al*. 1990). The Regional Board monitors the quality of drainwater, including agricultural chemical residues (fertilizers and pesticides that do not readily adsorb to soil). Tables 4-11 and 4-12 of the draft EIS/EIR (Reclamation 2000a) present the results of the Regional Board=s analyses of trace elements and organic compounds in the drainwater. Most organic compounds were below detection levels.

Discharge from GDA was unaffected by the closure of the Drain, and its drainwater continued to discharge into Refuge water delivery channels after the closure of Kesterson Reservoir. To address this problem, a proposal was made in 1985 by the U.S. Fish & Wildlife Service (Service) to reopen the Drain and connect it to Mud Slough, a tributary of the San Joaquin River, with support from other federal and state agencies (Reclamation 1995; Reclamation and SL&D-MWA 1995; Reclamation *et al.* 1995). This project, known as the Grassland Bypass Project (GBP), collects agricultural drainwater from GDA into the lower 28 miles of the Drain and thence into the lower portion of Mud Slough (about 6 miles). This effectively removes tainted drainwater from over 90 miles of wetland water supply channels in the Grassland area.

The original Grassland Bypass Project (GBP) was based on the use a portion of the Drain to separate drainwater from wetland water supply channels in Grassland Water District and adjacent Refuges. The original project was implemented in November 1995 with the signing of the "Agreement for Use of the San Luis Drain" (Agreement No. 6-07-20-w1319) (1995 Use Agreement) between Reclamation and San Luis and Delta-Mendota Water Authority (the Authority). A Finding of No Significant Impact (FONSI No. 96-1-MP) under the Federal National Environmental Policy Act (NEPA) was adopted by Reclamation for the original project, and environmental commitments set forth in the FONSI were made an integral component of the 1995 Use Agreement. The project became officially operational on October 1, 1996 and will conclude September 30, 2001.

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In March 1996, the Grassland Area Farmers (GAF) formed a regional drainage entity under the umbrella of the Authority to implement the Grassland Bypass Project and manage subsurface drainage within the GDA. The GDA currently consists of approximately 97,400 gross acres of irrigated farmland on the west side of San Joaquin Valley. Participants include the Broadview Water District, Charleston Drainage District, Firebaugh Canal Water District, Pacheco Water District, Panoche Drainage District, Widren Water District, and the Camp 13 Drainers (an association of landowners located in the Central California Irrigation District).

In 1996, the California Regional Water Quality Control Board, Central Valley Region (Regional Board) adopted amendments to its Water Quality Control Plan, Third Edition, for the Sacramento River and San Joaquin River Basins (1996 Basin Plan) dealing with discharges of selenium in agricultural subsurface drainage. These amendments were recognized and supported in a November 3, 1995, consensus letter from the Authority, Reclamation, U. S. Environmental Protection Agency, and the Service. The Regional Board issued Waste Discharge Requirements (WDRs) for discharges from the Drain on July 24, 1998. The WDRs established monthly and annual selenium discharge load values (measured in pounds) that would result in a 15 percent reduction from the average historical load to the San Joaquin River by the 5th year. The WDRs remain in effect through the term of the current project. Unless replacement WDRs are in place to take effect after September 30, 2001, a stated schedule of Total Maximum Monthly Load (TMML) limits will be applied if the Project continues. Success has been achieved in meeting the selenium load limits prescribed in the 1998 WDRs. Additional reductions are required, however, to continue improvements to San Joaquin River water quality and meet selenium requirements established in the Basin Plan as well as future salt and boron discharge limits.

Continued use of the Drain after the term of the existing 1995 Use Agreement requires a revised Use Agreement and additional environmental compliance with NEPA and the California Environmental Quality Act (CEQA). Alternatives for the proposed Grassland Bypass Project are being evaluated under NEPA /CEQA in the Environmental Impact Statement /Environmental Impact Report (EIS/EIR) that was released for public review in December 2000. (Reclamation 2000a)

The Project would meet water quality objectives that are applicable to the 2001-2009 project period as provided in the 1996 Basin Plan, (Regional Board, 1996). These objectives reduce the selenium concentration in surface water at three specific locations within the Grasslands Bypass Project area. Selenium levels for Salt Slough of 2 Φg/L (monthly mean) are currently in effect. Selenium levels for

affected segments of the San Joaquin River and Mud Slough would also be reduced to a level of 5 Φg/L (4 day average) by 2005 and 2010 respectively.

In September 1998, the GAF and the Authority developed a long-term drainage management strategy and plan of implementation for the Grassland Drainage Area (GAF and the Authority 1998). The Drainage Management Plan was submitted to the Regional Board, as required by WDR Order 98-171, for public review on September 30, 1998, and updated July 1, 1999. The Drainage Management Plan outlines several steps and measures to achieve water quality objectives in the Basin Plan and includes continuation of the Grassland Bypass Project.

2.0 PERTINENT SPECIES AND HABITATS POTENTIALLY AFFECTED

The following is a comprehensive list of federally-listed, proposed for listing and candidate species that may occur (or be affected by the proposed action) in the Grassland Bypass Project area. See Appendix A for a complete list of listed species and species of concern (USFWS, 2001).

The 27 species considered in this document are:

A. Threatened and endangered species and/or their critical habitat within the action area:

Mammals

giant kangaroo rat, *Dipodomys ingens* (E)

Fresno kangaroo rat, *Dipodomys nitratoides exilis* (E)

San Joaquin kit fox, *Vulpes macrotis mutica* (E)

riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia* (E)

riparian brush rabbit, *Sylvilagus bachmani riparius* (E)

Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) sila* (E)

giant garter snake, *Thamnophis gigas* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

delta smelt, *Hypomesus transpacificus* (T)

Central Valley steelhead, *Oncorhynchus mykiss* (T)

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T)

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

Conservancy fairy shrimp, *Branchinecta conservatio* (E)

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

longhorn fairy shrimp, *Branchinecta longiantenna* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

Plants

Hoover's eriastrum (= woolly-star), *Eriastrum hooveri* (T)

Hoover=s spurge, *Chamaesyce hooveri* (T)
Colusa grass, *Neostapfia colusana* (T)
Palmate-bracted bird=s-beak, *Cordylanthus palmatus* (E)

B. Proposed species and/or proposed critical habitat within the action area:

Birds
mountain plover, *Charadrius montanus* (PT)

C. Category 1 candidate species within the action area:

Amphibians
California tiger salamander, *Ambystoma californiense* (C)
Fish
Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C)

A search of the California National Diversity Data Base (CNDDB) (revised December 2000) was conducted by the Service on twenty-two quadrangles to identify listed and proposed-listed species occurrences within the areas of affect. See Appendix B for a list of these quadrangles.

The following special status species are not considered further in this document because (1) the project area is located outside the species= range, or (2) no suitable habitat exists for the species in the project area.

giant kangaroo rat, *Dipodomys ingens* (E)
Fresno kangaroo rat, *Dipodomys nitratoides exilis* (E)
riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia* (E)
riparian brush rabbit, *Sylvilagus bachmani riparius* (E)
California red-legged frog, *Rana aurora draytonii* (T)
Hoover's eriastrum (= woolly-star), *Eriastrum hooveri* (T)
Hoover=s spurge, *Chamaesyce hooveri* (T)
Palmate-bracted bird=s-beak, *Cordylanthus palmatus* (E)

Giant kangaroo rat, *Dipodomys ingens* (E)
The CNDDB lists one record of this species in the twenty-two quadrangles covering lands within and adjacent to the study area. This observation was recorded in 1932 west of the GDA. No recent observations of this species have been recorded in the Project area.. Kangaroo rats are known for their large hind legs which they use to jump from place to place. Giant kangaroo rats are the

largest of the kangaroo rats. Giant kangaroo rat habitat includes areas of gentle slopes and well-drained, fine loam and sandy-loam soils that are dominated by native annual grasses and herbs (Grinnell 1922; Hawbecker 1951). They prefer homogeneous terrain that is devoid of shrubs or rocks (Braun 1985). Giant kangaroo rat populations are currently fragmented into six major geographic units, including the Panoche Region in western Fresno and Eastern San Benito Counties. This region is south of the project area and affected drainage flows to the north. Project activities are not likely to affect this species.

Fresno kangaroo rat, *Dipodomys nitratoides exilis* (E)
The CNDDB lists one record of this species in the twenty-two quadrangles covering lands within and adjacent to the study area. This observation occurred in 1956 in Madera County, about 20 miles east of the Project area. No recent observations of this species have been recorded in the Project area. Fresno kangaroo rats were historically distributed in an area of grassland and chenopod scrub communities from the Merced River to Tulare Lake. Areas with possibly extant populations of Fresno kangaroo rats include uncultivated grassland, alkali sink shrubland, and seasonally flooded wetlands within the Alkali Sink Ecological Reserve. This region is south of the project area and affected drainage flows to the north (USFWS 1998). Project activities are not likely to affect this species.

Riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia* (E)
Riparian brush rabbit, *Sylvilagus bachmani riparius* (E)
The CNDDB list no records of these two species in the twenty-two quadrangles covering lands within and adjacent to the study area. The riparian brush rabbit is a medium to small cottontail with color varying from dark brown to gray above to white underneath. The riparian woodrat is a medium sized rodent that is predominantly gray and cinnamon above and whitish beneath (Hooper 1938). Both population declines are attributed to the loss and/or deterioration of riparian forest and valley oak savanna habitats (Williams 1986). The riparian brush rabbit is currently restricted to a single population at Caswell Memorial State Park, San Joaquin County, on the Stanislaus River (Williams, and Basey 1986). Project activities are not likely to affect these species.

California red-legged frog, *Rana aurora draytonii* (T)
The CNDDB lists one record of this species in the twenty-two quadrangles covering lands within and adjacent to the study area. This observation was made in 1983 about 18 miles west of the terminus of the San Luis Drain, outside of the Project area. No recent observations have been recorded in the Project area. California red-legged frogs are the largest native frog in the western United States. They are now found primarily in wetlands and streams in coastal drainages of

central California, and in the Sierra Nevada foothills. The project is located entirely in the floor of the San Joaquin Valley. Red-legged frogs are believed to be extirpated from the floor of the Central Valley since 1960 (USFWS 2000a). Project activities are not likely to affect this species.

Hoover=s eriastrum (= woolly-star), *Eriastrum hooveri* (T)
There are no occurrences of this species on the CNDDB for the twenty-two quadrangles covering lands within and adjacent to the study area. Hoover's eriastrum is an annual herb with wiry stems that vary in height from 0.4-8.0 inches and threadlike leaves. Hoover's eriastrum has tiny white to pale blue flowers that are nearly hidden in tuffs of woolly hair (USFWS 1998). Optimal habitats are characterized by stabilized silty to sandy soils, a low cover of competing herbaceous vegetation, and the presence of a cryptogamic crust; however, it also has been found on loamy soils, in areas of dense vegetation, and in areas lacking cryptogamic crust (USFWS 1998). Populations of Hoover's eriastrum occur in alkali sinks, washes, ridge tops, and north- and south- facing slopes in a wide variety of plant communities, but typically in areas with less than 20 percent shrub cover (USFWS 1998). Hoover's eriastrum has been discovered at the Alkali Sink Ecological Reserve, south of the project area. Project activities are not likely to affect this species.

Hoover's Spurge, ***Chamaesyce hooveri* (T)**
Hoover's spurge is a prostrate, tap-rooted, annual herb in the spurge family (Euphorbiaceae) that forms mats from a few inches to a few feet across. Hoover's spurge occurs in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans and depositional stream terraces at the base of the Sierra Nevada foothills. It tends to occur where competition from other species has been reduced by prolonged seasonal inundation or other factors (Stone et al. 1988). This species is endemic to vernal pool complexes in the eastern Central Valley. Loss of vernal pool habitat to irrigated agriculture has probably caused most of the decline in this species. Its historical distribution is not well documented, but it is thought to have been more common than at present among the vernal pools of the eastern Sacramento and San Joaquin Valleys. The CNDDB lists one observation in 1987 of this species in Merced County, east of the San Joaquin River. This occurrence was outside of the Project area - 30 miles north of the GDA and 15 miles east of the Refuges. Project activities are not likely to affect this species.

Palmate-bracted bird=s-beak, *Cordylanthus palmatus* (E)
Palmate-bracted bird's-beak is an annual herb in the snapdragon family (Scrophulariaceae). Seedlings grow in late March or April. Flowers bloom from late spring through summer. Like other members of *Cordylanthus* and related

genera, it is hemiparasitic (partially parasitic) on the roots of other plants.

Palmate bracted bird=s-beak grows on seasonally-flooded, saline-alkali soils in lowland plains and basins at elevations of less than 500 feet. Within these areas, palmate-bracted bird's-beak grows primarily along the edges of channels and drainages, with a few individuals scattered in seasonally-wet depressions, *alkali scalds* (barren areas with a surface crust of salts), and grassy areas. Palmate-bracted bird's-beak occurs in the Valley Sink Scrub and Alkali Meadow natural communities in association with other halophytes such as iodine bush (*Allenrolfea occidentalis*), alkali heath (*Frankenia salina*), glasswort (*Salicornia subterminalis*), seepweed (*Suaeda moquinii*) and salt grass (Bittman 1985, 1986*a*, Holland 1986, Coats et al. 1993). It is currently known to occur in the Sacramento, Livermore and San Joaquin Valleys. The CNDDB lists four occurrences in 1993 of this flower in Madera County, about 10 miles north of the GDA and outside the refuges. Project activities are not likely to affect this species.

3.0 ENDANGERED SPECIES ACT CONSULTATION TO DATE

September 15, 1993: The Service informally consulted on Reclamation=s proposed San Luis Drain/North Mud Slough Agricultural Drain Water Project, Merced County, California. The proposed project would involve discontinuing the use of South Mud Slough and Salt Slough and reopening the San Luis Drain. The Service concurred that the project would not adversely affect delta smelt, giant garter snake, and the candidate western pond turtle, providing there would be no increase in selenium loading to the San Joaquin River (1-1-93-I-1016).

September 11, September 25 and October 26, 1995: The Service informally consulted on the proposed construction of the San Luis Drain/North Mud Slough Project supplying guidance and clarification so as to avoid impacts to delta smelt and giant garter snake. The Service concurred with Reclamation=s determination of Anot likely to adversely affect@ for the giant garter snake, providing Reclamation=s proposed conservation measures during construction were followed. The Service recommended a program monitoring selenium, and toxicological studies to ascertain effects to delta smelt (1-1-95-I-1462 and 1-1-95-I-67).

June 6, 1996: Informal consultation on the Operation and Maintenance of the San Luis Drain

February 9, 2000: The Service=s Sacramento Fish and Wildlife Office provided a comprehensive list of 23 animal species (five mammals, three birds, two reptile,

two amphibians, five fish, four invertebrates, two plants) that are federally-listed as endangered, threatened or proposed as endangered or threatened under the Federal Endangered Species Act and that have the potential to occur within the 22 USGS 7 2 minute quadrangles of the project area. The list also included 17 plant and animal species that are considered as sensitive and species of concern.

January 31, 2001: Updated species list from the Service=s Sacramento Fish and Wildlife Office.

4.0 DESCRIPTION OF PROJECT AREA

4.1 Location

The Project Area is located on the western side of the San Joaquin Valley, which is a gently sloping nearly unbroken alluvial plain about 250 miles long and an average 45 miles wide. The project is located in the Grassland Subarea as defined by the San Joaquin Valley Drainage Program (SJVDP 1990). The Grassland Subarea is an area of approximately 370,000 acres and is generally bounded on the north by the alluvial fan of Orestimba Creek and to the south by the Westlands Subarea. The San Joaquin River forms the eastern boundary and Interstate 5 forms the approximate western boundary (Reclamation *et al.* 1996). The elevation of the Project Area ranges from 60 feet along the San Joaquin River to 400 feet in the southern GDA.

4.2 Description

The Grasslands Subarea is composed primarily of agricultural lands and federal, state and private wetlands. Approximately 70,000 acres of agricultural land found in the Project Area have historically discharged subsurface drainage water through the Grassland Water District channels northward ultimately to the San Joaquin River. There are three areas of the Project Area: (1) cultivated fields which are the source of agricultural drainage, (2) wetland channels and sloughs throughout the private, state and federal wetlands, and (3) the subsurface agricultural drainage conveyance system.

(1) The first area is the 97,400-acre source zone known as the Grassland Drainage Area (GDA), located in the Central Valley of California, specifically in Merced and Fresno counties (see Figure 1). The GDA extends from the Charleston Drainage District on the north at State Highway 165 to the Firebaugh Canal Water District on the south near

State Highway 180, near the community of Mendota. The Project will also consider the addition of approximately 1,100 acres adjacent to the existing Grassland Bypass Channel that currently drains into the wetlands channels (see Figure 2).

(2) The second area consists of 93 miles of wetlands channels, Salt Slough, and the San Joaquin River from the confluence of Salt Slough downstream to Mud Slough (see Figure 2). The wetland channels cross Grassland Water District, the San Luis NWR Complex, and the North Grassland Wildlife Management Area. Under the Grassland Bypass Project, agricultural drainwater from the GDA is no longer discharged into these channels.

