Retirement of drainage-impaired agricultural lands was identified in the Recovery Plan for Upland Species of the San Joaquin Valley, California (USFWS 1998) as potentially contributing significantly to the conservation and recovery of listed species, particularly kit foxes (see Task 1.2.6).

Historically, drainage-impaired areas likely sustained alkali sink or even wetland communities. Wetland communities are not suitable habitat for kit foxes. Alkali sink communities appear to be suitable, with suitability likely increasing with soil aridity. Although not the optimal habitat for kit foxes, foxes commonly occur in this community type in such places as the Semitropic Ridge area (just south of Kern NWR in Kern County) and Coles Levee Ecopreserve (western Kern County). Thus, under natural conditions, these areas may not have supported high density kit fox populations, and foxes certainly could have difficultly reoccupying these highly altered lands.

However, with planning and active management, retired drainage-impaired agricultural lands could have value for kit foxes. Lands retired in large blocks or, minimally, retired in a manner that results in connected parcels, could benefit the kit fox and facilitate movement between populations. A kit fox family group may require a minimum of 1,200 acres (4.85 square kilometers) to support itself, based on studies conducted in optimal habitat (B. Cypher, pers. comm.; 2006). Therefore, the substantial amount of land that could be retired under various Project alternatives, if retired in large contiguous blocks and managed appropriately for kit foxes, could potentially provide habitat for multiple kit fox families, and reduce the risk of local extinction.

In contrast, if active vegetation management (e.g., grazing, mowing, and burning) does not occur on retired lands, vegetation would likely not be suitable for kit fox occupancy and the retired lands would create dispersal barriers. Potential lack of dens on retired lands could result in an increased chance of predation and the inability of kit fox to inhabit retired lands. Den establishment is particularly important in early colonization phases, as very few natural dens will be present for kit foxes.

The greatest possibility for retired lands to contribute to kit fox conservation and recovery may exist in the Westlands North area. The rationale for this includes:

1. Considerable acreage has already been retired in this area, and additional retirement could result in the creation of large blocks of habitat.

2. The span that would need to be bridged across unimpaired lands in order to link retired lands with natural lands is relatively narrow in this area. In many cases, the distance is less than 5 miles.

3. Retiring lands in this area and creating a corridor to natural lands to the west also would provide connectivity to natural lands to the east, including the Alkali Sink Ecological Reserve, Kerman Ecological Reserve, Mendota Wildlife Area, and

natural lands along the San Joaquin River into Madera and Merced Counties. Creating a linkage between these natural lands and those lands west of I-5 is identified as an important need in Task 5.1.1 of the Recovery Plan.

For the reasons listed above, focusing on the Westlands North area probably will provide the greatest benefit to kit fox conservation and recovery. Once lands are retired in this area and linked to natural lands, then it might be possible to build a corridor of retired lands that extends north and/or south into the other drainage-impaired areas.

Linking retired lands with natural lands west of I-5 will necessitate a strategy to create a corridor across lands currently in agricultural production that are not currently drainage-impaired. This strategy could include: purchase of fee title, purchase of conservation easements, establishment of artificial refugia in a "stepping stone" configuration, or some combination of these. Kit foxes have been observed to use artificial dens installed in agricultural lands (Cypher *et al.* 2005). In the absence of a corridor across or through unimpaired lands, colonization of retired lands by kit foxes and maintenance of viable fox populations will be very difficult. Finally, as mentioned previously, the potential success of kit fox populations on retired lands will likely increase commensurate with the degree that retired lands include larger blocks of habitat, compatible land uses, active vegetation management, and habitat enhancements.

Evaluation of Benefit to San Joaquin Kit Fox from Land Retirement Alternatives: Based on the current regional population conditions and the conservation strategy described above, the Project can be examined with regard to what extent the kit fox may benefit from the amount of land retirement proposed under the various Project alternatives. Under the In-Valley Disposal alternative, 44,106 acres would be retired from irrigated agriculture. However, this acreage represents the amount of land that is already retired, and therefore does not represent any benefit to the kit fox from implementation of the Project. With each subsequent alternative, the amount of lands proposed for retirement increases, thereby increasing the potential for benefiting the kit fox. The greatest potential for benefit would come from the In-Valley/Drainage Impaired Area Land Retirement alternative, under which a total of 308,000 acres would be retired from irrigated agriculture. This alternative, if implemented to follow the conservation strategy outlined above, would substantially increase the chances of developing viable dispersal corridors linking the region's three core populations. The degree to which land retirement implemented under the Project will follow the conservation strategy depends on a variety of factors, many of which are not controlled by Reclamation because they involve landowners, other agencies, and uncertain funding levels.

Evaluation of Potential Adverse Effects from Retired Lands: Kit foxes may travel onto or through retired lands, whether these lands are grazed, fallowed, or dryland farmed. Such travel may be for temporary foraging excursions or for permanent dispersal of juveniles from family unit territories. Lands retired and managed for grazing, which could range in extent from 14,555 to 101,640 acres depending on the Project alternative (based on the assumption of proportional retirement), may be suitable habitat for the fox. Retired lands that are put into grazing may

therefore benefit the kit fox; however, such benefits could prove to be of limited value unless the lands are grazed under long-term management horizons and any pesticide control of ground-dwelling vertebrate pests is conducted using approved products that have been determined safe for use in kit fox-occupied territories.

Retired lands that are fallowed, and then dryland farmed on a rotational basis, may also provide additional kit fox habitat, although these lands would likely be considered sub-optimal for the fox. Fallowed lands may provide new foraging habitat, compared to existing agricultural uses, as well as potential new territories for den construction by dispersing foxes. The majority of dens known from the current kit fox distribution are located in areas where there is some degree of slope, and lands that may be retired for fallowing have generally been leveled. However, kit foxes have historically created dens in flat lands (http://www.cdpr.ca.gov/docs/es/espdfs/sjkfden.pdf), and this apparent preference for sloped areas may be an artifact of the reduced historic range. Therefore, fallowing lands could potentially be beneficial for foxes, but the degree of benefit would depend on whether the fallowed lands are sited in such a manner as to promote kit fox colonization and whether land management strategies could be implemented on these lands that were neutral or beneficial to the kit fox. The goal of Reclamation's strategic land retirement proposal would be to attempt to maximize these benefits to kit fox, while also achieving Project objectives for reduced contaminated drainage.

Fallowed lands are commonly disced for weed control on a biannual basis, generally to a depth of 4 inches, and left in a rough disced condition (T. Bettner, pers. comm.; 2006). This periodic discing may deter denning on fallowed lands; however, this has not been subjectively demonstrated or verified, and there is anecdotal evidence that this shallow discing may not fully prevent kit foxes from creating dens where discing occurs (B. Cypher, pers. comm.; 2006). Kit fox dens are deeper than 4 inches, and natal dens generally have multiple openings for ingress and egress. Although shallow discing is unlikely to injure or kill adult foxes that may have created dens on the fallowed fields, due to an adult fox's ability to escape the disturbance (B. Cypher, pers. comm.; 2006), discing during periods when pups or young juveniles are present may interrupt critical parental care and destroy den openings. It is likely that biannual discing for weed control, if done during the period when natal dens are present, would injure or kill kit fox juveniles or pups.

When fallowed lands are periodically brought back into production for dryland farming, they have to be turned to a deeper depth in preparation for bedding and planting. It has been determined that ground disturbance from typical agricultural production (*e.g.*, tilling, maintenance, harvesting) can destroy dens (B. Cypher, pers. comm.; 2006). In order for fallowed fields to be prepared for dryland farming, these fields could be ripped down to a depth of 18 inches, then disced to a depth of 12 inches, followed by other equipment to break up the rough clods (T. Bettner, pers. comm.; 2006). While adult kit foxes in occupied dens may be able to escape before the dens are destroyed or dig themselves out afterward (B. Cypher, pers. comm.; 2006), it is likely that juveniles or pups in natal dens will not be able to do so. Preparing

fallowed fields for dryland farming during a time when kit foxes are typically in natal dens is likely to destroy the dens, and injure or kill juveniles or pups.

Although fallowing the retired lands may provide short-term benefits for the kit fox, potentially providing additional habitat for the population, both the shallow discing for weed control and the ripping and deep discing for conversion to dryland farming may act to negate these benefits. Essentially, there is the potential for fallowed lands to become a population "sink," with individuals in natal dens being injured or killed when the fallowed land is disced for weed control or it is returned to dryland farming.

Conveyance/Collection Systems

The proposed construction of a closed collection system to collect and convey drainwater from on-farm subsurface tile drains to regional reuse facilities would take place in narrow linear corridors entirely within the agricultural heart of the valley, and generally would be limited to previously disturbed road, canal, and railroad rights-of-ways or the perimeters of agricultural fields. While there is a slight possibility that some of these areas currently serve as habitat for kit fox foraging, and the construction of these systems may disturb nearby foxes, the amount of foraging habitat lost would be minimal and the disturbance from construction would be temporary. Further, any effects from disturbance will be minimized through the Project's proposed conservation measures. Therefore, the Service does not anticipate any take of kit foxes associated with the construction of these conveyance/collection systems. In addition, once these systems are constructed, the continued operation of these systems will likely be neutral with regard to effects.

Reuse Areas

The conversion of existing cropland, whether currently irrigated or fallowed, to reuse areas is a component of all four SLDFR In-Valley alternatives. The number and size of the proposed reuse areas varies with each alternative: 16 reuse areas on approximately 18,925 acres (In-Valley Disposal Alternative), 15 reuse areas on 16,700 acres (In-Valley Ground Water Quality Land Retirement Alternative), 14 reuse areas on 12,500 acres (In-Valley/Water Needs Land Retirement), and 1 reuse area on 7,500 acres in Northerly area (In-Valley/Drainage Impaired Area Land Retirement). Although the lands proposed for conversion to reuse areas represent currently sub-optimal habitat for kit foxes, it is likely that kit foxes to the east and west of the action area may occasionally travel onto and through Project lands and use these areas for foraging. While reuse areas may provide a different vegetative cover than the currently grown crops, it is unlikely that they would substantially reduce the available kit fox prey base or provide even lower quality kit fox habitat conditions. Therefore, the Service does not consider the construction of reuse areas to be a loss of existing kit fox habitat, and no take from habitat loss is anticipated.