(3) The third area consists of the San Luis Drain from Russell Avenue on the south to its northern terminus at Mud Slough, 6 miles of Mud Slough upstream of its confluence with the San Joaquin River, and the San Joaquin River downstream from Mud Slough to Crows Landing. These waterways would convey agricultural drainage from the GDA, and, thus, would be directly affected by the Proposed Action (see Figure 2).

5.0 DESCRIPTION OF PROPOSED ACTION

The Grassland Bypass Project under the proposed 2001 Use Agreement would consolidate subsurface drainwater on a regional basis and utilize a portion of the Federal San Luis Drain to convey it around wetland habitat areas. The Project would collect drainwater from the 97,400- acre GDA and an adjacent 1,100-acre area and place it into the Drain at a point near Russell Avenue (Site A - San Luis Drain near South Dos Palos, California) (see Figure 3). The drainage would continue to travel in the Drain to its northern terminus (Site B - San Luis Drain near Gustine, California). From here, the drainage would enter Mud Slough (North) for 6 miles before reaching the San Joaquin River at a location 3 miles upstream of its confluence with the Merced River (Reclamation 2000a).

5.1 Existing Features of Proposed Action

Existing features of the current Grassland Bypass Project that would continue under the Proposed Action include the following (see Figure 2):

- The removal of agricultural drainwater from 93 miles of conveyance channels in the Grassland wetlands and wildlife refuges. These channels

are shown on Figure 2.

- The use of the Grassland Bypass Channel, a 4-mile-long earthen ditch that conveys drainwater from the GDA to the San Luis Drain at Russell Avenue.

- The drainwater would continue to travel approximately 28 miles in the San Luis Drain to its northern terminus near Gustine, California. From that point, the drainwater would enter Mud Slough (North) for 6 miles before reaching the San Joaquin River at a location 3 miles upstream of its confluence with the Merced River.

- The maximum flow of drainwater from the GDA shall not exceed 150 cubic feet per second (cfs), primarily to prevent suspension of sediments within the Drain.

5.2 New Features of Proposed Action

New features of the Proposed Action may or would include:

- Negotiation with Reclamation (and other stakeholders) for a new 2001 Use Agreement for the Drain, to include an updated compliance monitoring plan, revised selenium load limits, and a new Waste Discharge Requirement (WDR) from the Regional Board.

- Possible addition of approximately 1,100 acres of farmland immediately adjacent to the GDA, south of the Drain and east of the Grassland Bypass Channel, that currently drain to wetland channels. (See Figure 2). This would require the construction of up to three short culverts from existing sumps to the Channel through highly disturbed embankments.

- Other drainage management actions to meet water quality objectives/load limits.

5.3 In-Valley Treatment/Drainage Reuse

The Proposed Action would include an In-Valley Treatment (IVT) element on up

to 6,200 acres of land within the GDA. The location of the IVT is shown on Figure 3. This component of the Project would dedicate specific lands for the irrigation of salt-tolerant crops with subsurface drainwater to reduce the volume; treat the concentrated drainwater to remove salt, selenium, and boron; and dispose of the removed salts Ain valley@ to prevent them from discharging to the San Joaquin River. The Project is planned to handle half of the total drainwater produced in the GDA (50 percent of 35,000 acre-feet or approximately 17,000 acre-feet annually) and would include three phases, described in more detail below:

Phase I: Purchase of land and planting to salt-tolerant crops, by 2003

Phase II: Installation of subsurface drainage and collection systems, initial treatment system, by 2007

Phase III: Completion of construction of treatment removal and salt disposal systems, by 2009

The In-Valley Treatment element would be comprised of the following phases:

Phase I: Subsurface drainwater from the GDA (12,000 acre-feet) would be used to irrigate salt- tolerant crops (alfalfa, pasture mix, bermuda grass, bermuda/pasture mix, and grains such as winter wheat) on land ideally situated for this purpose. Ongoing monitoring of soil and water constituents will be done to assure no irreversible changes occur and to protect groundwater (Panoche Drainage District 2000) The land is adjacent to the collected Grassland drainwater, so the water can easily be captured and placed on the land. Since this land is also the lowest in elevation within the drainage area, no downstream collection of drainwater occurs. The land is owned by the Panoche Drainage District. . Salt-tolerant crops will be irrigated with salty subsurface drainwater, thus preventing that water from being discharged to the San Joaquin River. Grazing pasture could increase from 250 to 1,000 acres on the site (Panoche Drainage District 2000).

Phase II: To continue to apply the salty water to the lands developed in Phase I, it will be necessary to install subsurface drainage and collecting system (tile) systems so the soil can be leached and a salt balance maintained. The water percolating below the root zone would be captured in the drainage system and passed on to the next, more salt-tolerant crop. The salt, selenium, and other constituents would be collected in the water coming out of the subsurface drainage systems. The system would sequentially reuse about 14,000 acre-feet of

drainwater on increasingly salt-tolerant crops to concentrate and decrease the volume of drainwater. An initial phase of treatment would remove the salt and the selenium and much of the other constituents from the water, leaving usable water for agriculture or possibly other beneficial uses. The treatment system would be designed to tie in at any point in the reuse system. The salt would be deposited in approved waste units and not discharged to the San Joaquin River, resulting in additional reductions in salt and selenium discharges to the river.

Phase III: This final phase would be necessary to provide for maximum improvement to water quality in the San Joaquin River and to meet the ultimate reductions needed to meet future water quality objectives. This phase would include expansion of initial treatment (under Phase II) with additional construction of treatment facilities as well as additional waste disposal units. It would handle 17,000 acre-feet of drainwater per year.

Each phase of the In-Valley Treatment would significantly reduce the quantity of drainwater discharged to the San Joaquin River. The treatment systems would also produce a product water sufficient in quality for reuse on agricultural lands within the GDA. The In-Valley Treatment element of the Proposed Action would be designed to meet applicable water quality objectives for Water Year 2006 (October 1, 2005). The applicable selenium load limit for 2006 (based on the current applicable total maximum monthly load [TMML]) is 3,087 lbs. In comparison, the load value in the existing 1995 Use Agreement for Water Year 2001 is 5,661 lbs. Such a large reduction requires implementation of additional methods of drainage management.

Phase I of the facility was evaluated in the Initial Study of the Proposed Project (Panoche Drainage District 2000). Phases II and III of the facility are evaluated in the Grassland Bypass Project EIS/EIR (Reclamation, 2000a). These related construction phases were deferred to the EIS/EIR because Phase I has independent utility and does not foreclose consideration of alternatives to the larger project or to the Project site. Even if the In-Valley Treatment/Drainage Reuse Project were to stop at Phase I without the later phases being implemented, it has value on its own for drainage management in the Panoche Drainage District and in the GDA. Also, the changes in proposed cropping patterns are reversible should the later phases not be implemented. Reclamation and the Authority will consult with the Service if it is determined that the construction and operation of Phase III facilities may have an adverse impact on listed species.

5.4 Other Drainage Management Actions

Other drainage management actions that would occur with implementation of the

Proposed Action would include the following:

- Utilizing and installing drainage recycling systems to mix subsurface drainwater with irrigation supplies under strict limits.

- Continuing current land retirement policies listed in the *Long-Term Drainage Management Plan for the GDA*. Key among these is that land retirement should be voluntary (GAF and Authority 1998).

- Continuing the operation of a regional drainage management entity to perform management, monitoring, and funding of necessary control functions.

- An active land management program to utilize subsurface drainage on salt-tolerant crops.

- Low-interest loans for irrigation system improvements, such as gated pipe, sprinkler, and drip irrigation systems.

- An economic incentive program including tiered water pricing and tradable loads.

- A no-tailwater policy that would minimize silt from being discharged into the San Luis Drain and promote the secondary benefits of irrigation water management.

- Implementing drainwater displacement projects such as using drainwater to grow salt- tolerant crops and using subsurface drainage for dust control on roadways.

- Meeting with landowners as necessary to implement projects and policies cited above.

5.5 Conservation Measures for Endangered Species

In addition to the primary drainage management actions associated with the Project that will reduce exposure to selenium and improve water and habitat quality, the following conservation measures included in the project description are established to avoid or minimize impacts to special status species, especially during any construction. The BA describes the potential effects of Proposed Actions on special status species. Conservation measures are designed to bring potential adverse effects to a level of A*not likely to affect adversely@*.

Mountain plover, *Charadrius montanus* (PT)

Pilot programs irrigating with subsurface drainwater on the surface of agricultural fields sometimes result in highly seleniferous ponding, creating hazards to birds. The potential for similar hazards developing in the In-Valley Treatment is unknown. However, careful management of irrigation water and tailwater may be sufficient to avoid or minimize the potential for ponding. The IVT project description discusses general protective measures for wildlife. If ponding occurs despite careful management, wildlife risks will be evaluated (by Service or Service-approved biologists) and if adverse wildlife exposure to contaminants is detected, irrigation of the IVT field will cease until an irrigation method that does not cause ponding is identified and implemented (Reclamation 2000a).

San Joaquin kit fox, *Vulpes macrotis mutica* (E)

Attached in Appendix D are the 1999 *U.S. Fish and Wildlife Service Standardized Recommendations for Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance*. The GBP proponents have agreed to follow these protocols.

At the recommendation of Service biologists, GBP proponents in the In-Valley Treatment area agree to adopt an additional practice to the above kit fox protocols. Kit foxes may locate dens in soil banks along the edge of farms (S. Jones, pers. comm.). A common farming practice is to remove all exotic vegetation with herbicides down to bare soil. This is known as a @clean farming@ practice. To ensure protection of denning kit foxes attracted into the In-Valley Treatment area, especially during pupping season, GBP proponents agree to plant, and mow when necessary, drought tolerant native species on soil banks within the IVT facility. The National Resource Conservation Service provides informational handbooks on native plants for erosion control, landscaping and maintenance along right-of-ways. These plants can be planted without fertilizers, and, once established, can ward off weeds that can be maintained without herbicides.

Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (VELB) (T)

Any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level are considered VELB habitat. Surveys will be conducted on IVT project sites at least 6 months before construction activities to locate elderberry plants. Elderberry plants will be avoided if possible. If elderberry plants cannot be avoided, consultation with the Service will be required. An incidental take permit from the Service will be necessary to remove or transplant elderberry plants. Transplanting of elderberry plants will follow the Service=s protocols and will be included in the revegetation plan (USFWS 1999). Sixty days before construction, a pre- construction survey will be conducted to flag remaining elderberries. During construction bright orange construction fencing or similar material will temporarily fence plants so they are not disturbed. The fence will run at least 20 feet from the dripline of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level.

California tiger salamander, *Ambystoma californiense* (C)

Grazing pasture could increase in the IVT area from 250 to 1,000 acres (Panoche Drainage District 2000). Stock ponds that mimic ephemeral pools are potential habitat for California tiger salamanders. Livestock will be watered with man-made, above-ground containers. If stock ponds are created, measures will be initiated to interrupt the establishment of bull frog populations (predators of both California tiger salamanders and giant garter snakes) and predatory fish. Stock ponds need to be allowed to go dry every year, preferably in August.

Giant garter snake, *Thamnophis gigas* (T)

Giant garter snake may occur in permanent aquatic habitat or habitats seasonally flooded during the snakes active season (early-spring through mid-fall), such as marshes, sloughs, ponds, low gradient streams, irrigation and drainage canals, and rice fields. If habitat is present in the IVT area, a giant garter snake survey will be conducted at least 6 months before construction begins. If giant garter snakes are found or their habitat may be affected, consultation with the Service will be required.

Construction activity within giant garter snake habitat will be limited to May 1 through October 1, when the snakes are usually active. Other construction times would require additional guidance from the Service to determine if additional measures are necessary, as giant garter snakes are more susceptible to take when occupying underground burrows or crevices. The IVT project area will be surveyed for the snake 24-hours prior to construction activities, and any sightings reported to the Service. Survey of the IVT project area will be repeated if a lapse

in construction activity of 2 weeks or greater has occurred. IVT construction personnel will receive Service-approved worker awareness training to instruct workers to recognize the snake and its habitat.

Giant garter snake habitat within and adjacent to IVT construction sites will be flagged as environmentally sensitive areas. Movement of heavy equipment to and from IVT project sites, staging areas, or borrow sites will be confined to existing roadways to minimize habitat disturbance. Equipment and construction activities will keep at least 200 feet from giant garter snake aquatic habitat to avoid impacts. If construction activities must occur less than 200 feet from habitat, the effected area will be confined to the minimum necessary for construction activities. A Service-approved biologist will be on site during clearing and grubbing of wetland vegetation. Any dewatered habitat will remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat. If a snake is encountered during construction, activities will stop until it successfully escapes the project area or until capture and relocation have been completed by a Service-approved biologist. Disturbed areas will be returned to pre-project conditions following construction.

A Service-approved biologist will inspect the sites of proposed culverts from the 1,100 acre annexation. The same protocols will be implemented for pre-construction surveys, monitoring, and avoidance of giant garter snake.

5.6 Monitoring

The GBP will includes a monitoring program to provide data with which to evaluate whether the terms and conditions under which the project was allowed to proceed were being met. The monitoring program will be updated in 2001 with the coordination and cooperation of Reclamation, the Service, the USGS, the U.S. Environmental Protection Agency, the Regional Board, the California Department of Fish and Game (CDFG), and the Authority.

Thirteen monitoring stations are located throughout the Project Area in the San Luis Drain, conveyance canals, wetland channels, and San Joaquin River (see Figure 3). The following parameters will be monitored: water quality, , flow, , biotic tissue sampling, community analysis, toxicity testing, bioaccumulation analysis, and sediment quality monitoring (Reclamation *et al.* 1996).

Annual summary reports have been produced to document multi-agency data collection efforts. Each report builds on previous information allowing for evaluation of changes of conditions over time. Monthly data reports have been published by the San Francisco Estuary Institute, which also maintains a web

page for the Project.

6.0 SPECIES ACCOUNTS

This section includes summary accounts for the federally-listed species known to occur within the Project Area or may be potentially affected by the project. The summaries include habitat preference, general distribution, and some special consideration as they relate to evaluating potential project effects.

6.1 Mammals

San Joaquin kit fox, *Vulpes macrotis mutica* (E)
The historical range of the San Joaquin kit fox includes most of the San Joaquin Valley but it has declined due to fragmentation of its habitat. Today, kit fox populations have been reduced by more than half, with the largest portion of the range remaining in the southern and western parts of the valley (USFWS 1998). In the central portion of their range, the kit fox is associated with Valley sink shrub, Interior Coast Range saltbrush scrub, Upper Sonoran subshrub scrub and annual grassland, the remaining native grasslands. Kit fox populations are found in the Panoche Hills and east of the San Joaquin River (Harris 2000). The CNDDB lists an observation of a kit fox in the San Luis NWR in 1990. Agriculture dominates this region where kit foxes mostly inhabit grazed, non-irrigated grasslands, but also live next to and forage in tilled or fallow fields, irrigated row crops, orchards, and vineyards (USFWS 1998). The species utilizes grasslands, scrublands, row crops, irrigated pasture, vineyards and grazed grasslands where it can dig friable soil for its dens.

The diet of kit foxes varies geographically, seasonally and annually, based on temporal and spatial variation in abundance of potential prey. In the southern portion of their range, kangaroo rats, pocket mice, white-footed mice, and other nocturnal rodents comprise about one-third or more of their diets. Kit foxes also prey on California ground squirrels, black-tailed hares, San Joaquin antelope squirrels, desert cottontails, ground-nesting birds, and insects. Dens are used by the fox for temperature regulation, shelter from adverse environmental conditions, and escape from predators. Kit foxes excavate their own dens, use those constructed by other animals, and use human-made structures (culverts, abandoned pipelines, and banks in sumps or roadbeds). Kit foxes often change dens and many dens may be used throughout the year. However, evidence that a den is being used by kit foxes may be absent. Kit foxes are subject to competitive exclusion or predation by other species, such as the nonnative red fox, coyote, domestic dog, bobcat, and large raptors.

6.2 Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (T)
This subspecies of Canada goose's breeding populations inhabit the small Aleutian Island of Buldir. The decline of this subspecies is largely attributed to predation resulting from the introduction of foxes and other small mammals to the Aleutian Islands during the period 1836 to 1930. The Buldir population presently winters only in the Central Valley (USFWS 1982) in an area near Colusa, and on scattered feeding and roost sites along the San Joaquin River from Modesto to Los Banos (Jones and Stokes Associates and CH_2M Hill 1986). In these areas, Aleutian Canada geese winter in wetlands and cropland on the Valley floor. Aleutian geese are very traditional in their selection of foraging and roosting locations. They forage primarily in the hours around dawn and dusk, and roost in the afternoon and at night.