The nature and extent of effects to the kit fox associated with operation of the 7,500 to 18,925 acres of proposed reuse areas is uncertain, but presumably would be limited to the potential risk of selenium bioaccumulation through ingestion of resident prey species. Selenium, applied to the reuse areas via agricultural drainwater, can enter the food chain through uptake by plants and soil invertebrates. Selenium can then be bioaccumulated by seed- and invertebrate-eating organisms, which represent typical kit fox prey. Although retired lands are not expected to result in high selenium levels in small mammals (USDI 2005), selenium levels can be expected to be substantially greater at the reuse areas due to the direct application of contaminated drainwater as irrigation source for reuse facility vegetation. Therefore, any kit foxes foraging at these reuse sites may be exposed to elevated selenium levels through their diet, presenting a substantial risk of selenium toxicosis. We make this determination based on the following rationale.

No toxicity tests with selenium have been performed on kit foxes. The most closely related surrogate species for which toxicity data are available is the domestic dog (*Canis familiaris*), which is in the same family (Canidae) as the kit fox. Dogs exposed to 7.2 µg/g dietary selenium suffered adverse effects, including reduced appetite and subnormal growth (Rhian and Moxon, 1943). Dogs exposed to 20 µg/g dietary selenium in this study suffered much more severe histopathological effects, and eventual mortality. The 7.2 ug/g concentration represents a Lowest Observed Adverse Effects Concentration (LOAEC); and therefore, the actual toxicity threshold for domestic dogs is therefore some unknown amount below this value.

While no definitive extrapolation can be made from the dog LOAEC regarding a toxicity threshold for the kit fox, it is reasonable to conclude that such a kit fox threshold would at least be on the same order of magnitude. The potential for selenium bioaccumulation by small mammals at reuse areas is dependent on a variety of factors, such as the type of crop grown, the biology of the particular species, and the selenium concentration in the applied drainwater, and cannot at this time be definitively predicted for the various alternatives proposed in this Project. However, studies of reuse areas at other sites in the San Joaquin Valley provide data with which to evaluate the potential for food chain bioaccumulation, and the risk to kit foxes foraging at the sites.

Chesemore *et al.* (1990) studied six different reuse areas in Fresno and Kings Counties from 1987 through 1989. All six of the reuse areas were planted primarily with eucalyptus trees, with sub-plantings of *Casuarina* trees. The reuse areas were generally surrounded by traditional irrigated crops, with some parcels in some years abutting fallowed lands. In addition, several of the plantations were adjacent to or very near evaporation ponds. Four of the reuse areas were irrigated with saline water from the west side of the San Joaquin Valley, while the other two served as controls, and were irrigated with water from the east side of the Valley. Small mammals, primarily deer mice, as well as insects and amphibians were collected from all sites in 1989 and tissues were analyzed for selenium.

Selenium concentrations in deer mice collected from the control site reuse areas averaged 0.36 µg/g (ppm) dry weight. In contrast, the concentration in deer mice collected from three of the

west side reuse areas averaged (arithmetic mean) 1.17 ppm, while the average concentration from the fourth reuse area was 6.8 ppm. This latter reuse area, the Peck site, had selenium concentrations significantly higher than the other three west side sites and so was excluded from the overall average. The concentration range for the Peck side was from 3.1 to 8.9 ppm. In addition to sampling mammals, both amphibians and insects were collected from the agroforestry sites and analyzed for selenium. One composite sample of two Western toads (*Bufo borealis*) revealed a selenium concentration of 22.3 ppm, the highest tissue concentration recorded during the study. Insects, a mix of Coleopterans and Orthopterans, had an average selenium concentration of 1.53 ppm, with a range of 0.30 to 4.20 ppm.

The average tissue concentration in deer mice (1.17 ppm) reported from the three reuse sites irrigated with west side water is below the domestic dog LOAEC described above, although it is well within the same order of magnitude. The average deer mouse selenium concentration from the Peck site (6.8 ppm) is essentially the same statistically as the dog LOAEC, and the highest concentration reported from this site (8.9 ppm) is above this LOAEC. The reuse area on the Peck site was situated directly adjacent to a large evaporation pond, in which an upper selenium concentration of 2,000 ppb was detected in water.

During two separate studies monitoring selenium residues in San Joaquin Valley agroforestry sites (also known as reuse facilities), the California Department of Fish and Game also confirmed that such facilities are capable of introducing elevated selenium concentrations into the food chain, bioaccumulating in small mammal species inhabiting these habitats (CDFG, 2006; CDFG, 1993). Summary values from one such site (the Mendota Agroforestry Plot, formerly known as Murrietta Farms) and a nearby reference site (Mendota Wildlife Management Area) are presented in Table 3.

The Mendota Agroforestry Plot is located on the Panoche Fan alluvial deposit in western Fresno County, and received drainwater from Westlands for the purposes of reducing agricultural drainwater volume. The site is known to be "very attractive to wildlife (resident and migratory birds, raptors, upland game birds, bats, and other small mammals, canid predators) providing what is certainly an 'island habitat' in an urban/agricultural landscape" (CDFG, 2006). Groundwater selenium concentrations at this site were measured between 590-2050 ug/L [Se] in 1996 (Herbel *et al.*, 2002).

It should be noted that few data were available on a whole-body basis (the most relevant measure for extrapolating risks to kit fox from dietary exposure). For purposes of this discussion, it is adequate to generally presume that whole body concentrations in small mammals would be at least as high as muscle concentrations, and possibly intermediate between those found in muscle and liver. Where whole-body residues were measured, small mammals sampled from this particular reuse site averaged (geometric mean) 3.5 ppm in voles, 10.2 ppm in shrews, and roughly 2 ppm in a single king snake. These values span the domestic dog LOAEC of 7.2 ug/g. Values measured in deer mouse liver were twice as high at the reuse site compared to those observed at Mendota Wildlife Area (although these have not been compared using statistical

significance testing).

While it is not possible from these studies to make a direct extrapolation to anticipated selenium levels in small mammals that may inhabit the Project's proposed reuse areas, the data provide clear evidence that deer mice and other small mammals in fields treated with selenium-contaminated drainwater can bioaccumulate elevated levels of selenium, relative to fields irrigated with non-contaminated water. The data also provide clear evidence that selenium concentrations in the exposed biota can approach and exceed a documented LOAEC for a canid species. Based on the above, it is likely that any kit foxes foraging at reuse sites would be exposed to elevated levels of selenium through ingestion of the resident mammal prey species.

Table 3. Selenium Residues (ppm, d.w.) in Tissues of Potential Kit Fox Prey Collected from the Mendota Agroforestry Site and a Nearby Reference Area from CDFG (2006 and 1993).

Site	Year	Species	Tissue	Geometric Mean [Se] (dry weight)	min	max	n
Mendota Agroforestry	98	CA vole (*M. californicus*)	Whole	3.46	3.3	3.7	3
Mendota Agroforestry	90-91	Deer mouse (*P. maniculatus*)	Liver	7.45	4.3	57.9	20
Mendota Agroforestry	97-98	Deer mouse (*P. maniculatus*)	Liver	7.20	1.1	68.0	58
Mendota Wildlife Area	97-98	Deer mouse (*P. maniculatus*)	Liver	3.54	2.7	5.0	20
Mendota Agroforestry	90-91	Deer mouse (*P. maniculatus*)	Muscle	2.46	1.2	19.7	20
Mendota Agroforestry	90-91	House Mouse (*M. musculus*)	Liver	6.00	5.0	8.1	9
Mendota Agroforestry	90-91	House Mouse (*M. musculus*)	Muscle	1.89	1.2	3.7	9
Mendota Agroforestry	91	King Snake (*L. getulus*)	Whole	1.74	-	-	1
Mendota Agroforestry	98	Ornate Shrew (*S. ornatus*)	Whole	10.23	9.2	57.9	9
Mendota Agroforestry	91	Pocket Gopher (*T. bottae*)	Liver	1.72	-	-	1
Mendota Agroforestry	91	Pocket Gopher (*T. bottae*)	Muscle	0.26	-	-	1

In addition, operation of reuse areas as a form of managed cropland potentially could increase the attractiveness of the sites to foraging kit foxes over current management (*e.g.*, cotton, row crops, fallowed lands). Attractiveness of a site to kit foxes depends on the vegetative cover, which influences both foraging success and predator avoidance, and prey abundance. The potential reuse area crops anticipated for this Project include a variety of perennial grasses, legumes, grains, and some tree varieties in appropriate areas. With these crop types, the reuse areas may have a relatively high density of small mammals, such as deer and house mice. For example, Chesemore *et al.* (1990) also found that densities of small mammals (*e.g.*, deer mice, a prominent kit fox prey species) varied with vegetation type on various croplands and agroforestry plots (Table 4). The agroforestry plots in this study were operated as drainwater reuse areas, and were planted primarily with eucalyptus trees. While these eucalyptus plantations differ from the perennial grasses, legumes, and grains anticipated for reuse area crops under Project implementation, the small mammal densities serve as an illustrative comparison between reuse areas and traditional irrigated crop production lands.

Deer mouse density estimates for four of the eucalyptus plantations in the Chesemore *et al.* study (1990) ranged from 139 - 282 animals per hectare, while the other two sites had lower estimates of 22 and 27 animals per hectare. In contrast, deer mouse density estimates for four crop types ranged from 32 animals per hectare in cotton, to 72 animals per hectare in alfalfa. Fallowed land produced the lowest density estimate of 13 animals per hectare. Based on these data, the Service believes it is likely that reuse areas would allow for a more abundant prey base than what would be typical under either current irrigated crop production or under fallowing.

Table 4. Estimated Densities of Small Mammals Associated with Various Types of Vegetation (from Chesemore *et al.* 1990).

SPECIES/VEGETATION	DENSITY (ESTIMATED NUMBERS PER 2.4 ACRES)
Deer Mice	
Alfalfa	72
Sugar Beets	71
Tomatoes	42
Cotton	32
Fallow	13
Agroforestry Plots (Eucalyptus Trees)	22 - 282
House Mice	
Alfalfa	55
Sugar Beets	43
Tomatoes	25

With regard to the suitability of reuse area vegetative cover for kit fox foraging and predator avoidance, no direct comparison with current management has been made. However, based on the kit fox's historical avoidance of irrigated agricultural lands, it is likely that reuse areas would not be any less attractive than lands with irrigated crops. Therefore, with the potential for a higher abundance of kit fox prey in reuse areas than under current irrigated crop production, it is likely that reuse areas would be suitable and attractive kit fox foraging habitat.

The mix of salt-tolerant crops that would be maintained on the reuse sites and the type of management practices implemented will ultimately determine the degree of food chain selenium bioaccumulation and risk of kit fox exposure to selenium-contaminated prey. If reuse sites can be made unattractive for kit fox foraging or less productive in terms of prey abundance, both the amount of time spent by kit foxes foraging at the sites and their dietary selenium exposure may be minimized. Such an approach fits well with the concept of "dietary dilution" and reducing the risk of selenium bioaccumulation in higher food-chain trophic levels (USFWS 1995); however, the ability to significantly reduce the attractiveness of a site such as a reuse area for kit fox prey has not yet been demonstrated.

The potential for selenium exposure by kit foxes from implementation of the Project would be greatest from the proposed alternatives with higher numbers of reuse sites (In-Valley Disposal Alternative, In-Valley Ground Water Quality Land Retirement Alternative, and In-Valley/Water Needs Land Retirement Alternative). The degree of risk for selenium toxicosis in kit foxes would be highest at those reuse areas where drainwater with the highest selenium concentrations would be applied (*i.e.*, Northerly Areas and WWD-North facilities) and at the larger reuse areas, where a larger portion of a kit fox's foraging territory might be included in the reuse area.

Similarly, of the 16 potential reuse area sites, those located nearest the eastern edge of the project area near adjacent preferred natural habitat would be more likely to be utilized for foraging than sites that are more isolated within the surrounding agricultural landscape. However, for at least some of the more isolated reuse sites, the proposed retirement of large contiguous tracts of cropland in the vicinity of the sites could eventually create travel lanes to the interior sites, expanding potential kit fox foraging areas to include all or most of the reuse areas. This possibility increases the importance of developing vegetation management plans that would be effective in making reuse areas unattractive for kit fox foraging and the fox's prey base.

The reuse areas will total from 7,500 to 18,925 acres, depending upon the Project alternative. Although these acreages are broken up into as many as 16 areas, there is enough potential foraging habitat within a given section of the action area that, if efforts to make the reuse sites unattractive are not completely effective, kit foxes may forage relatively often at those areas. This is especially true of the Northerly Area and the southern-most portion of the action area, where the greatest amount of nearby habitat occurs for the species. Therefore, based on the likelihood of kit foxes traveling to and foraging in reuse areas, the high potential for a greater abundance of kit fox prey at reuse areas, and the high probability for food chain bioaccumulation

of selenium at these sites, the Service anticipates that kit foxes will suffer some degree of toxicosis resulting from ingesting selenium-contaminated prey at reuse areas. Depending on the extent and concentration of food chain bioaccumulation at the sites, the level of anticipated toxicosis could range from reduced appetite and subnormal growth to adverse histopathological effects and mortality.

Reverse Osmosis and Biotreatment Facilities, and Evaporation Basins

With the four Project alternatives presented, between 1,275 and 3,300 acres of existing irrigated cropland will be converted to reverse osmosis and biotreatment facilities, and evaporation basins. Once converted, these lands will be predominantly facilities and aquatic features, with only minor acreage being maintained as berms and roadways. Although the lands proposed for conversion to these facilities represent currently sub-optimal habitat for kit foxes, it is likely that kit foxes to the east and west of the action area may occasionally travel onto Project lands and use these areas for foraging. In this regard, converting these lands from sub-optimal foraging habitat to unsuitable aquatic features represents a loss of kit fox habitat.

However, though the number of acres to be converted permanently is not insubstantial, the Service believes the overall effect on both kit fox individuals and the population will be minor for the following reasons. The amount of potential "lost" habitat is from a much larger block of similar habitat, comprising over 300,000 acres. The lands to be converted are currently only marginally suitable for kit fox, and will be surrounded by habitat similar to what was lost. Any kit foxes that would venture from their currently occupied territories onto irrigated cropland to forage or den would still have abundant acreage available, despite the conversion of some land to aquatic habitat. In addition, each of the Project alternatives would retire some amount of land, ranging from 44,106 to 308,000 acres, from irrigated agricultural production. This land, which will be fallowed, dryland farmed, and converted to grazing lands, in equal proportions, may provide additional habitat and may be more suitable for kit foxes than current land uses. Therefore, the Service does not anticipate any take of kit foxes associated with the habitat loss of converting current agricultural land to reverse osmosis and biotreatment facilities, or to evaporation basins.

Construction activity associated with initial development and installation of the major Project facilities would require extensive use of heavy equipment, and would result in significant surface disturbance at multiple sites throughout the study area. Any take of kit foxes in the form of harassment from this construction would be greater in magnitude for alternatives that involve fewer acres of retired land and more acres converted to facilities. However, the Service believes that any exposure to this disturbance would be avoided because of both the kit fox's currently limited use of and generally low density in these action area lands and because of the Project's conservation measures.

Operation of the reverse osmosis and biotreatment facilities, and evaporation basins would likely not provide habitat or prey availability that would attract kit fox. While elevated selenium in

evaporation ponds has been associated with reproductive effects and increased mortality in waterbirds, similar effects at evaporation ponds are unlikely for the kit fox. Kit fox use of the predominantly aquatic evaporation facilities is not anticipated, and the limited terrestrial features at each facility site would not provide attractive kit fox habitat. Berms and roadways would be compacted or riprapped, and the developed portions of each site would be maintained free of terrestrial ground cover and emergent vegetation that could provide habitat for prey species. Seasonal hazing to prevent nest establishment of ground-nesting shorebirds would further limit development of a potential kit fox prey base. Without a substantial prey base and suitable habitat to attract kit fox to these facilities, the potential for dietary exposure to selenium will be avoided. Therefore, the Service does not anticipate any take of kit foxes resulting from the operation of these facilities.

Giant Garter Snake

The giant garter snake is found in a variety of permanent aquatic environments including marshes, sloughs, ponds, low gradient streams, and agricultural waterways, such as poorly maintained irrigation and drainage canals. Recognized giant garter snake sub-populations are located in the Los Banos and Gustine areas, with recent (1995-98) captures and sightings in the Mendota Wildlife Management Area, Volta State Wildlife Area, North and South Grasslands, and Los Banos Creek near Kesterson NWR. Excluding the Grasslands and Mendota Wildlife Management Area records, all of the recent observations were in areas to the west of surface waters that have been impacted by agricultural drainage discharges (USFWS 2002b). Furthermore, all are located outside areas that would be (1) directly affected by construction of major project features such as reuse areas and treatment/evaporation facilities or (2) indirectly affected by changes in crop mixes within the drainage study area brought about by reallocation of irrigation water from retired lands.

The closest proposed facilities to occupied giant garter snake habitat would be the Northerly Area's evaporation basin and its associated reuse facility, located near the San Luis NWR-Grasslands area, and the WWD-North evaporation basin and its associated reuse areas, located across Highway 180 from the Mendota Wildlife Management Area. Construction of these facilities would take place on existing agricultural lands (or would expand upon the existing Panoche Reuse Facility) and would not directly affect the adjacent refuge.

Construction of the collection system may require crossing a small number of permanently watered, poorly maintained irrigation and drainage canals; however, no collection system crossings would take place in major permanent natural waterways or wetlands, and most agricultural conveyance structures that would be crossed do not constitute giant garter snake habitat. If construction is going to be completed within 200 feet of giant garter snake habitat, Reclamation has committed to implement the approved avoidance, restoration, and conservation measures described in the Service's *Standard Avoidance and Minimization Measures During Construction Activities in Giant Garter Snake (*Thamnophis gigas*) Habitat* (See Appendix). Estimates of the amount of suitable aquatic and adjacent upland habitat that may be disturbed to

construct collection system crossings are unavailable, as these features cannot be designed and sited until a preferred alternative is selected and other facilities are sited. In any case, under any alternative, we anticipate the amount of suitable giant garter snake habitat disturbed in the Northerly Area by construction of collection systems to be small, no more than 10 acres. Due to a lack of siting information for these crossings, this is an estimated amount of habitat disturbance based on the statements above that many of the crossings will be across agricultural conveyance structures rather than natural waterways or wetlands.

Operation of the collection system and treatment facilities would have no effect on the giant garter snake. The hypersaline evaporation basins would not provide suitable habitat, and the reuse areas would be operated to prevent the occurrence of ponded water and emergent vegetation. The near-vertical internal sides of the evaporation basins, in combination with the 2 foot difference between the water level and the retaining wall crest, would preclude use by the snake in the event an individual crossed the unsuitable habitat of the reuse areas to reach the less saline, fresher cells. As described in the "**Status of the Species**" section, steep sloped areas with no emergent vegetation are not habitat useable by the snake

Through the implementation of the Standard Avoidance and Minimization Measures for any construction in or near giant garter snake habitat, we anticipate that construction effects to giant garter snakes will be minimized. While flows in Mud Slough will be reduced following project implementation (especially during late summer), the species could indirectly benefit from a general improvement in water quality in the slough and other Grasslands area waterways as a result of the project's northerly area facilities.