Bald eagle, *Haliaeetus leucocephalus* (T)
The bald eagle is a large raptor, a member of the family Accipitridae. The bald eagle is the only North American representative of the fish or sea eagles, and is endemic to North America. The breeding range of the bald eagle includes most of the continent, but they now nest mainly in Alaska, Canada, the Pacific Northwest states, the Great Lake states, Florida, and Chesapeake Bay. Adults average about 3 feet from head to tail, weigh approximately 10 to 12 pounds and have a wingspread that can reach 7 feet. Generally, females are larger than the males. The characteristic adult plumage consists of a white head and tail with a dark brown body. Juvenile eagles are completely dark brown and do not fully develop the white head and tail until the fifth or sixth year.

Fish are the primary food source but bald eagles will also take a variety of birds, mammals, and reptiles (both live and as carrion) when fish are not readily available. During winter, habitat use by eagles changes. Eagles feed from a variety of water bodies, including lakes, rivers, and flooded areas, where they take waterfowl, other waterbirds, and fish, especially dead, recently spawned salmon. At night, birds roost in the nesting territories or in traditional winter communal roost areas (Detrich 1986). Communal winter roosts occur in old, open forest stands near feeding grounds or in riparian woodlands (Detrich 1986). Scattered smaller groups of wintering eagles occur throughout the state near reservoirs, and typically in close proximity to large concentrations of over-wintering migratory waterfowl. Bald eagles are occasional winter visitors to the San Luis NWR Complex and have been observed in the Grasslands area (Reclamation 1991b). There are no recorded occurrences of this species in the CNDDB on the twenty-

two quad sheets covering land within or adjacent to the Project area.

Mountain plover, *Charadrius montanus* (PT)
The mountain plover is a medium-sized (7-inch long), dull brown shorebird that occurs in grassy upland habitats. The mountain plover formerly bred throughout the dry prairies of the western Great Plains. Nearly half the remaining breeding population is now found in Colorado and Montana (Graul 1975, Knowles *et al.* 1982). Wintering birds are found in the San Joaquin Valley, Southern California, Arizona, Texas, and northern Mexico. Wintering populations of plovers in California have been declining. On the wintering grounds, mountain plovers congregate in flocks of fifteen to several hundred birds, feeding on alkaline flats, grazed pastures and plowed fields. Their diet consists primarily of insects, including beetles, crickets, grasshoppers and ants. Mountain plovers are occasional visitors to the San Luis NWR Complex (Tim Keldson, pers. comm.). There are no recorded occurrences of this species in the CNDDB on the twenty-two quad sheets covering land within or adjacent to the Project area.

6.3 Reptiles

Blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) sila* (E)
Blunt-nosed leopard lizard is endemic to the San Joaquin Valley. The currently known occupied range is in scattered parcels of undeveloped land on the Valley floor including wild lands near Firebaugh and Madera (USFWS 1998). They usually find suitable habitat in Valley needlegrass grassland, nonnative (annual) grassland, and alkali playa (Holland 1986). Leopard lizards use small rodent burrows for shelter from predators and temperature extremes (Tollestrup 1979). These burrows are usually abandoned ground squirrel tunnels, or occupied or abandoned kangaroo rat tunnels (Montanucci 1965). Diet consists primarily of insects (mostly grasshoppers, crickets and moths) and opportunistically of animals in the available size range, chiefly other lizards. Blunt-nosed leopard lizards have been sighted near the San Luis refuge boundaries but have not been documented on-site. However, as habitat occurs on the refuge, they probably occur there and are thus in the project area (Tim Keldson, pers. comm.) There are three recorded observations of this species in the CNDDB in Madera County, 20 miles east of the GDA, and five occurrences in the foothills west of the GDA. There are no recorded occurrences within the GDA.

Giant garter snake, *Thamnophis gigas* (T)
The giant garter snake is one of the largest garter snakes, reaching a total length of at least 63 inches. Females tend to be slightly longer and proportionately heavier

than males. Female giant garter snakes typically weigh 1-1.5 pounds. Dorsal background coloration varies from brownish to olive with a checkered pattern of black spots, separated by a yellow dorsal stripe and two light colored lateral stripes. Giant garter snakes feed primarily on small fishes, tadpoles, and frogs (Fitch 1941, Hansen 1980, Hansen 1988).

Habitat requisites consist of (1) adequate water during the snake's active season (early-spring through mid-fall) to provide food (fish and amphibians) and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season; (3) grassy banks and openings in waterside vegetation for basking; and (4) higher elevation uplands for cover and refuge from flood waters during the snake's dormant season in the winter (Hansen 1980).

The giant garter snake inhabits small mammal burrows and other soil crevices above prevailing flood elevations throughout its winter dormancy period (November to mid-March). Giant garter snakes typically select burrows with sunny exposure along south and west facing slopes. The breeding season extends through March and April, and females give birth to live young from late July through early September (Hansen and Hansen 1990). Brood size is variable, ranging from 10 to 46 young, with a mean of 23 (Hansen and Hansen 1990). Young immediately scatter into dense cover and absorb their yolk sacs, after which they begin feeding on their own. Although growth rates are variable, young typically more than double in size within the first year. Sexual maturity averages three years for males and five years for females.

During the snakes' active season, giant garter snakes may occur in permanent aquatic habitat or seasonally flooded habitats such as marshes, sloughs, ponds, low gradient streams, irrigation and drainage canals, and rice fields (USEPA 2000). Giant garter snakes are typically absent from larger rivers and other water bodies that support introduced populations of large, predatory fish, and from wetlands with sand, gravel, or rock substrates (Hansen 1980, Rossman and Stewart 1987, Brode 1988, Hansen 1988). Riparian woodlands do not provide suitable habitat because of excessive shade, lack of basking sites, and absence of prey populations (Hansen 1980).

The aquatic habitat in Mud Slough is potentially suitable for giant garter snakes, but no occurrences of garter snake from Mud Slough (North) are documented. Giant garter snakes are known from Los Banos Creek, a different Mud Slough southeast of Los Banos, and the Volta Wasteway, in the project vicinity (Wylie undated, Beam *et al.* undated). Eleven snakes were captured (plus eight additional

recaptures) in the U.S. Geological Survey=s spring and fall 1998 survey of the North Grasslands area (Los Banos Creek and Volta State Wildlife Area). Snake densities were considered to be extremely low in comparison to study areas in the Sacramento Valley. Numbers may reflect that surveys were conducted during usually wet cool weather during spring (Wylie undated). In 1999, seven sites were trapped and 14 new garter snakes were captured with 11 recaptures. No recaptures were made of the previous season. Three snakes were located during walking surveys (two road kills and one live capture).

Although habitat has been lost or degraded throughout the Central Valley, there have been many recent sightings of giant garter snakes in the Sacramento Valley while there have been very few recent sightings within the San Joaquin Valley. The 1995 report on the status of giant garter snakes in the San Joaquin Valley (Hansen 1996) indicates that Central San Joaquin Valley giant garter snake numbers appear to have declined even more dramatically than has apparently suitable habitat. Factors in addition to habitat loss may be contributing to the decline. Factors which affect giant garter snakes within suitable habitat include interrupted water supply, poor water quality, and contaminants (Hansen 1996).

There are twenty-five recorded observations of this species in the CNDDB within the twenty-two quadsheets covering land within and adjacent to the Project area. All are located north of the GDA within the refuges and other farmlands. One was observed in 1976 near Firebaugh just outside the GDA. There are no recorded observations of this species within the GDA.

6.4 Amphibians

California tiger salamander, *Ambystoma californiense* (C)
The California tiger salamander is a large, stocky, terrestrial salamander with a broad, rounded snout. This distinct population segment of the species was proposed as endangered on January 19, 2000 (65 **FR** 3110). California tiger salamanders are restricted to California, and their range does not overlap with any other species of tiger salamander (Stebbins 1985). California tiger salamanders prefer to breed in natural ephemeral pools, large vernal pools, or ponds that mimic ephemeral pools (stock ponds that go dry). California tiger salamanders have been found in surveys of vernal pools in the San Luis NWR Complex (D. Woolington, pers. comm.). A 1994 refuge sampling report notes that California tiger salamanders have been particularly common in the vernal pools of Kesterson, but the 1994 sampling was probably too early for that season (Peters 1994). The CNDDB shows four occurrences in the vicinity of the Project Area. The factors believed to be responsible for the decline of the species are habitat loss due to

conversion of natural habitat to intensive agriculture, urban development, habitat fragmentation, and agricultural contaminants.

California tiger salamanders spend much of their life estivating in underground retreats where it is moist and dark. From April to June, as the ephemeral ponds evaporate, they disperse to their burrows. They are poor burrowers, and so require refugia for the dry months provided by ground squirrels, gophers and other burrowing mammals. Once fall and winter rains begin, they emerge from these retreats on nights of high relative humidity and during rains to feed and to migrate to the breeding ponds. Adults may migrate up to 2 kilometers (1.2 miles) from summering to breeding sites. The distance from breeding sites may depend on local topography and vegetation. Eggs hatch in 10 to 14 days with newly hatched larvae ranging from 11.5 to 14.2 millimeters (0.45 to 0.56 inch) in total length. Larvae feed on algae, small crustaceans, and mosquito larvae for about 6 weeks after hatching, when they switch to larger prey (P.R. Anderson 1968). Larger larvae have been known to consume smaller tadpoles of Pacific treefrogs and California red-legged frogs as well as many aquatic insects and other aquatic invertebrates (J.D. Anderson 1968; P.R. Anderson 1968).

There are eight recorded observations of this species in the CNDDB in the twenty-two quadsheets that cover lands within and adjacent to the Project area. All occurrences were in the San Luis and Kesterson NWRs and in Merced County, east of the San Joaquin River. There are no recorded occurrences of this species in the GDA.

6.5 Fish

Winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
Central Valley spring run chinook salmon, *Oncorhynchus tshawytscha* (T)
Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C)

Salmon occur in the Sacramento River and it tributaries, Suisun Marsh, the San Joaquin River, as well as five east-side tributaries to the San Joaquin including the Merced, Tuolumne, Stanislaus, Mokelumne and Cosumnes rivers. Salmon are also found in the Sacramento-San Joaquin Delta (Delta) region (Moore *et al.* 1990) and are sometimes are found in the Calaveras river. Water flowing from the grassland region flows through the San Joaquin River and eventually makes its way through the Delta. Salmon are anadromous fish, meaning they spend most of their lives in the ocean (two to three years) and migrate upstream to their home rivers to spawn. After spawning, adult salmon die. San Joaquin chinook generally begin arriving in the system in the early fall. Salmon usually begin entering San Joaquin

River tributaries by mid-October and have completed spawning by mid-December (USFWS 1996). Between October and January, the CDFG operates a barrier across the San Joaquin River near Hills Ferry (upstream of the Merced River confluence) to prevent salmon migration.

Eggs incubate in the gravel for 10-12 weeks, depending on temperature. Sac fry hatch but remain in the gravel until the yolk sack is absorbed. Juveniles emerge and feed on aquatic invertebrates for an additional 8-12 weeks until reaching 75-100 millimeters fork length. From mid-March through early June, juvenile undergo smolting changes necessary for the transformation from fresh water to the ocean.

There are no occurrences of these species in the CNDDB for the twenty-two quadsheets covering lands within and adjacent to the Project area.

Delta smelt, *Hypomesus transpacificus* (T)
Delta smelt are an euryhaline species (tolerant of a wide salinity range) that spawn in fresh water. Delta smelt usually live for only one year. Most of their lifespan is spent in the freshwater- saltwater mixing zone of the Sacramento-San Joaquin Delta and Suisun Bay. When delta smelt are ready to spawn, they move upstream into river channels and tidally-influenced backwater sloughs. Delta smelt feed primarily on planktonic copepods, cladocerans (small crustaceans) amphipods, and to a lesser extent insect larvae. Larger fish may also feed on opossum shrimp (USFWS 1996). Delta smelt are found in the Sacramento-San Joaquin Delta and Suisun Bay and have historically ranged upstream as far as Sacramento on the Sacramento River and Mossdale on the San Joaquin River. Water quantity and quality in the San Joaquin River affect delta smelt spawning success (USFWS 1996). There are no occurrences of this species in the CNDDB for the twenty-two quadsheets covering lands within and adjacent to the Project area.

Sacramento splittail, *Pogonichthys macrolepidotus* (T)
Sacramento splittail are endemic to California's Central Valley where they were once widely distributed in lakes and rivers (Moyle 1976). Sacramento splittail live in freshwater and some estuarine systems. Splittail were historically found as far north as Redding on the Sacramento River and as far south as the site of Friant Dam on the San Joaquin River (Rutter 1908). Sacramento splittail are benthic foragers that feed on opossum shrimp, although detrital material makes up a large percentage of their stomach contents (Daniels and Moyle 1983). Earthworms, clams, insect larvae, and other invertebrates are also found in the diet. Predators include striped bass and other piscivores. Sacramento splittail are sometimes used

as bait for striped bass (USFWS 1996). Splittail usually spawn on submerged vegetation on temporarily flooded upland and riparian habitat. Splittail were caught in Mud and Salt Sloughs in June 1998, an El Niño year (Beckon *et al.* 1999).

Central Valley steelhead, *Oncorhynchus mykiss* (T)

Steelhead are the anadromous form of rainbow trout. Steelhead trout sporadically use the San Joaquin River and its tributaries for in-migration, spawning, rearing and out-migration. Studies are underway to determine if the rainbow trout that spawn in the Merced River are anadromous. (Tim Heyne, pers. comm.). The steelhead spawning migration in the Central Valley begins in early fall (sometimes as early as mid-August), peaking in October and November and extending through March. Spawning occurs in December through April (McEwan and Jackson 1996). Unlike other Pacific salmonids, steelhead are capable of spawning more than once before dying. Depending on water temperature, steelhead eggs may incubate in redds for 1 2 to 4 months before hatching as alevins. Following yolk sac absorption, fry emerge from the gravel and begin to feed. Fry may remain in the river for 1 to 4 years before smolting and emigrating to the ocean. They mature in 1 to 4 years at sea before returning to their natal streams to spawn as 4 or 5-year olds (Barnhart 1986). There are no occurrences of this species in the CNDDB for the twenty-two quadsheets covering lands within and adjacent to the Project area.

6.6 Invertebrates

Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)
Valley elderberry longhorn beetles are dependent on their host plant, elderberry (*Sambucus* spp.), which is a common component of the remaining riparian forests of the Central Valley. The beetle's larvae live inside the elderberry bushes, before boring a hole in the stem and later emerging as adults. The beetle's current distribution is patchy throughout the remaining habitat of the Central Valley, north to Trinity County, south to San Diego County, and east to San Bernardino County (Barr 1991). There are no occurrences of this species in the CNDDB for the twenty-two quadsheets covering lands within and adjacent to the Project area.

Conservancy fairy shrimp, *Branchinecta conservatio* (E)
longhorn fairy shrimp, *Branchinecta longiantenna* (E)
vernal pool fairy shrimp, *Branchinecta lynchi* (T)
vernal pool tadpole shrimp, *Lepidurus packardi* (E)
Listed vernal pool crustaceans may occur in vernal pools, vernal swales, and other seasonal wetlands that pond water for three weeks or more. These shallow depressions fill with water from winter storms and subsequently dry up during spring or early summer. Vernal pool communities are a special form of wetland found within Annual Grasslands habitats throughout California and occur within the Grassland Wetlands Area. Vernal pools exist on the Kesterson and San Luis NWRs. Vernal pool fairy shrimp inhabit pools with clear to tea-colored water, most commonly in grass or mud bottomed swales, or basalt flow depression pools in unplowed grasslands. They have been collected from early December to early May. Vegetation is characterized by annual herbaceous plants (Holland and Keil 1987). The length of time that the water persists, salinity, and alkalinity generally determine plant species composition.

Nearly all fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus. The females carry the eggs in an oval or elongate ventral brood sac. The eggs are either dropped to the pool bottom or remain in the brood sac until the female dies and sinks. The resting or "summer" eggs are known as "cysts." They are capable of withstanding heat, cold and prolonged desiccation. When the pools refill in the same or subsequent seasons, some, but not all, of the cysts may hatch. The cyst bank in the soil may contain cysts from several years of breeding. The early stages of the fairy shrimp develop rapidly into adults. Once they reproduce these adult populations often disappear early in the season long before the vernal pools dry up.

There are sixteen recorded observations of these species in the Kesterson and San Luis NWRs.

6.7 Plants

Colusa grass, *Neostapfia colusana* (T)

Colusa grass is a robust, tufted annual in the grass family that grows 3-12 inches tall and occurs in large or deep vernal pools with substrates of adobe mud (Stone *et al*. 1988). It is restricted to the Sacramento and San Joaquin Valleys. Approximately 44 populations remain along a 100 mile stretch of the eastern San Joaquin Valley in Merced and Stanislaus counties. Loss of habitat from conversion to agricultural use is the biggest threat to Colusa grass populations. Herbicide contaminated runoff and competition from introduced weed species are also threats. This rare species is found on the non-irrigated upland habitats on the San Luis and West Bear Creek Units of the San Luis NWR Complex (Reclamation 2000a).

7.0 EXISTING ENVIRONMENT

This section briefly describes habitats that may be associated with federally-listed, proposed for listing, and candidate species that may occur within project area boundaries and that may be affected by project-related activities. These environments include: (1) Native Habitats: annual and perennial grasslands, vernal pools, iodine bush scrub, great valley mixed riparian forest freshwater marsh wetlands aquatic habitat secondly, and (2) Induced Habitats: ruderal, agricultural and managed wetlands.