California Least Tern

California least terns are small, aquatic-dependent birds, most commonly associated with coastal areas. However, small numbers of nesting pairs have been observed around the inland evaporation ponds in the Tulare Lake Basin southeast of the project area, and at Kettleman City in the San Joaquin Valley at the southern boundary of Westlands Water District (WD) and at Lemoore NAS for the past several years (J. Seay, H.T. Harvey and Associates, pers. comm.; 2006). Lemoore NAS is within the district boundaries of Westlands WD. There was one nest reported from the terminal cells of evaporation basins at the Kettleman City location that successfully produced one fledgling from two eggs in 1998 (DFG 1999b).

Least terns are piscivorous, which places them at risk from waterborne contaminants that can enter the food web and bioaccumulate in their prey. Evaporation basins create artificial aquatic ecosystems, in which some semblance of an aquatic food web can develop in the selenium-contaminated drainwater. Depending on the salinity of the water, these large holding ponds may support a variety of aquatic micro- and macro-invertebrates, as well as some species of salinity-tolerant fish. As evaporation basins are generally not connected in any way to natural aquatic systems, any fish present in these ponds are either intentionally or accidentally introduced. Due to the highly bioaccumulative nature of selenium and the preternaturally high selenium

concentrations found in evaporation basin water, any aquatic organisms living in these ponds are likely to develop high selenium body burdens. Similarly, any higher trophic level species that feeds on an evaporation basin's aquatic organisms is also likely to develop high body burdens, with the consequent risk for adverse effects of selenium toxicity.

The evaporation basin design for this Project includes an absence of vegetation near the ponds, steep-sloped sides, and relatively deep water levels. While these design features may serve to minimize or prevent exposure of other bird species to the evaporation basin water, they will do little to stop any California least terns that are intent on foraging in the ponds. Least terns search for prey while flying or hovering over water. Upon locating a suitable item, the bird drops to the water surface, partially submerging, and captures the prey in its beak (Thompson *et al.* 1997).

The California least tern (*S. a. browni*) is one of three recognized geographic subspecies; the other two being from the Atlantic and Gulf coasts of the United States, and the West Indies (*S. a. antillarum*) or from the interior United States (*S. a. athalassos*) (Thompson *et al.* 1997). At the species level, least terns are known to be primarily piscivorous, but will also consume insects and aquatic crustaceans such as shrimp (Thompson *et al.* 1997). However, studies of the *S. a. browni* subspecies indicate these birds have a strictly piscivorous diet (Massey 1974; Atwood and Minsky 1983; Atwood and Kelly 1984). While the latter of these two references make no direct statements concerning the possibility of non-fish prey items, Massey (1974) stated "I have never seen any food but fish being caught, carried, or eaten by adults or fed to chicks."

It is important to note that, in all three of the references cited above, the California least terns studied were from coastal locations. The possibility exists that any least terns that move inland to evaporation ponds may develop feeding strategies different from those used along the coast. Evaporation ponds are known to exhibit high primary productivity, oftentimes leading to very abundant aquatic invertebrate communities. Based on the evidence for preying on shrimp and other invertebrates by other least tern subspecies (Thompson *et al.* 1997), it is conceivable that least terns could alter their feeding behavior to take advantage of an evaporation pond's rich aquatic macro-invertebrate food resource.

Two different tern species, Caspian terns (*Sterna caspia*) and Forster's terns (*Sterna forsteri*), feed primarily on small fish, but will also consume invertebrates (Cuthbert and Wires 1999; McNicholl *et al.* 2001). During studies in the Tulare Basin, Forster's terns nesting around evaporation basins laid eggs with very high levels of selenium (J. Skorupa, pers. comm.; 2006). These birds foraged in and around the evaporation ponds, which did not appear to contain fish but were known to contain aquatic invertebrates. Caspian terns, which have a larger foraging radius than the Forster's terns, were utilizing the same evaporation ponds but did not exhibit elevated egg selenium levels (J. Skorupa, pers. comm.; 2006). This information provides some suggestion that these two tern species took advantage of the evaporation pond's abundant aquatic invertebrate communities, and that the Forster's terns, because of their more limited foraging range, had a greater percentage of evaporation pond invertebrates in their diets, leading to the higher egg selenium concentrations.

However, observations of nesting California least terns from around the Tulare Basin evaporation ponds suggests further evidence that these birds maintain their strictly piscivorous behavior, even in the presence of abundant aquatic macro-invertebrates. California least terns were first noticed nesting around these evaporation ponds in 1998, with one known pair setting up a nest and producing a clutch of eggs (J. Seay, pers. comm.; 2006). Since that time, least terns have continued to nest around these ponds in every subsequent year, with the highest number of known nest pairs (3) occurring in 1999. The foraging behavior of these nesting terns has been observed each year, and the only food items ever seen were fish captured from open drainwater canals, nearby flood control reservoirs, and evaporation ponds (J. Seay, pers. comm.; 2006). The types of fish captured and their origin in the drainage canals could not be readily determined, but at least one fish from the silversides family (Antheridae) was dropped by a foraging least tern and identified by a biologist, and *Gambusia* were known to have been established in the evaporation ponds by local mosquito abatement personnel (J. Seay, pers. comm.; 2006).

Thus, while it is possible that California least terns could alter their feeding behavior and forage from an aquatic macro-invertebrate-only food web, such as commonly develops in evaporation ponds, it appears much more likely that the primary risk to terns is from the consumption of small fish that can develop high body burdens of selenium and other bioaccumulative pollutants. As the proposed Project design does not include any open water conveyance canals, and based on the assumption that any ponding of water in reuse areas that may result from flooding events will be too short term to allow the development of an aquatic prey base, the only potential exposure route for terns would be fish either intentionally or accidentally established in the proposed evaporation ponds. Examples of accidental introductions include intermittent connections of the ponds via flood events to fish-inhabited waters, and piscivorous birds inadvertently dropping live prey fish, captured from other waterways, into the ponds. While both of these scenarios are feasible, the probability of these occurring and allowing for the establishment of a viable fish prey base is likely very low.

A much more plausible scenario for exposure is the intentional introduction of fish into the evaporation ponds to control mosquito populations. While salinity in the more terminal basin cells would likely be too high to support any fish populations, mosquitofish (*Gambusia affinis*) are tolerant of high salinities and could potentially inhabit some of the initial cells with the greatest depths and the least saline water. California least terns are known to prey on mosquitofish (Thompson *et al.* 1997), and any terns nesting around evaporation basins would likely forage from the ponds should mosquitofish populations become established. Due to the highly bioaccumulative nature of selenium and other pollutants that may be present in the agricultural drainwater (*e.g.*, methylmercury), any least terns foraging from such a prey base are likely to be exposed to these contaminants.

The proposed conservation measures for the Project include the agreement that Reclamation and the various water districts will work with the local mosquito abatement districts to minimize the use of *Gambusia* in the evaporation basins. However, due to the current concern over West Nile

virus and other mosquito-borne diseases, no assurance is provided that mosquitofish or other insectivorous fish will *not* be intentionally released into the evaporation ponds. For this reason, the Service believes that the proposed action will result in adverse long-term effects to the California least tern from exposure to elevated levels of selenium. These effects will be greater in magnitude for the alternatives that involve the least land retirement.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

San Joaquin Kit Fox

There is a trend toward an increase in the number of acres in Westlands Water District planted in permanent crops (orchards and vineyards) (Phillips 2006b; Westlands Water District 2004-2005), particularly on the western, non-drainage-impaired portion of the district (Phillips 2006b). The number of acres planted in permanent crops in Westlands Water District has doubled from 1993 to the 2004-2005 water year (Westlands Water District 2004-2005). In the last three years, the number of acres planted in permanent crops rose by over 15%, with an almost 8% decrease in the number of acres planted with field crops (Westlands Water District 2004-2005). There is less data available for the southern portion of the San Luis Water District than for Westlands Water District, but field observations indicate the same general trend is occurring in San Luis Water District (S. Phillips, pers. comm.; 2006).

This trend can be expected to affect the San Joaquin kit fox. The species can colonize fallowed lands when they are adjacent to occupied habitat (Cypher 2006). Land can be fallowed and left untilled for less than three years and then brought back into production with CVP water, without surveys for listed species and habitat. While the land lies fallow and untilled, even for one or two years, it can provide the foxes with a temporary increase in habitat, which is especially important in areas that function as movement corridors. Fallow fields are often disced for weed and pest control, which would reduce their value to kit foxes, primarily by discouraging the establishment of a prey base. In Kern County in the vicinity of Bakersfield, kit foxes have been observed using fallowed agricultural lands within weeks of being fallowed, with increasing use as fallowing continued (Cypher 2006). Within Westlands Water District, lands that may be fallowed are not disced more than twice a year (T. Bettner, pers. comm.; 2006).

With a trend toward permanent crops on the west side, which is where most of the more suitable habitat remains in the vicinity of the action area (B.L. Cypher, pers. comm.; 2006), there is expected to be a decrease in the acreage of land fallowed at any one time. Although orchards and vineyards have a somewhat higher value to kit foxes than annual crops (Cypher 2006), both permanent and annual crops are less likely than fallowed lands to support the preferred prey of

kit foxes (kangaroo rats) and they do not allow kit foxes as much visibility to detect potential predators. Permanent crops are not fallowed. Thus, a trend toward less fallowing on the western side can potentially have adverse cumulative effects on the San Joaquin kit fox, by reducing habitat value. This is of greatest concern in the areas where Little Panoche Creek, Panoche Creek and Cantua Creek intersect Interstate 5, because the available movement corridor for kit foxes is already reduced to a strip less than 0.5 miles in width (Cypher 2006). In these areas, kit foxes have very little room to move between the northern and southern portions of their range, because to the immediate west, the steeper land of the Coast Range provides little or no suitable habitat (B.L. Cypher, pers. comm.; 2006).