7.1 Native Habitats

Native habitat types within the Project Area are identified and described in this section. Where present, these habitats by support numerous plant and wildlife species, including threatened and endangered species. Habitat types have generally been classified according to the standard descriptions used in the Wildlife Habitats Relationship system (Mayer and Laudenslayer 1988). However, some of the habitat types are derived from the natural community classification utilized by the California Natural Diversity Data Base (CNDDB 2000). These habitat types are discussed below, with the description of each habitat type=s relative location and distribution, and the dominant vegetative structure.

Annual and Perennial Grasslands

These habitats occur throughout the Central Valley, mostly on level plains to gently rolling foothills. Annual grasslands are composed primarily of annual grass and forb species and are found at elevations immediately higher than or

surrounding valley-foothill riparian and iodine bush scrub habitats. Perennial grasses, such as purple needle grass and alkali sacaton, are typically found in moist, lightly grazed relict area within the annual grassland habitat. Annual grasses found in grassland habitats include wild oats, soft chess, ripgut brome, medusa head, wild barley, red brome, and slender fescue. Perennial grasses found in grassland vegetation include purple needlegrass and alkali sacaton. Forbs commonly encountered in grassland vegetation include long-beaked filaree, redstem filaree, clover, Mariposa lily, popcornflower, and California poppy. Blunt-nosed leopard lizards will live in grassland areas in abandoned or occupied rodent burrows (USFWS 1998). San Joaquin kit foxes will utilize grassland habitats in areas of gentle slopes and well-drained, fine loam and sandy-loam soils that are dominated by native annual grasses and herbs.

Annual and perennial grasslands are located within the refuges and do not occur in the GDA.

Vernal Pools

Vernal pools are a special form of wetland found within grassland habitats throughout California and occur within the Grassland Wetlands area. Vernal pools are shallow depressions filled with water from winter storms that subsequently dry up during spring or early summer. The length of time that the water persists, salinity, and alkalinity generally determine plant species composition. Vegetation is characterized by annual herbaceous plants (Holland and Keil 1987)

Vernal pools support a flora dominated by annual species that germinate when the pools become saturated or inundated and complete their flowering, set seed, and die as the pool dries. Vernal pool species flower along the drying margins of the pools, resulting in conspicuous zonation patterns being formed by consecutively blooming species. Characteristic dominant plants include popcornflowers, low barley, downingia, coyote thistle, goldfields, meadowfoam, owl's clover, pogogyne, woolly marble, and navarretia.

Although vernal pools are an ephemeral aquatic habitat, invertebrates and amphibians also have adapted to this resource. When standing water is available, the California tiger salamander, western spadefoot toad, and Pacific treefrog may use the pools for egg laying and for the development of young. Aquatic invertebrates such as cladocerans, copepods, branchiopods, and crawling water beetles may also inhabit vernal pools. In winter and spring, waterbirds such as mallard, cinnamon teal, killdeer, California gull, green-backed heron, great blue heron, and great egret may use vernal pools for resting and foraging grounds. Western kingbird, black phoebe, and Say's phoebe feed on flying insects above vernal pools. Several federally-listed branchiopods, including longhorn fairy

shrimp, conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp are found in vernal pools.

Vernal pools are located in the refuges and do not occur in the GDA.

Iodine Bush Scrub

This succulent chenopod shrub habitat is dominated by iodine bush. Plant species found in this habitat include alkali heath, alkali weed, pickleweed, alkali sacaton, and saltgrass. In addition, plant species such as greasewood, rusty molly, samphire, bush seepwood, and shadscale may be present (Sawyer and Keeler-Wolf 1995). This vegetation type is included in the Holland classification of alkali scrub or alkali sink shrubland. Iodine bush scrub occurs in San Joaquin Valley in areas with low precipitation and relative humidity, hot summer and cool winter temperatures, and high levels of solar radiation. Plant species composition varies along moisture, salinity, and micro-topographic gradients (Holland and Keil 1987). This habitat has a structure that can vary greatly within short distances (Kuchler 1977).

Common birds that forage or nest in iodine bush scrub include roadrunner, mourning dove, blue- gray gnatcatcher, common raven, sage sparrow, white-crowned sparrow, house finch, and American and lesser goldfinch. Common mammals include pocket gopher, California ground squirrel, desert cottontail, deer mouse, California vole, Heermann's kangaroo rat, black-tailed hare, striped skunk, badger, and coyote. Reptiles, such as side-blotched lizard, western whiptail, western fence lizard, gopher snake, and western rattlesnake, are commonly observed in iodine bush habitat. Flocks of the proposed threatened mountain plover may be observed wintering in this habitat.

Iodine bush scrub habitat is located in the refuges and does not occur in the GDA.

Great Valley Mixed Riparian Forest

This habitat, also described as riparian forest by Kuchler (1977), is found in association with annual and perennial grasslands and other habitats, and ranges in elevation from sea level to 3,000 feet. Riparian forest habitats occur along creeks, canals, and rivers and are found throughout the Project Area. This vegetation type has adapted to cope with wide yearly and seasonal fluctuations in flow volumes, abundant floodplain moisture, and a dynamic erosion- deposition cycle. Great Valley mixed riparian forest habitats are typically found in valleys bordered by gently sloping alluvial fans, lower foothills, and coastal plains (Holland and Keil 1987).

Dominant species include cottonwood, California sycamore, and valley oak. Typical shrubs include California wild grape, wild rose, California blackberry, blue elderberry, willows, hoary nettle, poison hemlock, rushes, and grasses commonly found in the herbaceous layer (Reclamation 1991a). The endangered valley elderberry longhorn beetle live in elderberry shrubs that grow in riparian areas.

Remnant riparian forests in the northern portion of the Project Area, are restricted to the San Joaquin River channel, isolated stands along some intermittent tributaries (such as Los Banos Creek and Panoche Creek), and some of the larger sloughs. Approximately 500 acres of riparian habitat are located along Mud and Salt sloughs (Reclamation 1991a). Four percent of historic San Joaquin Valley riparian habitat remains today.

Great Valley Mixed Riparian Forest occurs along the San Joaquin River and Mud and Salt Sloughs within the refuges; it does not occur in the GDA.

Freshwater Marsh Wetlands

Freshwater marsh wetlands are characterized by the presence of erect, rooted, herbaceous, water- seeking vegetation. Freshwater marsh wetlands are inundated or saturated for a significant period of time, and anaerobic conditions exist in the root zone. Vegetation of this wetland type can vary from small isolated clumps within a waterbody to large uninterrupted expanses covering many acres. Freshwater marsh develops where fine-textured sandy and silty soils are inundated or saturated for long periods during the growing season. The community is intolerant of quickly flowing water, water depths exceeding 5 feet, rapid or wide fluctuations in water level, and saltwater. This community is restricted to ponds, canals, sloughs, river backwaters, and similar sites. Freshwater marshes within the Central Valley provide important habitat for waterfowl and a variety of other wildlife species, including Aleutian Canada geese, grebes, herons, egrets, bitterns, coots, shorebirds, rails, hawks, owls, muskrat, raccoon, opossum, and beaver. Many other upland species such as ring-necked pheasant, California quail, black-tailed hare, and desert cottontail take cover and forage at the margins of wetland habitats. Many amphibians and reptiles such as common garter snake, aquatic garter snake, giant garter snake, Pacific treefrog, and bullfrog also breed and feed in freshwater marsh habitats of the region.

Freshwater marsh wetlands are located within the refuges and do not occur in the GDA.

Aquatic Habitat

The Project Area includes 93 miles of natural or semi-natural open wetland

channels. The San Luis Drain includes 28 miles of concrete-lined open-water channels. The aquatic habitats within the Project Area are divided into eight subareas and include (1) GDA, (2) Mud Slough, (3) Salt Slough, (4) Wetland Channels, (5) San Joaquin River south of Mud Slough, (6) San Luis Drain and GDA Channels, (7) San Joaquin River north of Mud Slough to the Merced River, and (8) San Joaquin River north of Merced River to Crows Landing. With the exception of the GDA, which is primarily irrigated agricultural land, and the San Luis Drain and GDA channels, which are mostly constructed transport facilities for agricultural drainage, the aquatic habitat for fish species within these subareas is generally similar and the fish species present will overlap to a large extent. Because of the physical characteristics and artificial nature of the GDA and the San Luis Drain and GDA channels, these subareas are considered to provide only limited aquatic habitat for fish species. Typical species found in the San Luis Drain include bullfrog, mosquitofish, carp, inland silverside, and fathead minnow. The remaining subareas are comprised of either riverine or wetland aquatic habitats and as such are far more valuable to fish species.

Mud and Salt Sloughs are tributaries to the San Joaquin River that receive drainage from the GDA as well as from wetlands and other farms within their watersheds (Reclamation 1991a). The San Joaquin River in the vicinity of the Project Area has a variety of aquatic habitats including slow-moving backwaters with emergent vegetation and shallow tule beds and deep pools of slow-moving water in the main river (Moyle 1976). The natural habitat and water quality of the San Joaquin River and Mud and Salt Sloughs is highly modified by the addition of canals, agricultural drainwater, and seasonal regulation of main-stem river flows (Saiki 1998; Reclamation 1991a). These additions have resulted in poorer quality water (accumulations of salt, trace elements, and nutrients) downstream to the Merced River (Regional Board 1988). Birds, such as mallards, gadwalls, great blue herons, and great egrets, utilize the sloughs.

The general aquatic habitat conditions existing within the Project Area are more favorable to introduced species. The majority of the species found in the Project Area are introduced species (Saiki 1998). Introduced species exhibit opportunistic life history traits (broad environmental tolerances, high fecundity, early sexual maturation, long reproductive season, omnivorous diet, relatively short life span) that help them survive in conditions where less tolerant native species cannot (Brown 1998). The taxonomic composition of fishes within the Project Area did not change in response to the implementation of the Grassland Bypass Project in 1996, and the existing composition is similar to taxa present in 1980-81 and 1986 (Saiki 1998). However, sampling for this study occurred only one year after the project began and project benefits had not been fully realized and thus would not

have been reflected in the fish populations within the Grassland Area as yet.

7.2 Induced Habitats

Natural habitats in the San Joaquin Valley have been largely replaced by induced habitats such as ruderal, agricultural and managed wetlands that provide a much more varying and diminished benefit.

Agricultural Lands

Cropland is the largest land use in the San Joaquin Valley. Ninety-eight percent of cropland is irrigated (CDWR 1999). Six agricultural types have been identified in the Central Valley: pasture, orchard-vineyard, row crops, grain, rice, and cotton. The intensive management of agricultural lands, including disking, grazing, crop rotation, and the use of chemicals, reduces the value of these habitats for wildlife. However, many wildlife species have adapted to particular crop types and now use them for foraging and nesting. For example, pre-irrigation of agricultural lands can provide valuable habitat for migratory waterfowl such as pintail and mallard ducks (Moore *et al*. 1990). The Project Area has 69,554 acres of agricultural land (CDWR 1999). Small fields of corn and wheat are grown in the Refuges.

Ruderal

Ruderal is a disturbed habitat. Yellow star thistle, ripgut-brome, bermuda grass, milk thistle, Russian thistle, tree-tobacco, soft chess, pepper-grass, wild oak, Johnson grass, poison hemlock, non-native grasses, and short-podded mustard are species found at project sites. This habitat is occasionally considered grassland or barren depending upon the degree of disturbance. Areas of riprap are also deemed barren. A direct correlation exists between vegetation and the richness of biologic diversity. This habitat is poor quality for wildlife.

Managed Wetlands

The Refuges in the Project Area constitute the largest contiguous block of wetlands in the Central Valley. Seventy-nine percent of the managed wetlands in the San Joaquin Valley occur in the Project Area. (Moore *et al.* 1990). Managed wetlands are used on federal and state refuges and by private hunting clubs in the Project Area to maximize habitat suitability for waterfowl and other wetland-dependent wildlife. Approximately 36,562 acres of managed wetlands are found in the Project Area and vicinity (CDWR 1999).

The water supply to the managed wetlands can still be impaired by subsurface agricultural water that is generally not produced by the GBP. Sump pumps along the Delta-Mendota Canal near the town of Firebaugh discharge selenium-laden flow into the water supply (CEPA 1999). In addition, when flood flows exceed

the capacity of the GBP, surface and subsurface water can enter the water supply. The Regional Board monitors the water supply at five stations and selenium concentrations have on occasion exceeded the 2 Φg/L standard (Reclamation *et al.* 1999) mandated by the Basin Plan (California Regional Water Quality Control Board 1996). The Regional Board and Reclamation have made efforts to identify and control these selenium sources. Levels have not exceeded 2 Φg/L in Salt Slough since March of 1998 (preliminary data, Regional Board http://www.swrcb.ca.gov/rwqcb5/agunit/bypass/f.htm).

There are no managed wetlands in the GDA. Managed wetlands in the Refuges can be broadly categorized into seasonal wetlands, semi-permanent wetlands, and permanent wetlands:

Seasonal Wetland. Seasonal wetlands are flooded in fall and maintained through winter or spring but allowed to dry or are drained through summer.

Semi-permanent Wetlands. Semi-permanent wetlands are frequently the low portions of seasonal wetlands that remain flooded after seasonal wetlands experience summer drying or are drained. This type of wetlands management maintains water on the site for 8 to 12 months annually and provides important summer water and brood ponds for resident waterfowl and other wildlife.

Permanent Wetlands. Permanent wetlands are flooded throughout the year, with periodic drainage to control emergent vegetation and increase productivity. Water is maintained at a depth from 30 to 48 inches. Dominant vegetation includes cattails, tules, and pondweeds.

8.0 EFFECTS OF THE PROPOSED ACTION ON LISTED SPECIES

This section presents the potential effects that could impact special status species as a result of the proposed action. Potential effects can be categorized as having direct[1], indirect[2], and cumulative effects[3] and are discussed as they apply to the Project Area.

The array of GBP activities are primarily, but not exclusively, related to the management and reduction of selenium load in subsurface drainage water, rather than construction activities or water diversions. The primary focus of the effects determination is selenium bioaccumulation, which may effect growth, reproduction and survival of animal species.

8.1 Ecological Risk Assessment for Selenium

Biological Assessment for Grassland Bypass Project, 2001-2009

Assessment of the risks that selenium poses to fish and wildlife can be difficult due to the complex nature of selenium cycling in aquatic ecosystems (Lemly and Smith 1987). Early assessments developed avian risk thresholds through evaluating bird egg concentrations and relating those to levels of teratogenesis (developmental abnormalities) and reproductive impairment (Skorupa and Ohlendorf 1991). In 1993, to evaluate the risks of the Grassland Bypass Project on biotic resources in Mud and Salt Sloughs, a set of Ecological Risk Guidelines based on selenium in water, sediment, and residues in several biotic tissues were developed by a subcommittee of the San Luis Drain Reuse Technical Advisory Committee (CAST 1994; Engberg *et al.* 1998). These guidelines (as recently modified: Table 1) are based on a large number of laboratory and field studies, most of which are summarized in Skorupa *et al.* (1996) and Lemly (1993). For the GBP the selenium risk guidelines have been divided into three levels: No Effect, Level of Concern, and Toxicity. In the No Effect range risks to sensitive species are not likely. As new information becomes available it should be evaluated to determine if the No Effect level should be adjusted. Since the potential for selenium exposure exists, periodic monitoring of water and biota is appropriate.

Within the Level of Concern range there may be risk to sensitive species, and contaminant concentrations in water, sediment, and biota should be monitored on a regular basis. Immediate actions to prevent selenium concentrations from increasing should be evaluated and implemented if appropriate. Long-term actions to reduce selenium risks should be developed and implemented. Research on effects on sensitive or listed species may be appropriate.

Within the Toxicity range, adverse affects are more likely across a broader range of species, and sensitive or listed species would be at greater risk. These conditions will warrant immediate action to reduce selenium exposure through disruption of pathways, reduction of selenium loads, or other appropriate actions. More detailed monitoring, studies on site-specific effects, and studies of pathways of selenium contamination may be appropriate and necessary. Long-term actions to reduce selenium risks should be developed and implemented.

Table 1. Recommended Ecological Risk Guidelines for Selenium Concentrations.

Medium					
Warmwater Fish (whole body)					
Vegetation (as diet)					
Invertebrates (as diet)					
Sediment					
Water (total recoverable Se)					

Avian egg

Notes

These guidelines, except those for avian eggs, are intended to be population based. Thus, trends in means over time should be evaluated. Guidelines for avian eggs are based on individual level response thresholds (e.g., Heinz 1996; Skorupa 1998)

A tiered approach is suggested with whole body fish being the most meaningful in assessment of ecological risk in a flowing system.

The warmwater fish (whole body) Level of Concern threshold is based on adverse effects on the survival of juvenile bluegill sunfish experimentally fed selenium enriched diets for 90 days (Cleveland *et al.* 1993). It is the geometric mean of the @no observable effect level@ and the @lowest observable effect level@.