Permanent crops, however, are not subject to the periodic discing that occurs with fallowed lands, including when they are brought back into production. If kit foxes use fallowed lands that are subsequently disced, dens can be destroyed and/or foxes displaced into unfamiliar areas that put them at increased risk of being harmed (Cypher 2006). It should be noted that, although permanent crops are not subject to disturbance from discing, the harvesting activity that typically occurs in late summer for nut crops (e.g. almonds) involves shaking trees with equipment. This can stir up a great deal of dust and creates noise. This harvesting coincides with part of the typical dispersal period for juvenile kit foxes (Bjurlin *et al.* 2005).

Pesticide application, rodent control, blading, mowing, trenching, installation and repair of structures, roads, fences, and utilities, and other activities routinely conducted on farm and ranch lands may affect San Joaquin kit fox by disrupting foraging, eliminating prey or kit fox refugia, or favoring species that compete with or prey upon kit fox.

Additionally, effects may occur from changes in land use and management, human population growth, recreational disturbances, vandalism, road kills, off-road vehicle use, chronic disturbance, noise, and domestic dog and equestrian disturbances are likely to occur. These activities eliminate kit fox habitat or may kill individuals.

Giant Garter Snake

Rodent control by private landowners is likely to reduce refuge habitat for the giant garter snake. Discharges into surface waters including point source discharges, non-point source runoff, runoff from high-density confined livestock production facilities, agricultural irrigation discharges, runoff from overgrazed rangelands, municipal stormwater runoff, and illegal non-permitted discharges are likely to effect giant garter snake habitat and individuals. The introduction and spread of non-native fish, wildlife and plants, inbreeding of small populations, and genetic isolation could affect the giant garter snake.

Changes in land use and management, urban growth, and the illegal and/or unregulated fill or conversion of wetlands can affect giant garter snakes. In addition, recreational disturbances, vandalism, road kills, off-road vehicle use, chronic disturbance, noise, and domestic dog and equestrian disturbances are likely to occur.

California Least Tern

We have no information about reasonably foreseeable non-federal actions within the action area that would affect California least tern.

Conclusion

After reviewing the current status of the species considered in this opinion, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that implementation of the proposed project as described, is not likely to jeopardize the continued existence of the San Joaquin kit fox, giant garter snake, and California least tern. Critical habitat has not been designated for these species, therefore none will be affected. This conclusion is based primarily on the marginal habitat value existing currently within the action area, the potential beneficial effects of the project on the giant garter snake, the proposed adaptive management and monitoring programs, and the proposed project's conservation measures. Actions that are not included in, and consistent with, the project description in this document have not been analyzed for their impacts on the survival and recovery of proposed and listed species.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

Some actions related to the proposed action are not covered by this incidental take statement. Related actions that are not covered by this opinion include but may not be limited to: the design, designation, and management of wetland mitigation lands for the proposed project. Reclamation should consider whether it may have a duty to avoid irreversible or irretrievable commitments toward related actions before any biological opinion is completed for a related action. This incidental take statement does not authorize any incidental take of listed species resulting from related actions that are not part of or controllable by the San Luis Drainage

Feature Re-evaluation Project, and that are not included in the project description of this biological opinion.

The measures described below are non-discretionary, and must be implemented by Reclamation so that they become binding conditions of any agreement, contract, grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to any agreement, contract, permit, or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

San Joaquin Kit Fox

The San Joaquin kit fox may be incidentally taken resulting from the implementation of all the Project alternatives. Incidental take is likely to be in the form of: (a) direct harm or mortality resulting from the destruction of natal dens when occupied retired lands are disced for vegetation management or prepared for a return to dryland farming, and (b) direct harm or mortality from selenium toxicosis as a result of foraging on selenium-contaminated prey at reuse areas.

The number of individual animals which may be subject to incidental taking from these two Project features (*i.e.*, Land Retirement and Reuse Areas) cannot be definitively predicted for three reasons: (1) the final configuration of Project features over the landscape has not been determined, (2) the number of animals which may use these Project areas for foraging or denning, during and after implementation, cannot be comprehensively determined, and (3) the amount of exposure to elevated levels of selenium from bioaccumulation in the kit fox food chain is dependent on a variety of factors and future conditions that cannot be predetermined (including such things as siting of reuse areas, accessibility of reuse areas for kit fox, types of vegetation and vegetation management on reuse areas, and the selenium concentrations in water used to irrigate reuse area crops).

Based on our analysis presented in the **Environmental Baseline** and **Effects of the Action** sections, which describes how the majority of the Project area, both under current and proposed land management, may be considered suboptimal kit fox habitat and is not currently associated with kit fox "core" areas, we do not anticipate that large numbers of foxes are likely to be exposed to adverse effects from the management of retired lands or the operation of reuse areas under all proposed alternatives. However, because no estimate of the current kit fox population exists and there is no way to accurately determine what number of individuals or percentage of the population may currently exist in or travel onto Project lands, the Service is providing an anticipated level of take based on certain assumptions concerning Project configuration and kit fox ecology.

As described in the **Status of the Species** section and in the Recovery Plan for Upland Species of the San Joaquin Valley (USFWS 1998), kit fox mating and conception take place between late December and March, with litters of generally two to four pups being born sometime between February and late March. Pups emerge above ground at slightly more than one month of age. Then, after four to five months, family bonds begin to dissolve and juveniles may begin dispersing in search of new territories. Juveniles may disperse long distances during these searches, even through highly disturbed habitats. However, survival of dispersing juveniles is low (*e.g.*, < 35% surviving beyond 10 days reported by Koopman *et al.* 2000).

Amount or Extent of Take from Retired Lands: Between the four Project alternatives presented, approximately 44,100 and 308,000 acres of existing drainage-impaired lands will be retired. As previously explained, the 44,100 acres presented in the In-Valley Disposal alternative represents land that is already retired under a separate action, not as a result of implementation of the proposed Project. Therefore, take of kit foxes from the retired land component of the Project has been estimated for the three alternatives proposing acreage to be retired in addition to these 44,100 acres.

The additional acreage proposed for retirement under the three remaining alternatives totals: 48,486 (In-Valley Groundwater Quality Land Retirement); 149,850 ((In-Valley/Water Needs Land Retirement); 263,894 (In-Valley/Drainage Impaired Area Land Retirement). Based on the assumption of 1/3 each of these lands being grazed, fallowed, or dryland farmed, this means that approximately 16,162 to 87,964 acres will be fallowed and the same amount converted to dryland farming. It is assumed that fallowing and dryland farming will occur on a rotational basis, with fallowed land being periodically prepared for dryland farming and existing dryland farms being fallowed. Therefore, in any given year after Project implementation, between 16,162 and 87,964 acres will be fallowed, and these lands will be biannually disced for weed control. The deeper ripping of fallowed land associated with preparation for dryland farming should only occur after several years for any given parcel.

Although it is likely that juvenile and adult kit foxes will disperse onto retired lands in the Project area, we believe both the number of kit foxes traveling onto retired lands and the probability of kit foxes forming pair bonds and selecting these fallowed lands for natal dens would be low. In addition, the most vulnerable time for kit foxes in natal dens is between January and April, which may further reduce the risk of den destruction as this time period may not fully coincide with the need for discing or ripping. However, this probability of risk varies with the different Project alternatives (*i.e.*, less take anticipated for alternatives with less retired land, and more take from alternatives with increasing acres of retired land). The amount of take anticipated from each Project alternative is presented in Table 5 below.

Amount or Extent of Take from Reuse Areas: Between the four Project alternatives presented, the number and size of the proposed reuse areas varies: 16 reuse areas on approximately 18,925 acres, 15 reuse areas on 16,700 acres, 14 reuse areas on 12,500 acres, and 1 reuse area on 7,500

acres in Northerly area. For all but the alternative with one reuse area, reuse areas and associated treatment and evaporation facilities will be distributed throughout the entire length of the Project area. Reuse areas will be placed around four separate treatment and evaporation facility sites, located in four distinct Project areas (Northerly Area, Westlands North, Westlands Central, and Westlands South). The alternative with only one reuse area would focus only on the Northerly Area.

Kit foxes, particularly juveniles dispersing from whelping dens in search of new territories, are likely to travel through the Project area and find foraging opportunities at reuse areas. Based on the analysis in the **Effects of the Action** section, we believe the probability of kit foxes finding an abundant prey base at these areas and being exposed to elevated levels of selenium through their diet is relatively high, although the numbers of kit foxes traveling onto reuse areas and thus exposed should be relatively low. Similar to the anticipated take from retired lands, the probability of risk from reuse areas varies with the different Project alternatives (*i.e.*, more take anticipated for alternatives with greater numbers of reuse areas, and less take from alternatives with fewer reuse areas). The amount of take anticipated from each Project alternative is presented in Table 5 below.

Table 5. Anticipated Take of San Joaquin Kit Fox Individuals Per Year from Various Project Alternatives.

Project Alternative	Take on Retired Lands	Take on Reuse Areas	Total Take
In-Valley Disposal	0	4	4
In-Valley Ground Water Quality Land Retirement	1	4	5
In-Valley/Water Needs Land Retirement	1	4	5
In-Valley/Drainage Impaired Area Land Retirement	2	1	3

Therefore, the total amount of take, in the form of harm or mortality, anticipated for the proposed Project ranges from 3 to 5 individual foxes per year. Monitoring for kit fox presence and use, as required by the Service's Terms and Conditions, will provide data by which these exposure estimates can be verified. If data indicate the number of individual foxes incidentally taken exceeds the anticipated numbers presented here, Reclamation may need to reinitiate consultation (see **Reinitiation-Closing Statement**).

Giant Garter Snake - The Service expects that incidental take of giant garter snakes will be difficult to quantify for the following reasons: (1) the snakes are secretive and notoriously sensitive to human activities, (2) individual snakes are difficult to detect unless they are observed, undisturbed, at a distance, and (3) detection and tracking of all operations and maintenance activities that may result in take of giant garter snake is difficult. We do not have evidence that giant garter snakes are present in the action area in large numbers. Although the collection and conveyance systems have not yet been designed, we anticipate that the amount of suitable giant garter snake aquatic and upland habitat that will be disturbed by construction of Project infrastructure and facilities will be small. We anticipate that conservation measures proposed by Reclamation will minimize the amount of take that may result from construction of Project infrastructure and facilities. As a result, we estimate that no more than one (1) giant garter snake may be harmed during construction of Project facilities in the Northerly area. Additionally, we estimate that all giant garter snakes present in aquatic or adjacent upland habitat in up to 10 acres adjacent to any stream crossings required to construct pipelines and conveyance systems in the Northerly area after implementation of giant garter snake take minimization measures (see **Description of the Proposed Action**) may be harassed by project construction.

California Least Tern – All California least terns that forage and/or nest at the evaporation basins are likely to be adversely affected by the proposed project. Incidental take of the California least tern is expected to be in the form of killing or harming of individual birds, resulting from contamination. Incidental take is authorized for three (3) California least tern individuals confirmed annually to be killed, be harmed, or have produced failed eggs, resulting from selenium contamination.

Effect of the Take

The Service has determined that this level of anticipated take, from implementation of the San Luis Drainage Feature Re-evaluation Project, is not likely to result in jeopardy to the San Joaquin kit fox, giant garter snake, or California least tern. The majority of the terrestrial portion of the action area is actively farmed lands that do not support large numbers of any of the subject species (see **Environmental Baseline**). Each of the three species is likely to be exposed to adverse effects from either Project implementation (San Joaquin kit fox), Project facility construction (giant garter snake), or Project facility operation (San Joaquin kit fox, California least tern). Construction effects on giant garter snake will be minimized by implementation of the Service's standard avoidance and minimization measures. The potentially more significant effects of Project implementation and operation on San Joaquin kit fox (through management of retired lands and exposure to contaminants in reuse areas) and California least tern (through exposure to contaminants in evaporation basins) are not anticipated to be significant at the population level due to the low numbers of individuals expected to be exposed. At the local level, however, these effects have the potential to be significant, although not to a degree that would appreciably reduce the likelihood of survival and recovery in the wild. In addition, Reclamation has committed to implementing land retirement in a way that will attempt to maximize benefits to San Joaquin kit fox while meeting overall drainage reduction targets for the

Project.

Reasonable and Prudent Measures for the San Joaquin Kit Fox

The following reasonable and prudent measures are necessary and appropriate to minimize the impact of take caused by the San Luis Drainage Feature Re-evaluation Project on the San Joaquin kit fox:

1. Minimize the incidental take of the San Joaquin kit fox resulting from the management of fallowed and dryland farmed lands under the proposed land retirement Project feature.

2. Maximize the potential beneficial effects on the San Joaquin kit fox resulting from management of grazed lands under the proposed land retirement Project feature.

3. Minimize the incidental take of the San Joaquin kit fox resulting from kit fox foraging on selenium-contaminated prey in reuse areas.

Terms & Conditions for San Joaquin Kit Fox

In order to be exempt from the prohibitions of section 9 of ESA, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

The following terms and conditions implement Reasonable and Prudent Measure Number One (1):

1. For those lands retired from irrigated agricultural production and fallowed, Reclamation will include in the non-irrigation covenants on the deed to lands that are retired a reservation for the Federal government and its agents to have access to the retired lands at any time for research, environmental assessment, monitoring, and evaluation of the premises for compliance with the biological opinion on the SLDFR. Reclamation shall conduct monthly surveys for the first year and quarterly surveys for the subsequent 2 years to determine if any kit foxes have moved onto the land and created den sites. The purpose of this surveying is to determine if biannual discing of the fallowed fields is sufficient to deter kit fox den creation, or whether an increased schedule is required to ensure deterrence.

2. For those lands retired from irrigated agricultural production and dryland farmed, Reclamation will include in the non-irrigation covenants on the deed to lands that are retired a reservation for the Federal government and its agents to have access to the retired lands at any time for research, environmental assessment,

monitoring, and evaluation of the premises for compliance with the biological opinion on the SLDFR. Reclamation will conduct the same survey procedures as in item 1, above, once the dryland farmed land is scheduled for rotation to fallowing.

3. As part of the "strategic land retirement program" to maximize the benefits of retired lands to kit fox recovery within the primary goals of reducing contaminated drainage, Reclamation shall, in coordination with the Service and willing landowners, develop long-term monitoring plans, contingency plans, and adaptive management plans to be incorporated into the operating plans for retired lands. The contingency plans shall identify measures that shall be implemented if kit fox survey results indicate biannual discing is not sufficient to deter kit fox den creation.

4. Reclamation shall provide the Service with copies of all surveys and monitoring results in a timely fashion (*i.e.*, within 30 days for monthly surveys and monitoring results, and 45 days for quarterly surveys), so as to facilitate prompt analyses and decisions regarding land management.

The following terms and conditions implement Reasonable and Prudent Measure Number Two (2):

1. When planning and siting the retired lands that are to be used for grazing, Reclamation shall give priority to lands identified by the Endangered Species Recovery Program and the Service that would maximize their utility for kit fox recovery when such lands also meet Project goals to reduce contaminated drainage.

The following terms and conditions implement Reasonable and Prudent Measure Number Three (3):

1. Reclamation shall complete preliminary site studies during feasibility and final design project planning stages to ensure that siting of SLDFR reuse areas are abutted on each side by land types (*e.g.*, existing irrigated cropland or dryland farmed land) that would tend to deter San Joaquin kit fox from traversing into the reuse areas. These surrounding land areas should provide a minimum barrier of 1.5 km between the reuse areas and any retired land being fallowed or grazed in order to deter kit fox crossing into a reuse area. In the event a 1.5 km barrier cannot be achieved, SLDFRE reuse areas should be sited in such a manner that retired lands around the reuse area that will be fallowed or grazed do not provide an uninterrupted connective corridor through which kit foxes would likely travel from other potentially occupied habitat (*e.g.*, natural areas outside the Project area).

2. Reclamation shall, in consultation with the Service, develop long-term monitoring plans, contingency plans, and adaptive management plans to be incorporated into the operating plans for reuse areas including:

    2a. Reclamation shall work with the Service and the California Department of Fish and Game to develop vegetation management plans for reuse areas that will reduce their attractiveness for the kit fox.

    2b. Reclamation shall work with the Service and the California Department of Fish and Game to develop both a kit fox survey plan and a tiered food chain monitoring plan for these reuse areas. These plans shall monitor the use of the areas by kit fox, as well as the selenium levels in small mammal prey species and the vegetation they consume.

    2c. Reclamation shall develop, in consultation with the Service and the California Department of Fish and Game, and implement as needed, a contingency plan to reduce drainwater contaminant exposure if monitoring data indicate that San Joaquin kit foxes are being exposed to elevated selenium levels in their prey from these areas. Examples of contingency measures may include small mammal trapping and removal, harvesting the standing reuse area crop, or installation of an exclusionary predator proof fence around the perimeter of the reuse area. The contingency plan shall be included in Project budget estimates.

Reasonable and Prudent Measures for Giant Garter Snake

No reasonable and prudent measures are required for the giant garter snake because take will be minimized by the conservation measures in the project description.

Reasonable and Prudent Measures for the California Least Tern

The following reasonable and prudent measure is necessary and appropriate to minimize the impact of the San Luis Drainage Feature Re-evaluation Project on the California least tern:

1. Minimize the incidental take of California least terns resulting from terns foraging on selenium-contaminated prey in or around evaporation basins.

Terms & Conditions for the California Least Tern

In order to be exempt from the prohibitions of section 9 of ESA, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary. The following terms and conditions implement the Reasonable and Prudent Measures:

1. Reclamation shall facilitate the formation of an inter-agency team with representatives from Reclamation, the Service, local water districts, and mosquito abatement districts. The purpose of this team will be to develop a mosquito control plan for the Project's evaporation basins which will serve to minimize or eliminate the introduction of mosquito-predator fish (*e.g., Gambusia affinis*) into any evaporation ponds, or to eliminate the potential for least tern exposure to introduced fish populations. The goal of a joint mosquito control plan is to remove the potential for a piscivorous bird prey base that would likely develop highly elevated levels of selenium from the evaporation pond water.

2. Reclamation shall fund bird surveys by a biologist determined to be qualified by the Service's Sacramento Fish and Wildlife Office on and around each evaporation basin to determine the presence or absence of California least terns. Surveys shall be conducted by a qualified avian biologist or ecologist, and should be initially conducted on a bi-weekly basis from approximately one month prior to the typical arrival time for reproductive adults until the end of typical least tern chick fledging period. After the fledging period, surveys shall be conducted on a weekly basis for one month in order to observe any terns that may be attempting a second nest. Any documented least tern sighting shall trigger an increased monitoring protocol, with parameters dependent on the when the sighting occurred. When the MWG for the SLDFR project develops protocols for evaluating possible effects to migratory birds at the evaporation ponds, California least terns must be included as one of the evaluation species.

    2a. If least terns are sighted outside of the typical breeding period (courtship, nesting, fledging), evaporation basins shall be surveyed daily, for a minimum of one hour of intense scanning (binoculars, spotting scopes) during optimal viewing daylight hours. The purpose of these surveys is to determine if terns are foraging from the evaporation ponds. If it is determined that terns are not feeding from the evaporation ponds, every effort shall be made to ascertain the likely feeding location or general direction via observations of flight lines. Monitoring of this nature will continue until least terns are not observed for three consecutive days, at which time the regular bi-weekly schedule may resume.