The Toxicity threshold for warmwater fish (whole body) is the concentration at which 10% of juvenile fish are killed (DeForest *et al.* 1999).

The guidelines for vegetation and invertebrates are based on dietary effects on reproduction in chickens, quail and ducks (Wilber 1980; Martin 1988; Heinz 1996).

If invertebrate selenium concentrations exceed 6 mg/kg then avian eggs should be monitored (Heinz *et al.* 1989; Stanley *et al.* 1996).

The GBP Draft EIR/EIS provides detailed water quality modeling and risk assessments for selenium effects on aquatic resources in the Project Area. That information has been used to determine potential selenium effects on listed species in this section (Reclamation, 2000a).

Special Status Species

8.2 Mammals

San Joaquin kit fox, *Vulpes macrotis mutica (E)*

The Proposed Action includes an In-Valley Treatment element of up to 6,200

acres of land within the GDA (Phase I). Grazing pasture could increase from 250 to 1,000 acres on the site. No native pasture or habitat will be replaced in this action. Planting of salt-tolerant crops such as alfalfa, pasture, and bermuda grass is likely to provide a low-horizon habitat that is attractive to kit foxes and their prey. Conservation measures replacing Aclean farming@ along soil banks with an alternative planting practice has been included in the project description to reduce impacts to denning kit foxes. In general, the habitat replacement of row crops by alfalfa and pasture is considered beneficial for kit foxes.

The diet of kit foxes is principally based on seed-eating nocturnal rodents. It is possible for selenium to bioconcentrate in seeds produced by salt-tolerant grasses. Plant species vary in their ability to uptake selenium and to convert selenium to forms available for assimilation by animal species. Problems with selenium bioaccumulation and toxicity to wildlife are generally associated with aquatic food chains. These proposed salt-tolerant crops are not known to concentrate or biomagnify selenium. Testing of these crops to date has not shown any increased uptake of selenium from drainage reuse (Panoche Drainage District 2000). Monitoring will continue to determine increased selenium uptake by salt-tolerant crops at the IVT.

Kit fox forage extensively within a large area of grasslands and cultivated fields, which minimizes the potential that these species would ingest toxic quantities of prey from the IVT site. However, impacts to a kit fox may occur if a significant portion of its home range overlaps this IVT area. Kit fox populations are found in the Panoche Hills and east of the San Joaquin River (Harris 2000). Although no kit fox ranges are known in the proposed IVT area, they would probably occur (S. Jones, pers. comm.). The CNDDB lists two occurrences of this species on the 23 quadsheets covering lands within and adjacent to the Project area. Both are more than 15 miles from the IVT area.

Chronic exposure to diets with selenium concentrations as low as 1 mg/kg can cause adverse effects on mammals (intestinal lesions and longevity in rats, Eisler 1985). Reproductive impairment has been reported at a dietary exposure of 3 mg/kg (rats, Olsen 1986). In dogs (in the same family as kit fox) sublethal effects were found at a dietary exposure of about 7 mg/kg (Rhian and Moxon 1943). Based on these data, 3 mg/kg would be a conservative Level of Concern threshold, and 7 mg/kg would be a reasonable Toxicity threshold for dietary exposure to selenium applicable to mammals such as the kit fox.

A monitoring program and contingency plan will be designed with recommendations from the Service to address potential kit fox exposure to

selenium. Selenium uptake by salt-tolerant crops irrigated with drainwater at the IVT will continue to be monitored. If selenium concentrations in these crops reach the Level of Concern threshold for dietary effects on mammals (3 mg/kg), a contingency plan and monitoring program will be instituted to determine selenium dietary effects on the small mammal prey of kit fox. In addition, the county trapper can be engaged to shoot coyotes (kit fox surrogates) foraging in the area. Shooting is preferred to leg-traps, which can capture kit fox as well. Hair or blood can be sampled to determine selenium bioaccumulation levels in the coyotes. The monitoring will be elevated to kit foxes if the risk reaches a Level of Concern based on coyote monitoring at Kesterson Reservoir and selenium effects on mammals.

Construction of facilities may impact kit fox habitat in Phase II (subsurface drainage collection system) and Phase III (treatment facilities construction). Most construction will be across agricultural land. In the future, when the construction details of Phase III treatment facilities are known, and should it be determined such facilities are needed, such construction will be evaluated for potential to impact kit fox prey base and habitat. A separate ESA section 7 consultation will likely be needed for the design, construction, and operation of Phase III of the IVT. Conservation measures have been incorporated into the project description to avoid and minimize negative effects to kit fox for Phases I and II of the IVT. Phase I and II construction activities are not likely to adversely affect kit fox.

The GBP may affect San Joaquin kit fox but is not likely to adversely affect them, based on the following:

(1) the extensive foraging area of kit fox within the grasslands, cultivated fields and the vicinity, minimizes the potential that these species would ingest toxic quantities of prey from the Project site,

(2) conservation measures and the Service=s protocols (see Appendix D) have been included in the project description,

(3) salt-tolerant crops are not known to bioconcentrate selenium when irrigated with drainwater, however this will continue to be monitored,

(4) additional monitoring of kit fox prey base and kit fox surrogates (such as coyotes) will be done if selenium in the diet of the prey (seeds) reach

the Level of Concern of 3 mg/kg,

(5) a contingency plan to limit kit fox exposure to selenium will be implemented should selenium levels in kit fox prey or kit fox surrogates reach the Level of Concern of 3 mg/kg.

8.3 Birds

Aleutian Canada goose, *Branta canadensis leucopareia (T)*
No adverse impact is likely to affect this species from construction activities at the project sites. Aleutian Canada geese forage in harvested corn fields, newly planted or grazed pastures, or other agricultural fields (e.g., rice stubble and green barley). Geese forage extensively within a large area of the grasslands and cultivated fields, which minimizes the potential that these species would ingest toxic quantities of plants or seeds from the In-Valley Treatment area. Plant species vary in their ability to uptake selenium and to convert selenium to forms available for assimilation by animal species. These proposed salt-tolerant crops are not known to concentrate or biomagnify selenium. Testing of these crops to date has not shown any increased uptake of selenium from drainage reuse (Panoche Drainage District 2000). Also, irrigation with drainwater will be monitored/controlled to avoid the ponding of water with high selenium concentrations. Therefore, Aleutian Canada goose, which feeds on upland grains, should not be affected by project activities.

bald eagle, *Haliaeetus leucocephalus (T)*
No adverse effect is likely to affect this species from construction activities at the project sites. Bald eagles occur virtually anywhere in California during migration. They nest near water bodies in the northern portion of the state and winter throughout the State wherever suitable prey resources are available (Reclamation *et al.* 2000). In the Project Area during flood events, when drainage flows exceeds the capacity of the Drain and Mud Slough, overflowing onto the floodplain, fish-eating bald eagles may be attracted to widely-dispersed selenium contaminated prey. The extensive foraging area of wintering bald eagles around the Project Area and vicinity minimizes the potential that these species would ingest toxic quantities of prey. The rare event of feeding on contaminated prey is not likely to affect adversely bald eagles.

Mountain plover, *Charadrius montanus (PT)*
No adverse impact is likely to affect this species from construction activities at the project sites. The Proposed Action would include an In-Valley Treatment

element on up to 6,200 acres of land within the Grassland Drainage Area. Salt-tolerant crops would be grown with highly seleniferous subsurface drainwater. Ponding of this water in these fields may create a bioaccumulation hazards to wildlife, in particular, shorebirds and wading birds. Conservation measures described in Section 5.5 have been incorporated into the project description to avoid and minimize negative effects of ponding in the In-Valley Treatment portion of the project. will be evaluated (by Service or Service-approved biologists) and if adverse wildlife exposure to contaminants is detected, irrigation of the IVT field will cease until an irrigation method that does not cause ponding is identified and implemented (Reclamation 2000a).

To assure protection of mountain plover, however, the project proponents will cease irrigation of the IVT field immediately if mountain plover are present. The risk to mountain plover will be evaluated (by Service or Service-approved biologists) and if adverse exposure to contaminants is detected the project proponents will coordinate with the Service to develop protection measures for the mountain plover

It is the determination that the GBP may affect mountain plover but not adversely affect them, based on the following:

(1) general wildlife conservation measures included in the project description for the In- Valley Treatment site to reduce ponding and assess wildlife exposure risks if ponding does occur,

(2) the project proponents will cease irrigation of the IVT field immediately if mountain plover are present. The risk to mountain plover will be evaluated (by Service or Service- approved biologists) and if adverse exposure to contaminants is detected the project proponents will coordinate with the Service to develop additional protection measures for the mountain plover.

8.4 Reptiles and amphibians

Blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) sila (E)*

No adverse impact is likely to affect this species from construction activities at the project sites. Problems with selenium bioaccumulation and toxicity to wildlife are generally associated with aquatic food chains. Native, upland habitat will not be removed or affected by this largely aquatic and agrarian project. Therefore, the

blunt-nosed leopard lizard, which feeds on insects and other terrestrial animals, should not be affected by project activities.

Giant garter snake, *Thamnophis gigas (T)*

The giant garter snake has a restricted distribution and is entirely dependent on its aquatic ecosystem. Construction of facilities may impact giant garter snake habitat in Phase II (subsurface drainage collection system) and Phase III (treatment facilities construction), however, most construction will be across agricultural land. Should there be any giant garter snake habitat discovered in the construction zone, conservation measures have been incorporated into project description to avoid and minimize negative effects to giant garter snake. Construction activities are not likely to affect adversely giant garter snake.

As top predators, giant garter snakes are at risk of exposure to elevated levels of contaminants that bioaccumulate such as mercury and selenium. Over the life of the giant garter snake it is possible for snakes to accumulate contaminants that can impact the growth, survival, and reproduction of individuals, leading to declines in distribution. Water quality impairment of aquatic habitat that supports giant garter snakes could reduce the prey base, contribute to bioaccumulation, impair essential behaviors, and reduce reproductive success.

Selenium is suspected as being a contributing factor in the decline of the giant garter snake populations, particularly for the North and South Grassland subpopulation (i.e., Kesterson NWR complex) (USFWS 1993). Giant garter snakes have not been discovered in Mud Slough (North) but have been found in the vicinity. Agricultural drainage flows result in the discharge of elevated selenium, boron, and other constituents into Mud Slough (North). It is possible that elevated selenium levels in the San Joaquin Valley contributed to the severe decline and possible extirpation of the giant garter snake from the majority of this area. The remaining giant garter snake populations are more commonly found in waterbodies not impaired by selenium.

There is little data specifically addressing the toxicity of selenium for reptiles. Although giant garter snakes are live-bearing snakes, the female does carry the eggs internally and newly born snakes have yolk sacs like other egg laying species. Since most reptiles are egg-laying vertebrates, it is expected that toxicity thresholds for giant garter snakes should be similar to those of fish and birds. The Department of the Interior=s *Guidelines for the Interpretation of the Biological Effects of Selected Constituents in Biota, Water and Sediment (Guidelines)* summarizes background selenium levels in lizards, snakes collected from the San Joaquin Valley, and pine snake hatchlings from New Jersey (USDOI 1998).

Alligator eggs from Florida suggest that reptile eggs are at the same selenium background level as fish and bird eggs (1-3 mg/kg). In the San Joaquin Valley, background levels of selenium in frog tissue range from 1.0 mg/kg to 3.6 mg/kg dry weight. Livers from gopher snakes in reference sites near Kesterson contained 1 - 4 mg/kg selenium. Skinless, whole-body pine snake hatchlings (considered representative of snake eggs) from New Jersey averaged 2.6 mg/kg. The *Guidelines* suggests that it is probably safe to assume whole body concentrations at or above 10 times normal background (or ∃20 mg/kg) are probably toxic to populations of sensitive species (USDOI 1998). Further, the *Guidelines* state that reproductive impairment is likely to be the most sensitive response and snake eggs with selenium concentrations ∃10 mg/kg are being reproductively impaired.

Mercury levels in fish from the lower San Joaquin River and Mud Slough have been found to be elevated (Davis *et al.* 2000; Slotton 2000). The ultimate source is likely the New Idria Mine located in the Panoche/Silver Creek watershed. It has been shown that mercury added to the already selenium enriched test diet of mallards increased the amount of selenium stored in the mallards eggs (Heinz and Hoffman 1998). The potential for this to occur in giant garter snakes in the project area warrants study.

Aside from the selenium contamination, the aquatic habitat in Mud Slough is potentially suitable for giant garter snake, but no occurrences of garter snake are documented. It is not unlikely that giant garter snakes may be attracted to Mud Slough and consume the contaminated fish. About 23 to 46 percent of fish samples at Site D (Mud Slough) would exceed the Toxicity threshold of 9 mg/kg if a critically dry year were to occur in 2001. By 2009, the proportion of fish samples exceeding the Toxicity threshold in a critically dry year would be 5-19 percent under existing waste discharge requirements, 7-24 percent under stakeholder load limits, or 8-27 percent under alterative load limits. Since a significant portion of the fish in Mud Slough are at the Level of Concern and Toxicity ranges, it can be assumed that giant garter snakes, if feeding on the prey base in Mud Slough (north), have the potential to be exposed to levels of selenium that could impair reproduction, but it is unknown if the 9 mg/kg threshold is appropriate for giant garter snakes.

Under the Proposed Action, quarterly biological monitoring of Mud Slough will continue throughout the proposed project life to determine the selenium risk levels at Mud Slough for warmwater fish (Reclamation 2000a). This information can be used to assess risks to the giant garter snake. Through requirements of the Service=s biological opinion on interim water contract renewals (USFWS 2000b), Reclamation will support studies on selenium impacts to giant garter snakes.

To address the risks of the project to giant garter snakes, the project proponents will work cooperatively with the Service and other agencies to support the following actions within the Project Area :

(1) a mark and recapture survey of giant garter snakes to assess population and distribution within the Project Area

(2) study the effects of contaminants (specifically selenium and mercury) on giant garter snake surrogates. This work should lead to the use of biomarkers useful in interpreting selenium risk to giant garter snakes, such as blood selenium concentration, that can be taken during field surveys without harming snakes and tissue samples that can be analyzed from past and future road kill samples.

(3) maintain clean-water delivery channels in a manner that protects and maintains giant garter snake habitat.

(4) determine the amount of existing giant garter snake habitat in the Project Area. An important feature for giant garter snake management is permanent water for a secure prey base of fish and small frogs. The current status of giant garter snake habitat in the Project Area is unknown. A first step in the understanding of available habitat in the Refuges is in tables in Appendix E, *Future State and Federal Refuge Acreage Habitats*. Further studies would have to be completed to better determine the acreage and location of suitable habitat throughout the wetlands and channels of the Project Area.

(5) develop a contingency plan should it be determined that selenium in Mud Slough is negatively impacting giant garter snakes.

Nevertheless, throughout the Project Area, wetland habitat and giant garter snake habitat, has improved and will continue to improve. As an action of the original GBP, Mud Slough was chosen to be the sole conveyance channel for combined agricultural subsurface drainage. Drainage water has been removed from a total of 93 miles of conveyance and wetland channels. Wetland managers now receive higher quality water through these channels. Surveys in Water Year 1999 of fish show that selenium concentrations in Salt Slough, have stabilized at levels well

below the Level of Concern threshold (Reclamation *et al.* 1999). Giant garter snake may be expected to widely travel throughout these improved Project canals corridors.

It is the determination that the GBP may affect giant garter snakes but not adversely affect them, based on the following:

(1) there are no known occurrences of giant garter snakes in Mud Slough (North),

(2) agricultural discharge via the GBP is conveyed solely through Mud Slough (North), while 93 miles of wetlands and channels are now provided with good quality water improving giant garter snake habitat in the project area and vicinity,

(3) the amount of selenium load released from the GDA into Mud Slough (North) will decrease over the life of the project, as is required by the Regional Board and proposed use agreement,

(4) the project proponents will assist in the protection, monitoring, survey and study of giant garter snakes in the Project area, and

(5) the project proponents will work cooperatively with the Service and other agencies to develop a contingency plan to address selenium contamination in Mud Slough if it is determined (via number 4 above) that agricultural drainage from the GDA is having a significant impact on giant garter snakes.

California tiger salamander, *Ambystoma californiense (C)*

No adverse impact is likely to affect this species from construction activities at the project sites.

There may be increased grazing at the In-Valley Treatment sites in the GDA (Phase I). Grazing pasture could increase from 250 to 1,000 acres on the site (Panoche Drainage District 2000). Conservation measures will be provided to interrupt the establishment of bull frog populations in IVT stock ponds (if constructed) that mimic ephemeral pools.

The San Luis NWR Complex along Salt and Mud Slough has an extensive grassland/vernal pool complex. The San Luis NWR Complex 1994 survey has records of California tiger salamanders (CTS) at the Kesterson NWR, and West Gallo Unit (Now West Bear Unit) (Peters 1994).
In flood events, species may be affected when rainwater and drainage flows exceed the capacity of Mud Slough, overflowing onto the refuge floodplain and into adjacent vernal pools. Selenium can enter the vernal pools and may evapoconcentrate as the pools dry up.