    2b. If least terns are sighted during the typical breeding period, detailed

censuses of the evaporation basins and surrounding lands for nesting terns shall be conducted in addition to the surveys described in 2.a. above. Any least tern nests found shall be monitored for reproductive success, following Service-approved protocols. Any fail-to-hatch eggs will be collected, examined to determine egg status, and analyzed for total selenium by a Service-approved laboratory.

2c. If least terns are observed feeding from the evaporation ponds, observations shall continue until foraging stops. Foraging information shall be fully recorded, including such things as: number of feeding attempts per unit time; number of feeding attempts successful; prey items captured, identified to lowest possible taxon (*e.g.*, fish vs. aquatic invertebrates).

2d. Once determined that least terns are foraging in the evaporation ponds, and the prey items have been identified, monitoring of the pond's biota shall commence. Reclamation will work with the Service to develop an appropriate biotic monitoring plan, which shall include, at a minimum, an adequate sample of the least tern prey items. Monitoring of additional food chain components may also be required. This monitoring effort will determine selenium concentrations in the pond's biota in order to accurately assess the risk of selenium toxicity to least terns. Analysis of all biotic samples shall be conducted immediately on an emergency basis in order to most rapidly determine the extent and degree of risk, and implement any remediation response measures.

3. Reclamation will develop, in consultation with the Service, and implement as needed, contingency plans, and adaptive management plans that identify any and all feasible measures to minimize least tern risk of exposure to the evaporation pond's biota. These contingency and adaptive management plans will be incorporated into the operating plans for SLDFR evaporation ponds. These plans will require immediate coordination with the Service and any other appropriate agency (*e.g.*, water districts, mosquito abatement districts) once evaporation pond foraging by least terns has been determined, and identify minimization measures to be implemented by Reclamation. Minimization measures may include: hazing of nesting least terns; enclosing the ponds in netting; removal of fish; water level control. This list of tactics is not meant to be considered comprehensive, and other viable options may be developed.

Reporting Requirements

Injured San Joaquin kit fox, giant garter snake, or California least tern must be cared for by a licensed veterinarian or other qualified person; dead individuals of any of these three listed

species should be preserved according to standard museum techniques and held in a secure location. The Service and the California Department of Fish and Game must be notified within one (1) working day of the discovery of death or injury to a San Joaquin kit fox, giant garter snake, or California least tern that occurs due to project related activities or is observed at the project site. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a USGS 7.5 minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. The Service contacts are Deputy Assistant Field Supervisor, Endangered Species Program at the Sacramento Fish and Wildlife Office (916) 414-6600), and Scott Heard, Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660. The California Department of Fish and Game contact is Ron Schlorff at 1416 9th Street, Sacramento, California 95814, (916) 654-4262.

Reclamation shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of construction activity. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the San Joaquin kit fox or giant garter snake, if any; (v) occurrences of incidental take of any San Joaquin kit fox or giant garter snake, if any; (vi) documentation of employee environmental education; and (vii) other pertinent information.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. We propose the following recommendations to promote the conservation status of the several federally-listed species in the project area:

1. *Adopt a policy that maximizes land retirement (through all appropriate means) on drainage-impaired lands.* To avoid and minimize risks and effects to listed species in the San Joaquin Valley, Reclamation should consider retiring from irrigation all drainage impaired lands in the San Luis Unit. This approach would maximize the elimination of drainage at its source and avoid associated adverse effects from drainage contamination (such as effects to California least terns at evaporation ponds and to San Joaquin kit fox at reuse areas). This approach could also provide a significant amount of habitat for listed species recovery needs, such as San Joaquin kit fox.

2. *Manage retired lands to* benefit *listed species recovery needs.* In accordance with the conservation measure for "strategic land retirement", Reclamation should work with landowners, in collaboration with the Service and other local resource agencies, to manage retired lands in a manner that maximizes benefits to listed species such as San Joaquin kit fox. This would allow Reclamation to meet its obligation to comply with section 7(a)(2) for both the SLDFR and San Luis Unit long term contract renewal consultations. These consultations provide a unique opportunity for Reclamation to collaborate in the resolution of a significant resource issue of the southern San Joaquin Valley selenium contaminated drainage – in a way that furthers important resource management goals of both Reclamation and the Service. There is need for evaluation and development of a broad scale landscape mosaic plan for the San Luis Unit and adjacent areas focusing specifically on habitat restoration and endangered species recovery goals. Such a plan could provide guidance to Interior's and Westlands' management efforts on existing retired lands, and guide the Service and Reclamation on evaluation and implementation of future actions in the area. To accomplish this, Reclamation should establish a team of Service and Reclamation staff to negotiate an acceptable land retirement strategy that would address listed species recovery needs.

3. *Optimize SLDFR land retirement with related efforts to maximize benefit to recovery of threatened and endangered species.* The Service recommends that Reclamation begin the planning phase for the objectives to further listed species recovery associated with land retirement as soon as possible. The Service further recommends that Reclamation, jointly with the Service's SFWO, convene a SLDFR technical team under the larger San Joaquin Valley Recovery Team, and invite other interested parties and stakeholders to coordinate and integrate these recovery objectives in a practical manner with other related actions. An example of an action potentially related to SLDFR land retirement is encroachment mitigation -- a requirement of the State Water Resources Control Board (SWRCB) in their Decision D-1641 (dated March 2000). In D-1641 the SWRCB required in-kind mitigation for encroachment application of CVP water outside the CVP Place of Use. As of this date, about 22,000 acres of alkali scrub habitat have yet to be acquired for this mitigation requirement. All of the encroachment of alkali scrub occurred within the San Luis Unit (primarily Westlands) and within the SLDFR project area. The SWRCB D-1641 has given Reclamation 10 years (from March 2000) to complete this mitigation. Restoration of some of the SLDFR retired lands could be used to fulfill this mitigation requirement and could provide habitat that would support listed species such as San Joaquin kit fox.

4. *Allocate some of the water made available by SLDFR to meet level 4 refuge water supply.* Reclamation should reallocate some of the water made available by project features (e.g., land retirement and reverse osmosis treatment) to fulfill

currently unmet level 4 water supplies in the Grasslands and Mendota Areas. Provision of clean, reliable, level 4 refuge water supplies could provide additional permanent wetland habitat that would benefit giant garter snakes in furtherance of recovery objectives for the species in the San Joaquin Valley.

5. *Expand focus of Mitigation Work Group to include listed species issues.* Reclamation should expand the mitigation work group to address listed species issues of SLDFR planning that has yet be completed. SLDFR issues that have been deferred until a later date include: the preparation of mitigation monitoring and adaptive management plans; full discussion of risks associated with reuse facilities, mitigation and contingency measures; final siting and management planning for project facilities (including mitigation wetlands); and detailed cost estimation and framing of the feasibility analysis.

6. *Ensure a funding source is available to pay for contingencies.* Reclamation should ensure that adequate funding is available to pay for any needed contingencies or adaptive management needs specific to listed species that arises over the period SLDFR is implemented. Such contingencies could include detailed contaminant or California least tern use monitoring and nest surveys at evaporation ponds, contaminant monitoring, and San Joaquin kit fox use at reuse areas, or mitigation measures such as fencing of reuse areas or netting of evaporation ponds or provision of clean wetland compensation habitat for California least tern.. Reclamation should estimate and request adequate funding for contingencies that may be needed during the project life in the SLDFR feasibility and budgeting processes. Reclamation should also have contingency funding sources identified (such as acquisition of performance bonds) to enable immediate action to halt adverse effects if stepwise deterrence proves ineffective and prevent prolonged risk to listed species during a reinitiated consultation.

7. Ensure *adequate funding for and quality of water supply for mitigation wetlands.* To maximize benefit to listed species such as giant garter snake, Reclamation should seek allocation of firm, clean, contract water supply for mitigation wetlands. Sources of such water include reverse osmosis treated drainwater, water freed-up by land retirement, or CVP water contract assignments.

8. *Include compliance with selenium water quality objectives in the Grasslands wetlands channels as a SLDFR performance criterion.* As currently envisioned SLDFR project facilities will not be designed to capture and treat drainage generated from: (a) drainage contaminated runoff from the SLDFR project area during heavy rainfall events, (b) lands adjacent to the Delta Mendota Canal that discharge into the DMC check drains, (c) and lands within the San Joaquin Exchange Contract Service Area (e.g., Poso and Almond Drain areas) that are outside the Grasslands Bypass Project Area. Reclamation should consider

including compliance with water quality objectives in the Grasslands wetland channels as a SLDFR performance criteria. Reclamation should also develop and implement a plan on how to meet selenium objectives in the Grassland wetland supply channels. Compliance with these water quality objectives will likely benefit giant garter snake which forage in these waters.

9. *Monitor and assess the effects of San Joaquin Exchange Contract 10-year Transfer Program on water quality and giant garter snake populations in Mud and Salt Sloughs.* Reclamation should monitor and assess the effect of reduced flow in Mud and Salt Slough from the San Joaquin Exchange Contract 10-Year Transfer program on waterborne selenium concentrations and giant garter snake populations. This is an issue of emerging significance in the environmental baseline for Reclamation actions in this part of the San Joaquin Valley.

10. *Determine effects of selenium and mercury on giant garter snake.* Reclamation, together with the Service and other appropriate agencies, should implement a study on the effects of contaminants (specifically selenium and mercury) on giant garter snake surrogate species within the Grassland wetlands, Grassland wetlands supply channels, and Mud Slough (North).