Without species specific information, selenium toxicity guidelines for CTS could be the same for other reptiles and amphibians as described above for giant garter snakes: tissue concentrations at or above 10x normal background (∃20 mg/kg whole body; eggs ∃10 mg/kg, USDOI 1998). Tadpoles have been collected at Site D (Mud Slough) (see Figure 3) on only two occasions. The composite sample had a selenium concentration of 8.5 mg selenium/kg, well below recommended reptile/amphibian toxicity guidelines. A composite sample of Salt Slough tadpoles collected in August 1999 had about half of the selenium concentration (2.6 mg/kg) of a single bullfrog tadpole found there before the GBP began in March 1993 (5.8 mg/kg) (Reclamation *et al.* 1999). CTS may be vulnerable to bioaccumulation via invertebrate prey but experimental studies of dietary toxicity in amphibians are rare (see Invertebrates below).

Studies monitoring selenium of vernal pools and examining non-listed eastern tiger salamanders (as surrogates to CTS) to determine dietary impacts, may be considered. However, it is likely once study results are completed and if impacts are found, the action that would be required is the purpose of the GBP to reduce the selenium load of the drainage water discharged into Mud Slough (North). Therefore the project proponents are not suggesting specific CTS studies, however, a survey of selenium concentrations of sediment/soil and detritus from vernal pools adjacent to Mud Slough would be appropriate to assess potential risk to CTS (see Invertebrates below).

Water quality in vernal pool habitat adjacent to 93 miles of wetlands and channels throughout the Project Area has improved because of the GBP. As seen in reduced selenium concentrations in biota from Salt Slough (Reclamation *et. al* 1999), it is expected that the higher quality water delivered to these channels has decreased selenium levels within the vernal pools.

It is the determination that the GBP may affect CTS but not adversely affect them, based on the following:

(1) water quality in vernal pool habitat adjacent to the 93 miles of wetlands and channels throughout the Project Area has likely improved because of the project,

(2) agricultural discharge is combined and conveyed through Mud Slough (North). The amount of selenium load released into Mud Slough (North) will decrease over the life of the project, as is required by the Regional Board and proposed Use Agreement,

(3) a contaminant survey of sediment/soil and detritus from vernal pools adjacent to Mud Slough (north) and subject to overflow or flooding of Mud Slough (north) will be done to assess potential risks from selenium,

(4) the project proponents will work cooperatively with the Service and other agencies to develop a contingency plan to address selenium contamination in vernal pools adjacent to Mud Slough if it is determined (via number 3 above) that agricultural drainage has the potential for significant impacts on CTS.

8.5 Fish

Winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
No adverse impact is likely to affect this species from construction activities at the project sites. The project will not result in any diversion of water from the San Joaquin River or any of the channels. The project will reduce the load of salts and selenium discharged from the GDA into the river. Winter-run has been extirpated from the San Joaquin River and, therefore, is not found in the project area. The project is not likely to affect adversely this species.

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T)
No adverse impact is likely to affect this species from construction activities at the project sites. The project will not result in any diversion of water from the San Joaquin River or any of the channels. This species has been extirpated from the San Joaquin River. The critical habitat for this fish was designated by the National Marine Fisheries Service (NMFS) in February 2000 to include all river reaches accessible to the chinook salmon in the Sacramento River and its tributaries in California. NMFS= maps and fact sheet indicate that this critical

habitat does not include the San Joaquin River south of the Delta (NMFS 2001). The project is located south of the confluence of the San Joaquin River and the Merced River. Project activities are not likely to adversely affect this species.

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C)

No adverse impact is likely to affect this species from construction activities at the project sites. The project will not result in any diversion of water from the San Joaquin River or any of the channels.

The only coldwater fish studies available seem to indicate that salmon are more sensitive to selenium bioaccumulation than warmwater fish (Hamilton *et al.* 1990). The effect of selenium will depend on the amount of time salmon are exposed to the food chain and the concentration of that food chain. Adult salmon migrating upstream to spawn do not eat during their journey and thus are not likely to bioaccumulate selenium from the food chain. Fall-run chinook salmon spawn in the San Joaquin tributaries Merced, Stanislaus and Tuolumne. In an attempt to improve chinook salmon populations, wildlife managers place a physical barrier on the San Joaquin River, upstream of the confluence of the Merced River, to prevent adult salmon from straying away from Merced River spawning habitat (USFWS 1996). This barricading blocks these adults from entering the most selenium affected reach of the San Joaquin River between Mud Slough and the Merced River.

It is juvenile salmon migrating out of the Merced River in spring, through the mainstem of the San Joaquin River, and north to the Delta who might likely be affected by Project activities. At the Merced=s confluence the concern is whether salmon can consume enough contaminated prey while passing through to affect their growth or otherwise be at risk. Juvenile salmon are not likely to spend a great deal of residence time rearing in the project area. They are likely to rear in the Delta, although if it is a wet year they may rear in the river (S. Schoenberg, pers. comm.). Project data available on invertebrate food sources at Site H on the San Joaquin River (see Figure 3) shows recent selenium concentrations consistently below the Level of Concern. Water Year 1998 data for waterboatmen and red crayfish were below 2 mg/kg dry weight at Site H (Reclamation *et al.* 1999). Whole-Body fish tissues (warmwater) for Site H for 1998 also show selenium concentration below the Level of Concern and falling. By the time juvenile salmon reach Vernalis in their out-migration the median selenium concentration in the water has declined to 2 Φg/L (CEPA 1998, CEPA 2000b).

Because juvenile fall-run chinook salmon spend a limited period in the Project

Area, minimizing the potential to ingest toxic quantities of prey, and because that the amount of selenium load released into the San Joaquin River will continue to decrease over the life of the project, it is expected that the Project may affect the species but is not likely to affect it adversely.

Central Valley steelhead, *Oncorhynchus mykiss (T)*
No adverse impact is likely to affect this species from construction activities at the Project site. The project will not result in any diversion of water from the San Joaquin River or any of the channels.

Studies are underway to determine if the rainbow trout that spawn in the Merced River are anadromous. The only coldwater fish studies available seem to indicate that salmon are more sensitive to selenium bioaccumulation than warmwater fish (Hamilton *et al.* 1990). The effect of selenium will depend on the amount of time steelhead are exposed to the food chain and the concentration of that food chain. Central Valley steelhead are not known to spawn or rear in the San Joaquin River near the outfall of the Project Area. If shown to be anadromous, steelhead spawning migration up the Merced River would begin in early fall (sometimes as early as mid- August), peaking in October and November and extend through March. Steelhead will have two life stages that may be impacted by project activities: adults (in-migration) and juveniles (out- migration). Unlike chinook salmon, steelhead adults feed during in-migration and they are known to spawn more than once in a lifetime. Both adults and juveniles could eat aquatic invertebrates at Site H (San Joaquin River) on their migrations (see Figure 3). As described above for fall-run chinook, current data collected on prey species at Site H, show selenium concentration consistently below the Level of Concern, and the models of risk levels show a decreasing level as the project progresses. Steelhead is not likely to spend a significant amount of time of in the project area during either in-migration or out-migration. Should a steelhead individual return to the Project Area during its lifetime, the amount of selenium load released to the San Joaquin River at the Merced River is expected to have been further decreased according to the Project=s commitments. Because steelhead spend a limited period in the Project Area, minimizing the potential to ingest toxic quantities of prey, and because the amount of selenium load released into the San Joaquin River will continue to decrease over the life of the Project, it is expected that the Project may affect the species but is not likely to affect it adversely.

Sacramento splittail, *Pogonichthys macrolepidotus (T)*
No adverse impact is likely to affect this species from construction activities at project sites. The project will not result in any diversion of water from the San Joaquin River or any of the channels.

Splittail usually spawn on submerged vegetation on temporarily flooded upland and riparian habitat. In flood events, when drainage flows exceed capacity of the Drain or Mud Slough, agricultural subsurface drainage can overflow into wetland supply channels and across the adjacent floodplain. Larval stage splittail may be vulnerable to selenium bioaccumulation at this time and selenium may likely affect growth during this period. In 1999, invertebrates (water boatman, crayfish, backswimmer, and amphipods) collected at a back water to Mud Slough (Site I), exceeded Level of Concern for invertebrates used as a diet (3 mg/kg) (see Table 1 and Figure 3). Conditions in the backwater are variable and under certain conditions selenium may become more bioavailable (Reclamation *et al.* 1999).

Combined agricultural drainage flows result in elevated levels of selenium and other constituents which are discharged into Mud Slough (North). Selenium levels in Mud Slough biota and water are at Level of Concern and sometimes at Toxicity levels. These constituents are above the levels historically discharged to Mud Slough. Based on model results done for the project, about 23 to 46 percent of fish samples at Site D (Mud Slough) would exceed the Toxicity threshold if a critically dry year were to occur in 2001. By 2009, the proportion of fish samples exceeding the Toxicity threshold in a critically dry year would be 5-19 percent under existing waste discharge requirements, 7-24 percent under stakeholder load limits, or 8-27 percent under alterative load limits. Splittail were caught in Mud and Salt Sloughs in June 1998, an El Niño year (Beckon *et al.* 1999). At that time all samples of splittail from this area had concentrations of selenium high enough to be at a Level of Concern; the highest selenium concentration in splittail was found in the sample from Mud Slough just below the Drain discharge.

Recent data collected in the Montezuma Slough (Suisun Marsh) shows significant selenium bioaccumulation in clams and species of fish that feed on them including splittail. The source(s) of selenium in the food chain of this part of the Delta includes refinery discharges, which, until recently, are primarily composed of the most bioavailable species of selenium, selenite. New treatment systems at the refineries have significantly reduced the total selenium discharges by removal of much of the selenite. The remaining discharges are now predominantly in the form of selenate. USGS monitoring of fish and invertebrates has yet to see a decline in selenium bioaccumulation that would be expected. However, sufficient time has not passed for the selenium already in the food chain to complete the cycle and more recent monitoring in 2000 may show a decline (Stewart, R. USGS). Irrigation return flows and San Joaquin River inflows to the Bay-Delta bring in selenium that is predominantly selenate. The extent of contributions of selenium

from agricultural drainwater in the San Joaquin River to bioaccumulation in the Delta food web has not been fully studied. In 1999, studies in the San Francisco Bay showed higher selenium concentrations found in the bivalve-based food web than in a crustacean-based food web. Clams, such as *Potamacorbula amurensis*, had a concentration of selenium 10 times higher than amphipods and isopods. Selenium liver concentrations of Sacramento splittail from the Suisun Marsh, specifically those that forage on clams, are at levels associated with adverse reproductive effects in fish (Stewart *et al.* 2000). Feyrer and Matern (2000) studied the change in fish diets in the San Francisco Estuary resulting from the 1986 invasion of Asian clam, *P. amurensis*. Their results showed that among other selected fish species, splittail showed a significant decline in the dietary importance of mysids following the invasion. Splittail reproduction measured before the clam introduction was about twice as high compared after the clam introduction (Feyrer and Matern 2000). The change in splittail diet from mysids to bivalves, which are bottom feeders, suggests an adverse effect on population due to an elevated concentration of selenium in the food chain. Studies have not been done in the central or southern portions of the Delta where selenium from agricultural drainage may have an impact. Through requirements of a previous biological opinion on interim water contract renewals (USFWS 2000b), Reclamation is to support studies on selenium impacts to splittail. Reclamation has supported a preliminary assessment of selenium concentrations in splittail salvaged from Central Valley Project pumping operations in the south Delta but results are not yet available.(Maurer, T. pers. comm.)

Because of bioaccumulation effects of selenium in Mud Slough, bioavailability of selenium in backwaters during flood events, and the potential for effects to splittail in the delta, project activities may affect but are not likely to affect adversely this species for the following reasons:

(1) the selenium load released into Mud Slough (North) and ultimately the Delta has decreased in the past three years and will continue to decrease over the life of the project, as is required by the Regional Board and proposed use agreement,

(2) the project proponents will work cooperatively with the Service and other agencies to assess potential selenium impacts to splittail in the Delta via support of ongoing studies,

(3) the project proponents will work cooperatively with the Service and other agencies to develop a contingency plan to address selenium contamination in the Delta if it is determined that agricultural drainage is having a significant impact on splittail.

Delta smelt, *Hypomesus transpacificus (T)*
No adverse impact is likely to affect this species from construction activities at the Project sites. The project will not result in any diversion of water from the San Joaquin River or any of the channels. Delta smelt feed primarily on planktonic copepods, cladocerans (small crustaceans) amphipods, and to a lesser extent insect larvae. Larger fish may also feed on opossum shrimp. Unlike splittail, they are not known to feed on the exotic Asian clam (USFWS 1996) thus they are less likely to be exposed to high selenium concentrations in their diet. Contributions from agricultural drainwater of selenium into the delta smelt food chain are likely to be less than that for the splittail foodchain (discussed above). Delta smelt usually live for only one year. Most of their lifespan is spent in the freshwater-saltwater mixing zone of the Sacramento-San Joaquin Delta and Suisun Bay. The U.S. Fish and Wildlife Service analyzed delta smelt salvaged from survey trawls around Chipps Island near Suisun Bay in the spring of 1993 and 1994, and silversides (a surrogate species) in the spring of 1995 from various locations in the Delta (Maurer, T. USFWS, unpublished data). All selenium whole body and eggs concentrations in the delta smelt were less than 2 mg/kg, well below the Level of Concern and the silversides averaged 2.6 mg/kg also below the Level of Concern. No adverse impact is likely to affect this species.

8.6 Invertebrates

Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus (T)*
Construction of facilities may impact valley elderberry longhorn beetle (VELB) host plant elderberry in Phase II (subsurface drainage collection system) and Phase III (treatment facilities). Most construction will be across agricultural land. Elderberry bushes are found in riparian habitats. To minimize and avoid construction impacts, conservation measures have been incorporated into project actions. Construction activities are not likely to affect VELB, providing the conservation measures are followed. Problems with selenium bioaccumulation and toxicity to wildlife are generally associated with aquatic food chains. Bioaccumulation is not likely to affect VELB. Project activities may affect but are not likely to affect adversely this species.

Conservancy fairy shrimp, *Branchinecta conservatio* (E)
Longhorn fairy shrimp, *Branchinecta longiantenna (E)*

Vernal pool fairy shrimp, *Branchinecta lynchi (T)*
Vernal pool tadpole shrimp, *Lepidurus packardi (E)*
The San Luis NWR Complex along Salt and Mud Sloughs has an extensive grassland/vernal pool complex. The 1994 survey of the Complex records listed vernal pool fairy shrimp at the Kesterson NWR, Arena NWR, and West Gallo and East Gallo Units (now called West and East Bear Units) (Peters 1994). No adverse impact is likely to affect this species from construction activities at the Project sites.

In flood events, species may be affected when rainwater and drainage flows exceed the capacity of Mud Slough, overflowing onto the refuge floodplain and into nearby vernal pools. Selenium can enter the vernal pools and may evapoconcentrate as the pools dry up. However, because of the project, higher quality project water now flows along the other 93 miles of wetlands and channels thus improving the quality of vernal pools adjacent to these channels.

Vernal pool water as it evaporates is not likely to concentrate selenium to levels acutely toxic to fairy shrimp or other invertebrates. The waterborne acute toxicity threshold for selenate is around 500 Φg/L (USDOI 1998). No selenium concentration in water or prey is available to determine impacts to fairy shrimp or their surrogates. The *Guidelines* background level for selenium bioaccumulation for aquatic invertebrates is 0.4 to 4.5 mg selenium /kg. Experimental studies of dietary toxicity to invertebrates are rare. Midge larvae growth was inhibited on diets of algae ∃2.1 mg/kg selenium. Alternatively, amphipods showed no adverse effects due to feeding on algae bearing selenium at levels of 300 mg/kg selenium (USDOI 1998). Vernal pool invertebrates may have a relative tolerance to selenium. Cysts are capable of withstanding heat, cold and prolonged desiccation, salinity or alkalinity.

Nearby vernal pool habitat throughout the Project Area has likely improved along 93 miles of wetlands and channels when from overflow during high water events. As seen in the lower selenium concentrations in Salt Slough biota (Reclamation *et al.* 1999), it is expected that the higher quality water delivered to these channels has reduced selenium levels within adjacent vernal pools. Studies monitoring selenium of vernal pools and examining non-listed fairy shrimp, as surrogates to fairy shrimp, to determine dietary impacts, may be considered. However, it is likely once study results are completed and if impacts are found, the action that would be required is already the purpose of the GBP to reduce the selenium load in the drainage water discharged into Mud Slough (North). Therefore the project proponents are not suggesting fairy shrimp studies. However, a survey of selenium concentrations of sediment/soil and detritus from vernal pools adjacent

to Mud Slough would be appropriate to assess potential risk to vernal pool invertebrates.

It is the determination that the GBP may affect listed fairy shrimp but not adversely affect them, based on the following:

(1) water quality in vernal pool habitat adjacent to the 93 miles of wetlands and channels throughout the Project Area has likely improved because of the project.

(2) agricultural discharge is combined and conveyed through about 6 miles of Mud Slough (North). The amount of selenium load released from the GDA into Mud Slough (North) will decrease over the life of the project, as is required by the Regional Board and proposed use agreement.

(3) a contaminant survey of sediment/soil and detritus from vernal pools adjacent to Mud Slough (North) and subject to overflow or flooding of Mud Slough (North)will be done to assess potential risks to vernal pool invertebrates from selenium,

(4) the project proponents will work cooperatively with the Service and other agencies to develop a contingency plan to address selenium contamination in vernal pools adjacent to Mud Slough if it is determined (via number 3 above) that agricultural drainage from the GDA has the potential for significant impacts on listed vernal pool invertebrates.

8.7 Plants

Colusa grass, *Neostapfia colusana (T)*
This rare species is found on the non-irrigated upland habitats on the San Luis and West Bear Creek Units of the San Luis NWR Complex. No adverse impact is likely to affect this species from construction activities at the project sites. Native, upland habitat will not be removed or affected by this largely aquatic and agrarian project. Project activities are not likely to affect adversely this species.

8.8 Cumulative Effects (state and private actions)

Cumulative effects include the effects of future federal, state, local or private actions that are reasonably certain to occur within the vicinity of action area considered in this BA. Any federal, state, or private landowner actions that may occur within the Project Area that are unrelated to the proposed action are not considered in this BA and would require separate consultation pursuant to the Federal and/or California Endangered Species Acts.

The project is not likely to provide growth-inducing effects. However, the project endeavors to support and sustain the economic health of the current agricultural community in the area.
Aggregating and reducing contaminants in Mud Slough increases and improves grassland wetland and riparian habitat elsewhere throughout the vicinity of the Project Area. Cumulative
effects of the proposed action over the life of the project are expected to improve water and habitat quality throughout the Project Area and vicinity for the following special status species: giant garter snake, bald eagle, Central Valley fall/late fall-run chinook salmon, Central Valley steelhead, VELB, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and California tiger salamander. Because avoidance measures will be applied to each project site (Phase II--subsurface drainage collection system), no cumulative construction effects on VELB, giant garter snake, or San Joaquin kit fox should occur. Enhancements to the riparian zone and increased riparian habitat protection are expected to benefit VELB and other special status species using these habitats. The cumulative effects of improving wetland habitats would improve opportunities wildlife managers will have to assist in the recovery of the giant garter snake. Cumulative use of the native plants along soil banks within the In-Valley Treatment area could assist in the recovery of San Joaquin kit fox.

8.9 Analysis of alternate actions

The EIR/EIS considers two other alternatives to the Proposed Action: No Action and the Mud Slough Bypass. The latter would remove the GDA=s drainwater from Mud Slough and the San Joaquin River upstream of Hills Ferry. Instead, a pipeline, or combination of pipeline and concrete-lined canal would be constructed that would connect to the end of the San Luis Drain at Mud Slough and convey the drainwater directly to the San Joaquin River downstream of its confluence with the Merced River. This alternative meets the CEQA requirement to avoid or substantially lessen any potentially significant impact of the Proposed Project. Prior to conducting the detailed impact analyses, the project proponents identified Mud Slough as an area of potential impact due to the discharge of all of the drainage at this location. The EIR/EIS identified the Mud Slough Bypass as the

environmentally superior alternative (Reclamation 2000a). Potential effects on federally-listed species by construction activities for this alternative would have to be addressed in a separate Section 7 consultation once alignment options are fully developed.

9.0 CONCLUSION AND DETERMINATION OF EFFECTS

A. Listed species

Determination

No effect

Fresno kangaroo rat, *Dipodomys nitratoides exilis (E)*
giant kangaroo rat, *Dipodomys ingens (E)*
riparian brush rabbit, *Sylvilagus bachmani riparius (E)*
riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia (E)*
Aleutian Canada goose, *Branta canadensis leucopareia (T)*
California red-legged frog, *Rana aurora draytonii (T)*
blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) sila (E)*
Central Valley spring-run chinook salmon, *Oncorhynchus tshawtscha (T)*
winter-run chinook salmon, *Oncorhynchus tshawytscha (E)*
delta smelt, *Hypomesus transpacificus (T)*
Colusa grass, *Neostapfia colusana (T)*
Hoover's eriastrum (= woolly-star), *Eriastrum hooveri (T)*
Hoover=s spurge, *Chamaesyce hooveri (T)*
Palmate-bracted bird=s-beak, *Cordylanthus palmatus (E)*

may affect, but is not likely to adversely

San Joaquin kit fox, *Vulpes macrotis mutica (E)*
bald eagle, *Haliaeetus leucocephalus (T)*
giant garter snake, *Thamnophis gigas (T)*
Central Valley steelhead, *Oncorhynchus mykiss (T)*
Sacramento splittail, *Pogonichthys macrolepidotus (T)*
Conservancy fairy shrimp, *Branchinecta conservatio* (E)
longhorn fairy shrimp, *Branchinecta longiantenna (E)*
vernal pool fairy shrimp, *Branchinecta lynchi (T)*
vernal pool tadpole shrimp, *Lepidurus packardi (E)*
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus (T)*

B. Proposed species

Determination

may affect, but is not likely to adversely

mountain plover, *Charadrius montanus* (PT)

C. Candidate species

Determination

may affect, but is not likely to adversely

California tiger salamander, *Ambystoma californiense (C)*

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha (C)*

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Appendix A Endangered and Threatened Species That May Occur in or be Affected By Projects in the Area of the Grasslands Bypass Project, California

February 9, 2000 Revised February 6, 2001

Listed Species

Mammals

riparian (San Joaquin Valley) woodrat, *Neotoma fuscipes riparia* (E)

(May be extirpated from all or part of this area.)

riparian brush rabbit, *Sylvilagus bachmani riparius* (E)

(May be extirpated from all or part of this area.)

giant kangaroo rat, *Dipodomys ingens* (E)

Fresno kangaroo rat, *Dipodomys nitratoides exilis* (E)

San Joaquin kit fox, *Vulpes macrotis mutica* (E)

Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

Reptiles

blunt-nosed leopard lizard, *Gambelia (=Crotaphytus) sila* (E)

giant garter snake, *Thamnophis gigas* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

delta smelt, *Hypomesus transpacificus* (T)

Central Valley steelhead, *Oncorhynchus mykiss* (T)

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T)

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

Conservancy fairy shrimp, *Branchinecta conservatio* (E)

longhorn fairy shrimp, *Branchinecta longiantenna* (E)

vernal pool fairy shrimp, *Branchinecta lynchi* (T)

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)

vernal pool tadpole shrimp, *Lepidurus packardi* (E)

Plants

Hoover's eriastrum (= woolly-star), *Eriastrum hooveri* (T)

(May be extirpated from all or part of this area.)

Hoover=s spurge, *Chamaesyce hooveri* (T)

Palmate-bracted bird=s-beak, *Cordylanthus palmatus* (E)

Colusa grass, *Neostapfia colusana* (T)

Proposed Species

Birds

mountain plover, *Charadrius montanus* (PT)

Candidate Species

Amphibians

California tiger salamander, *Ambystoma californiense* (C)

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C)

Species of Concern

Mammals

San Joaquin (=Nelson's) antelope squirrel, *Ammospermophilus nelsoni* (CA)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

Merced kangaroo rat, *Dipodomys heermanni dixoni* (SC)

short-nosed kangaroo rat, *Dipodomys nitratoides brevinasus* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
small-footed myotis bat, *Myotis ciliolabrum* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
San Joaquin pocket mouse, *Perognathus inornatus* (SC)
Sierra Nevada red fox, *Vulpes vulpes necator* (CA)

Birds

tri-colored blackbird, *Agelaius tricolor* (SC)
western burrowing owl, *Athene cunicularia hypugea* (SC)
Swainson's hawk, *Buteo Swainsoni* (CA)
ferruginous hawk, *Buteo regalis* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
greater sandhill crane, *Grus canadensis tabida* (CA)
white-faced ibis, *Plegadis chihi* (SC)

Reptiles

silvery legless lizard, *Anniella pulchra pulchra* (SC)
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
southwestern pond turtle, *Clemmys marmorata pallida* (SC)
San Joaquin coachwhip (=whipsnake), *Masticophis flagellum ruddocki* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)
river lamprey, *Lampetra ayresi* (SC)
Kern brook lamprey, *Lampetra hubbsi* (SC)
Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ciervo aegialian scarab beetle, *Aegialia concinna* (SC)
San Joaquin dune beetle, *Coelus gracilis* (SC)
California linderiella, *Linderiella occidentalis* (SC)
molestan blister beetle, *Lytta molesta* (SC)

Plants

alkali milk-vetch, *Astragalus tener var. tener* (SC)
(May be extirpated from all or part of this area.)
heartscale, *Atriplex cordulata* (SC)
(May be extirpated from all or part of this area.)
brittlescale, *Atriplex depressa* (SC)
(May be extirpated from all or part of this area.)
valley spearscale, *Atriplex joaquiniana* (SC)
lesser saltscale, *Atriplex minuscula* (SC)
Lost Hills saltbush, *Atriplex vallicola* (SC)
hispid bird's-beak, *Cordylanthus mollis ssp. hispidus* (SC)
delta coyote-thistle, *Eryngium racemosum* (CA)
(May be extirpated from all or part of this area.)
spiny-sepaled coyote-thistle, *Eryngium spinosepalum* (SC)
Merced monardella, *Monardella leucocephala* (SC)
(May be extinct.)
little mousetail, *Myosurus minimus ssp. apus* (SC)
valley sagittaria, *Sagittaria sanfordii* (SC)

KEY:

(E) Endangered - Listed (in the Federal Register) as being in danger of extinction.

(T) Threatened - Listed as likely to become endangered within the foreseeable future.

(PT) Proposed - Officially proposed (in the Federal Register) for listing as threatened.
(C) Candidate- Candidate to become a proposed species.
(SC) Species of Concern - May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(D) Delisted - Status to be monitored for 5 years.
(CA) State-Listed Listed as threatened or endangered by the State of California.
Critical Habitat - Area essential to the conservation of a species.

Appendix B USGS Quads of Grasslands Bypass Project

USGS 7 2 minute quads	Quad #	CNDDB Keyquad #
Broadview Farms	382D	3612075
Charleston School	383A	3612087
Crows Landing	424A	3721241
Delta Ranch	402C	3712016
Dos Palos	382B	3612086
Firebaugh	381C	3612074
Gustine	423C	3712038
Hammonds Ranch	382C	3612076
Hatch	423B	3712048
Ingomar	403B	3712028
Laguna Seca Ranch	383D	3612077
Los Banos	403D	3712017
Mendota Dam	381D	3612073
Newman	424D	3712131
Oxalis	382A	3612085
Poso Ranch	381B	3612084
San Luis Ranch	403A	3712027
Santa Rita Bridge	402D	3712015
Stevinson	423D	3712037
Turlock	423A	3712047
Turner Ranch	402B	3712026
Volta	403C	3712018

Appendix C Scientific Names of Species Used in this Document

Invertebrates

Asian clam	*Potamacorbula amurensis*
backswimmers	*Notonectidae*
cladocerans	*Crusttacea*
Conservancy fairy shrimp	*Branchinecta conservatio*
copepods	*Copepoda*
crawling water beetles	*Haliplidae spp.*
crickets	*Gryllidae*
longhorn fairy shrimp	*Branchinecta longiantenna*
opossum shrimp	*Neomysis mercedis*
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*
vernal pool fairy shrimp	*Branchinecta lynchi*
vernal pool tadpole shrimp	*Lepidurus packardi*

Amphibians

bullfrog	*Rana catesbeiana*
California red-legged frog	*Rana aurora draytonii*
California tiger salamander	*Ambystoma californiense*
eastern tiger salamander	*Ambystoma tigrium*
Pacific treefrog	*Hyla regilla*
western spadefoot toad	*Scaphiopus hammondii*

Reptiles

American alligator	*Alligator mississippiensis*
aquatic garter snake	*Thamnophis couchi*
blunt-nosed leopard lizard	*Gambelia (=Crotaphytus) sila*
common garter snake	*Thamnophis sirtalis*
giant garter snake	*Thamnophis gigas*
gopher snake	*Pituophis melanoleucus*
pine snake	*Pituophis melanoleucus*
side-blotched lizard	*Uta stansburiana*
western fence lizard	*Sceloporus occidentalis*
western pond turtle	*Clemmys marmorata marmorata*
western rattlesnake	*Crotalus viradus*
western whiptail	*Cnemidophorus tigris*

Fish

carp	*Cyprinus carpio*

Central Valley spring-run chinook salmon	*Onchorhynchus tshawtscha*
Central Valley steelhead	*Oncorhynchus mykiss*
delta smelt	*Hypomesus transpacificus*
fall-run chinook salmon	*Oncorhynchus tshawytscha*
fathead minnow	*Pimephales promelas*
inland silverside	*Menidia beryllina*
mosquitofish	*Gambusia affinis*
Sacramento splittail	*Pogonichthys macrolepidotus*
winter-run chinook salmon	*Oncorhynchus tshawytscha*

Mammals

American badger	*Taxidea taxus*
black-tailed hare	*Lepus californicus*
bobcat	*Felis rufus*
Botta's pocket gopher	*Thomomys bottae*
California ground squirrel	*Spermophilus beecheyi*
California vole	*Microtus californicus*
coyote	*Canis latrans*
deer mouse	*Peromyscus maniculatus*
desert cottontail	*Sylvilagus audubonii*
domestic dog	*Canis familiaris*
Fresno kangaroo rat	*Dipodomys nitratoides exilis*
giant kangaroo rat	*Dipodomys ingens*
Heermann's kangaroo rat	*Dipodomys heermanni Procyon lotor*
pocket mice	*Perognathus* spp.

Vulpes vulpes

riparian brush rabbit

ni riparius

riparian woodrat	*Neotoma fuscipes riparia*
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*
San Joaquin kit fox	*Vulpes macrotis mutica*
striped skunk	*Mephitis mephitis*

Birds

Aleutian Canada goose	*Branta canadensis leucopareia*
American goldfinch	*Carduelis tristis*
bald eagle	*Haliaeetus leucocephalus*
black phoebe	*Sayornis nigricans*
blue-gray gnatcatcher	*Polioptila caerulea*

California gull	*Larus californicus*
California quail	*Callipepla californica*
cinnamon teal	*Anas cyanoptera*
common raven	*Corvus corax*
gadwall	*Anas strepera*
great blue heron	*Ardea herodias*
great egret	*Casmerodius albus*
green-backed heron	*Butorides striatus*
house finch	*Carpodacus mexicanus*
killdeer	*Charadrius vociferus*
lesser goldfinch	*Carduelis psaltria*
mallard	*Anas platyrhynchos platyrhynchos*
mountain plover	*Charadrius montanus*
mourning dove	*Zenaida macroura*
northern harrier	*Circus cyaneus*
northern pintail	*Anas acuta acuta*
ring-necked pheasant	*Phasianus colchicus*
roadrunner	*Geococcyx californianus*
sage sparrow	*Amphispiza belli*
Say's phoebe	*Sayornis saya*
western kingbird	*Tyrannus verticalis*
white-crowned sparrow	*Zonotrichia leucophrys*
white-tailed kite	*Elanus caeruleus*

Plants

alfalfa	*Medicago sativa*
alkali heath	*Frankenia salina*
alkali sacaton	*Sporobolus airoides*
alkali weed	*Cressa truxillensis*
bermuda grass	*Cynodon dactylon*
blue elderberry	*Sambucus caerulea*
broad-leaved cattail	*Typha latifolia*
bush seepwood	*Suaeda moquinii*
California blackberry	*Rubus vitifolius*
California poppy	*Eschscholzia californica*
California sycamore	*Plantanus racemosa*
California wild grape	*Vitius californica*
clovers	*Trifolium spp.*
Colusa grass	*Neostapfia colusana*
cottonwood	*Populis spp.*
coyote thistles	*Eryngium spp.*

downingia	*Downingia spp.*
goldfields	*Lasthenia spp.*
grasses	*Gramineae spp.*
greasewood	*Sarcobatus vermiculatus*
hoary nettle	*Urtica diocia*
Hoover's eriastrum (= woolly-star)	*Eriastrum hooveri*
Hoover=s spurge	*Chamaesyce hooveri*
iodine bush	*Allenrolfea occidentalis*
Johnson grass	*Sorghum halepense*
long-beaked filaree	*Erodium botrys*
low barley	*Hordeum depressum*
Mariposa lilies	*Lilium spp.*
meadowfoam	*Limnanthus douglasii*
medusa head	*Taeniatherum caput-medusae*
milk thistle	*Silybum marianum*
navarretia	*Navarretia intertexta*
owl's clovers	*Castilleja spp.*
Palmate-bracted-bird=s beak	*Cordylanthus palmatus*
peppergrass	*Lepidium latifolium*
pickleweed	*Salicornia virginica*
pogogyne	*Pogogyne spp.*
poison hemlock	*Conium maculatum*
pondweeds	*Potamogeton spp.*
popcorn flower	*Plagiobothrys torreyi*
purple needlegrass	*Nassella pulchra*
red brome	*Bromus rubens*
redstem filaree	*Erodium cicutarium*
ripgut brome	*Bromus diandrus*
rushes	*Juncus spp.*
Russian thistle	*Salsola tragus*
rusty molly	*Kochia californica*
saltgrass	*Distichlis spicata*
samphire	*Salicornia subterminalis*
shadscale	*Atriplex conferifolia*
short-pod mustard	*Brassica geniculata*
slender fescue	*Vulpia bromoides*
slender cattail	*Typha augustifolia*
soft chess	*Bromus mollis*
tree tobacco	*Nicotiana glauca*
valley oak	*Quercus lobata*
wheat	*Tritcum spp.*

wild barley	*Hordeum leporinum*
wild oats	*Avena fatua*
wild rose	*Rosa californica*
willows	*Salix spp.*
woolly marbles	*Psilocarphus spp.*
yellow-star thistle	*Centaurea solstitialis*

Appendix D San Joaquin Kit Fox Protocols

U.S. FISH AND WILDLIFE SERVICE STANDARDIZED RECOMMENDATIONS FOR PROTECTION OF THE SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE

Prepared by the Sacramento Fish and Wildlife Office
June 1999

INTRODUCTION

The following document includes many of the San Joaquin kit fox (*Vulpes macrotis mutica*) protection measures typically recommended by the U. S. Fish and Wildlife Service (Service), prior to and during ground disturbance activities. However, incorporating relevant sections of these guidelines into the proposed project is not the only action required under the Endangered Species Act of 1973, as amended (Act). Project applicants should contact the Service in Sacramento to determine the full range of requirements that apply to your project; the address and telephone number are given at the end of this document. Formal authorization for the project may be required under either section 7 or section 10 of the Act. Implementation of the measures presented in this document may be necessary to avoid violating the provisions of the Act, including the prohibition against "take" (defined as killing, harming, or harassing a listed species, including actions that damage or destroy its habitat). Such protection measures may also be required under the terms of a biological opinion pursuant to section 7 of the Act resulting in incidental take authorization (authorization), or an incidental take permit (permit) pursuant to section 10 of the Act. The specific measures implemented to protect kit fox for any given project shall be determined by the Service based upon the applicant's consultation with the Service.

The purpose of this document is to make information on kit fox protection strategies readily available and to help standardize the methods and definitions currently employed to achieve kit fox protection. The measures outlined in this document are subject to modification or revision at the discretion of the Service.

All surveys, den destructions, and monitoring described in this document must be conducted by a qualified biologist. A qualified biologist (biologist) means any person who has completed at least four years of university training in wildlife

biology or a related science and/or has demonstrated field experience in the identification and life history of the San Joaquin kit fox.
In addition, biologist(s) must be able to identify coyote, red fox, gray fox, and kit fox tracks, and to have seen a kit fox in the wild, at a zoo, or as a museum mount.

SMALL PROJECTS

Small projects are considered to be those projects with small foot prints such as an individual in- fill oil well, communication tower, or bridge repair. These projects must stand alone and not be part of, or in any way connected to larger projects (i.e., bridge repair or improvement to serve a future urban development). The Service recommends that on these small projects, the biologist survey the proposed project boundary and a 200-foot area outside of the project footprint to identify habitat features, and make recommendations on situating the project to minimize or avoid impacts. If habitat features cannot be completely avoided, then pre-construction surveys should be conducted.

Pre-construction/pre-activity surveys shall be conducted no less than 14 days and no more than 30 days prior to the beginning of ground disturbance and/or construction activities or any project activity likely to impact the San Joaquin kit fox. Surveys should identify kit fox habitat features on the project site and evaluate use by kit fox and, if possible, and assess the potential impacts to the kit fox by the proposed activity. The status of all dens should be determined and mapped (see Survey Protocol).

Written results of pre-construction/pre-activity surveys must be received by the Service within five days after survey completion and prior to the start of ground disturbance and/or construction activities. If a natal/pupping den is discovered within the project area or within 200-feet of the project boundary, the Service shall be immediately notified. If the preconstruction/preactivity survey reveals an active natal pupping or new information, the project applicant should contact the Service immediately to obtain the necessary take authorization/permit.

If take authorization/permit has already been issued, then the biologist may proceed with den destruction within the project boundary, except natal/pupping dens (active or inactive). Protective exclusion zones can be placed around all known and potential dens which occur outside the project footprint (conversely, the project boundary can be demarcated, see den destruction section).

OTHER PROJECTS

It is likely that all other projects occurring within kit fox habitat will require a take authorization/permit from the Service. This determination would be made by the Service during the early evaluation process (see Survey Protocol). These other projects would include, but are not limited to: linear projects; projects with large footprints such as urban development; and projects which in themselves may be small but have far reaching impacts (i.e., water storage or conveyance facilities that promote urban growth or agriculture, etc.).

The take authorization/permit issued by the Service may incorporate some or all of the protection measures presented in this document. The take authorization/permit may include measures specific to the needs of the project, and those requirements supersede any requirements found in this document.

EXCLUSION ZONES

The configuration of exclusion zones around the kit fox dens should have a radius measured outward from the entrance or cluster of entrances. The following radii are minimums, and if they cannot be followed the Service must be contacted:

Potential den	50 feet
Known den	100 feet
Natal/pupping den (occupied and unoccupied)	Service must be contacted
Atypical den	50 feet

Known den: To ensure protection, the exclusion zone should be demarcated by fencing that encircles each den at the appropriate distance and does not prevent access to the den by kit foxes. Exclusion zone fencing should be maintained until all construction related or operational disturbances have been terminated. At that time, all fencing shall be removed to avoid attracting subsequent attention to the dens.

Potential and Atypical dens: Placement of 4-5 flagged stakes 50 feet from the den entrance(s) will suffice to identify the den location; fencing will not be required, but the exclusion zone must be observed.

Construction and other project activities should be prohibited or greatly restricted within these exclusion zones. Only essential vehicle operation on existing roads

and foot traffic should be permitted. Otherwise, all construction, vehicle operation, material storage, or any other type of surface-disturbing activity should be prohibited within the exclusion zones.

DESTRUCTION OF DENS

Disturbance to all San Joaquin kit fox dens should be avoided to the maximum extent possible. Protection provided by kit fox dens for use as shelter, escape, cover, and reproduction is vital to the survival of the species. Limited destruction of kit fox dens may be allowed, if avoidance is not a reasonable alternative, provided the following procedures are observed. The value to kit foxes of potential, known, and natal/pupping dens differ and therefore, each den type needs a different level of protection. **Destruction of any known or natal/pupping kit fox den requires take authorization/permit from the Service**.

Natal/pupping dens: Natal or pupping dens which are occupied will not be destroyed until the pups and adults have vacated and then only after consultation with the Service. Therefore, project activities at some den sites may have to be postponed.

Known Dens: Known dens occurring within the footprint of the activity must be monitored for three days with tracking medium or an infra-red beam camera to determine the current use. If no kit fox activity is observed during this period, the den should be destroyed immediately to preclude subsequent use. If kit fox activity is observed at the den during this period, the den should be monitored for at least five consecutive days from the time of the observation to allow any resident animal to move to another den during its normal activity. Use of the den can be discouraged during this period by partially plugging its entrances(s) with soil in such a manner that any resident animal can escape easily. Only when the den is determined to be unoccupied may the den be excavated under the direction of the biologist. If the animal is still present after five or more consecutive days of plugging and monitoring, the den may have to be excavated when, in the judgment of a biologist, it is temporarily vacant, for example during the animal's normal foraging activities. The Service encourages hand excavation, but realizes that soil conditions may necessitate the use of excavating equipment. However, extreme caution must be exercised.

Destruction of the den should be accomplished by careful excavation until it is certain that no kit foxes are inside. The den should be fully excavated, filled with

dirt and compacted to ensure that kit foxes cannot reenter or use the den during the construction period. If at any point during excavation a kit fox is discovered inside the den, the excavation activity shall cease immediately and monitoring of the den as described above should be resumed. Destruction of the den may be completed when in the judgment of the biologist, the animal has escaped from the partially destroyed den.

Potential Dens: If a take authorization/permit has been obtained from the Service, den destruction may proceed without monitoring, unless other restrictions were issued with the take authorization/permit. If no take authorization/permit has been issued, then potential dens should be monitored as if they were known dens. If any den was considered to be a potential den, but is later determined during monitoring or destruction to be currently, or previously used by kit fox (e.g., if kit fox sign is found inside), then destruction shall cease and the Service shall be notified immediately.

CONSTRUCTION AND OPERATIONAL REQUIREMENTS

Habitat subject to permanent and temporary construction disturbances and other types of project- related disturbance should be minimized. Project designs should limit or cluster permanent project features to the smallest area possible while still permitting project goals to be achieved. To minimize temporary disturbances, all project-related vehicle traffic should be restricted to established roads, construction areas, and other designated areas. These areas should also be included in preconstruction surveys and, to the extent possible, should be established in locations disturbed by previous activities to prevent further impacts.

1. Project-related vehicles should observe a 20-mph speed limit in all project areas, except on county roads and state and federal highways; this is particularly important at night when kit foxes are most active. To the extent possible, night-time construction should be minimized. Off- road traffic outside of designated project areas should be prohibited.

2. To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than 2 feet deep should be covered at the close of each working day by plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the procedures under number 13 of this section must be

followed.

3. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe becoming trapped or injured. 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 should be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the Service has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

4. All food-related trash items such as wrappers, cans, bottles, and food scraps should be disposed of in closed containers and removed at least once a week from a construction or project site.

5. No firearms shall be allowed on the project site.

6. To prevent harassment, mortality of kit foxes or destruction of dens by dogs or cats, no pets should be permitted on project sites.

7. Use of rodenticides and herbicides in project areas should be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. All uses of such compounds should observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other state and federal legislation, as well as additional project-related restrictions deemed necessary by the Service. If rodent control must be conducted, zinc phosphide should be used because of proven lower risk to kit fox.

8. A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped individual. The representative will be identified during the employee education program. The representative's name and telephone number shall be provided to the Service.

9. An employee education program should be conducted for any project that has expected impacts to kit fox or other endangered species. The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their

employees, and military and agency personnel involved in the project. The program should include the following: a description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the above-mentioned people and anyone else who may enter the project site.

10. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. should be re- contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject to "temporary" disturbance means any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas should be determined on a site-specific basis in consultation with the Service, California Department of Fish and Game (CDFG), and revegetation experts.

11. In the case of trapped animals, escape ramps or structures should be installed immediately to allow the animal(s) to escape, or the Service should be contacted for advice.

12. Any contractor, employee, or military or agency personnel who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFG immediately in the case of a dead, injured or entrapped kit fox. The CDFG contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or biologist.

13. The Sacramento Fish and Wildlife Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The Service contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers given below. The CDFG contact is Mr. Ron Schlorff at 1416 9th Street, Sacramento, California 95814, (916) 654-4262.

Any project-related information required by the Service or questions concerning

the above conditions or their implementation may be directed in writing to the U.S. Fish and Wildlife Service at:

Endangered Species Division
2800 Cottage Way, Suite W2605
Sacramento, California 95825-1846
(916) 414-6620

"Take" - Section 9 of the Endangered Species Act of 1973, as amended (Act) prohibits the "take" of any federally-listed endangered species by any person (an individual, corporation, partnership, trust, association, etc.) subject to the jurisdiction of the United States. As defined in the Act, take means " . . . to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." Thus, not only is a listed animal protected from activities such as hunting, but also from actions that damage or destroy its habitat.

"Dens" - San Joaquin kit fox dens may be located in areas of low, moderate, or steep topography. Den characteristics are listed below, however, the specific characteristics of individual dens may vary and occupied dens may lack some or all of these features. Therefore, caution must be exercised in determining the status of any den. Typical dens may include the following: (1) one or more entrances that are approximately 5 to 8 inches in diameter; (2) dirt berms adjacent to the entrances; (3) kit fox tracks, scat, or prey remains in the vicinity of the den; (4) matted vegetation adjacent to the den entrances; and (5) manmade features such as culverts, pipes, and canal banks.

"Known den" - Any existing natural den or manmade structure that <u>is used or has been used at any time in the past</u> by a San Joaquin kit fox. Evidence of use may include historical records, past or current radiotelemetry or spotlighting data, kit fox sign such as tracks, scat, and/or prey remains, or other reasonable proof that a given den is being or has been used by a kit fox. The Service discourages use of the terms Aactive@ and Ainactive@ when referring to any kit fox den because a great percentage of occupied dens show no evidence of use, and because kit foxes change dens often, with the result that the status of a given den may change frequently and abruptly.

"Potential Den" - Any subterranean hole within the species= range that has entrances of appropriate dimensions for which available evidence is insufficient to conclude that it is being used or has been used by a kit fox. Potential dens shall include the following: (1) any suitable subterranean hole; or (2) any den or burrow

of another species (e.g., coyote, badger, red fox, or ground squirrel) that otherwise has appropriate characteristics for kit fox use.

"Natal or Pupping Den" - Any den used by kit foxes to whelp and/or rear their pups. Natal/pupping dens may be larger with more numerous entrances than dens occupied exclusively by adults. These dens typically have more kit fox tracks, scat, and prey remains in the vicinity of the den, and may have a broader apron of matted dirt and/or vegetation at one or more entrances. A natal den, defined as a den in which kit fox pups are actually whelped but not necessarily reared, is a more restrictive version of the pupping den. In practice, however, it is difficult to distinguish between the two, therefore, for purposes of this definition either term applies.

"Atypical Den" - Any manmade structure which has been or is being occupied by a San Joaquin kit fox. Atypical dens may include pipes, culverts, and diggings beneath concrete slabs and buildings.

Appendix E Future State and Federal Refuge Acreage Habitats

Federal Refuge Acreage Habitats under CVPIA Water Deliveries

Habitat Action	No Action	Proposed	
	Level 2 [a]	Level 4	Level 4
San Luis Unit			
Semi-permanent/permanent wetland	80	150	293
Seasonal wetland	2,950	3,400	2,166
Riparian habitat	----	-----	1,160
Total managed wetland	3,030	3,550	3,619
West Bear Creek Unit			
Semi-permanent/permanent wetland	156	156	111
Seasonal wetland	1,321	1,321	1,168
Riparian habitat	----	----	72
Total managed wetland	1,477	1,477	1,351
Kesterson Unit/Freitas Unit[b]			
Semi-permanent/permanent wetland	375	535	516
Seasonal wetland	686	1,456	1,490
Riparian habitat	----	---	18
Total managed wetland	1,061	1,991	2,024
East Bear Creek Unit			
Semi-permanent/permanent wetland	342	342	80
Seasonal wetland	2,341	2,341	675
Riparian habitat	---	----	100
Irrigated upland (pasture and cereal grains)	1,0721,072	310	
Total managed wetland and irrigated upland	3,755	3,755	1,165

[a]According to the Central Valley Project Improvement Act, firm water supplies must be measured at the refuge boundaries and provided at two levels, referred to as ALevel 2" and ALevel 4". Level 2 supply is the historic annual average delivery to each refuge and was required to be delivered upon enactment of the CVPIA. Level 4 water was defined a that incremental addition needed for full habitat.

[b]The Freitas Unit has been incorporated into the former Kesterson NWR.

Expected State Refuge Acreage Habitats under CVPIA Water Deliveries

Acres of habitat expected on the CDFG=s Wildlife Areas in the San Joaquin River basin under the No Action and Proposed Action that would be managed with water provided under the CVPIA.

Habitat	**No Action**	**Proposed**	
	Level 2	Level 4	Level 4
North Grasslands Wildlife Area / China Island Unit			
Semi-permanent/permanent wetland	118118	185	
Seasonal wetland	1,0021,002	995b	
Moist soil impoundment	430430		
Irrigated upland (pasture and cereal grains)	- -	630	
Total managed wetland and irrigated upland	**1,5501,550**	**1,810**	
North Grasslands Wildlife Area / Salt Slough Unit			
Semi-permanent/permanent wetland	151151	125	
Seasonal wetland	955955	918b	
Moist soil impoundment	- -		
Irrigated upland (pasture and cereal grains)	602602	720	
Total managed wetland and irrigated upland	**1,7081,708**	**1,763**	

Reference: (USBR 2000b)

Appendix F California Endangered, Threatened, and Candidate Species

The purpose of this table is to summarize the special status species listed by the State of California that may occur in the Project Area and to describe any impacts the Grassland Bypass Project may cause to them. The source of data is the California Natural Diversity Data Base (December 2000). Species accounts are included for each State-

[1] *Direct effects* - direct of immediate effect of the project on the species or their habitats (includes interrelated actions and interdependent actions). Interrelated actions are part of the larger action and depend on the larger for their justification. Interdependent actions have no independent utility apart from the proposed action.

2 *Indirect effects*- Are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. May include other Federal actions that have not undergone section 7 consultation but will result from the action under consideration.

3 *Cumulative effects*- Are caused by the aggregate of past, present, and reasonably foreseeable future actions.