11. *Assist the Service in the implementation of listed species recovery actions.* Reclamation should assist the Service in the implementation of recovery actions in the Recovery Plan for Upland Species in the San Joaquin Valley (USFWS 1998), Recovery Plan for the Sacramento/San Joaquin Delta Native Fishes (USFWS 1995), and the Draft Recovery Plan for the Giant Garter Snake (USFWS 1999). Priority 1 Recovery Actions from these plans include the following:
    a. Protect habitat on private lands in the North and South Grasslands for giant garter snakes;
    b. Protect habitat on private lands in the Mendota area for giant garter snakes;
    c. Develop/update and implement management plans for Mendota, China Island, Los Banos, and Volta Wildlife Areas for giant garter snakes;
    d. Improve in-Delta habitat conditions for Delta native fishes by increasing freshwater flows; and
    e. Expand and connect existing natural land for San Joaquin kit fox in the Mendota area, Fresno County, with the Ciervo-Panoche Natural Area, through restoration of habitat on retired, drainage-problem land.

12. *Develop a selenium budget for the San Joaquin River, Delta.* Reclamation, together with the Service and other appropriate agencies, should complete the studies necessary to develop a selenium budget and to determine the sources, fate

and impact of all selenium discharges in the San Joaquin River. This budget would include all presently impaired downstream water bodies used by listed species (e.g., giant garter snake, delta smelt, California clapper rail) including Mud Slough (North), the San Joaquin River, and the North Bay (e.g., Suisun Bay) and Sacramento-San Joaquin Delta.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation with Reclamation on Reclamation's proposal to construct and implement the SLDFR. As provided in 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the proposed action may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion; or (4) a new species or critical habitat is designated that may be affected by the proposed action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

Closing

The SFWO would like to thank you and your staff for their assistance in providing information, ground-truthing, helping us better understand Reclamation's water contracting process, and commitment to working with us to conserve listed species. Please contact Jan Knight or Mike Welsh at (916) 414-6600 with questions about this biological opinion.

Enclosures:

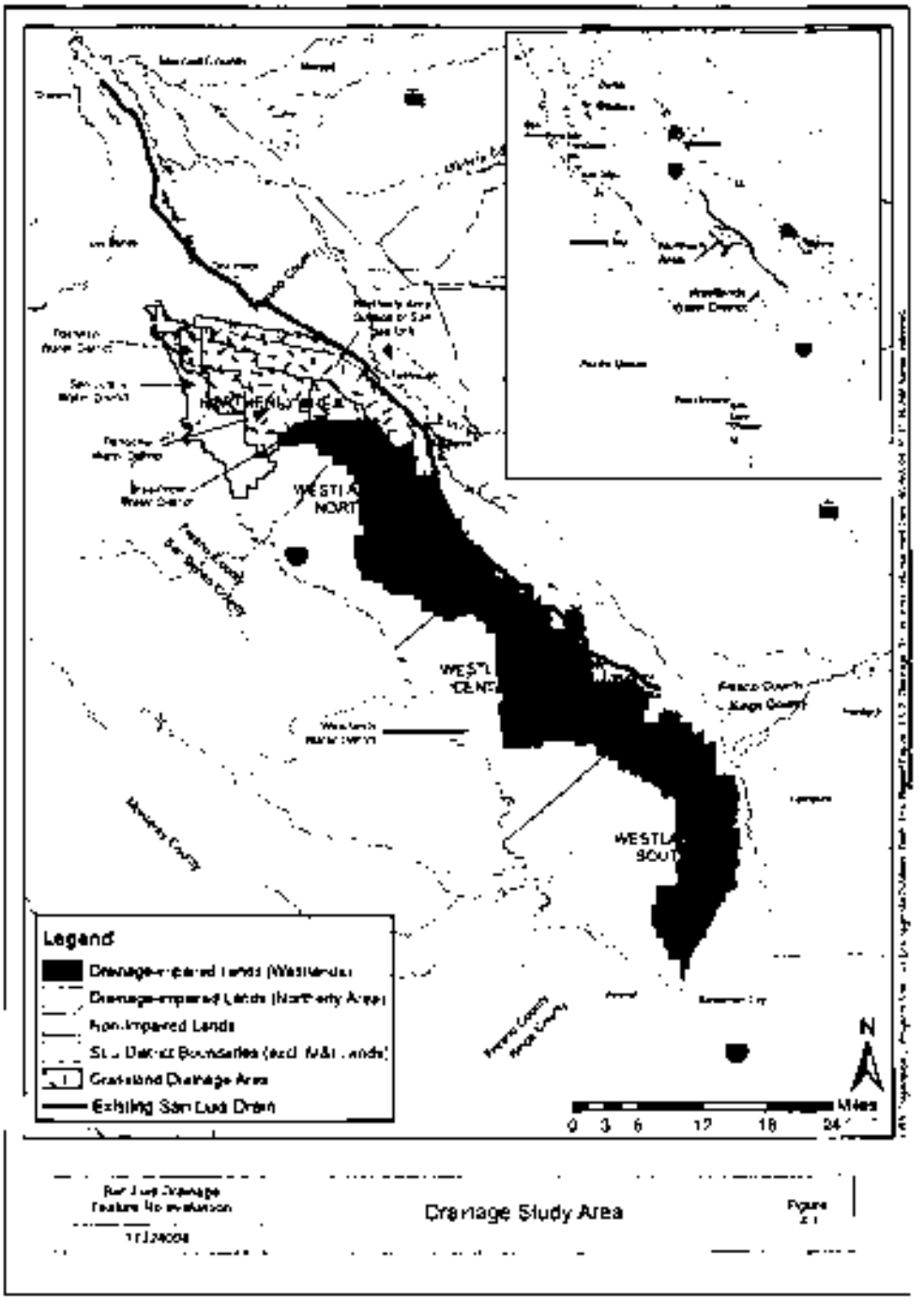
- List of Tables (5)
- List of Figures (1)
- List of Maps (9)
- Appendices (4)
- Literature Cited
- Unpublished Literature
- Personal Communications

cc:
ARD (ES), Portland, OR
USFWS, VFWO (Attn: Dave Pereksta)
USBR SCAO (Attn: Kathy Wood, Mike Delamore)
USBR Mid-Pacific Regional Office (Attn: Gerald Robbins)

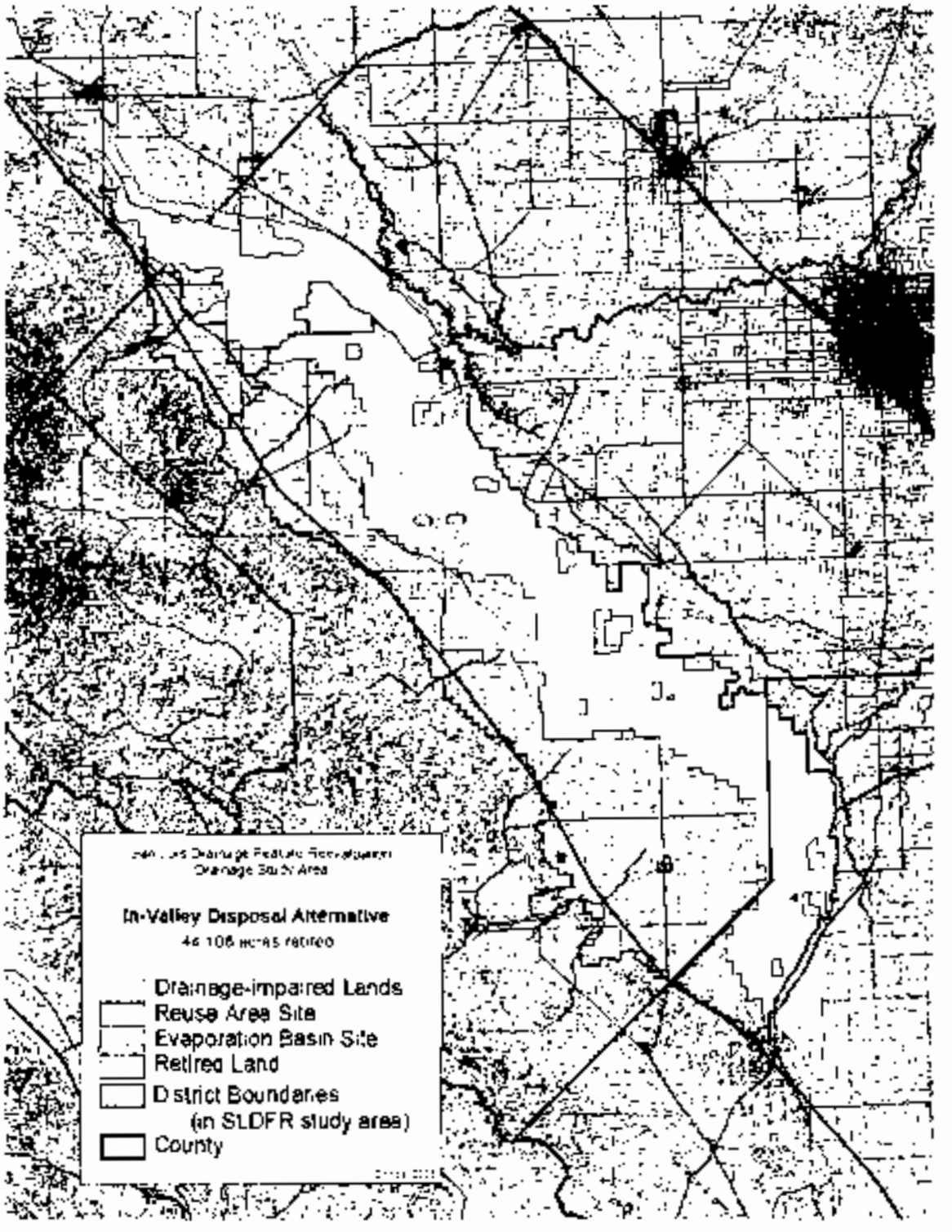
List of Tables

List of Figures

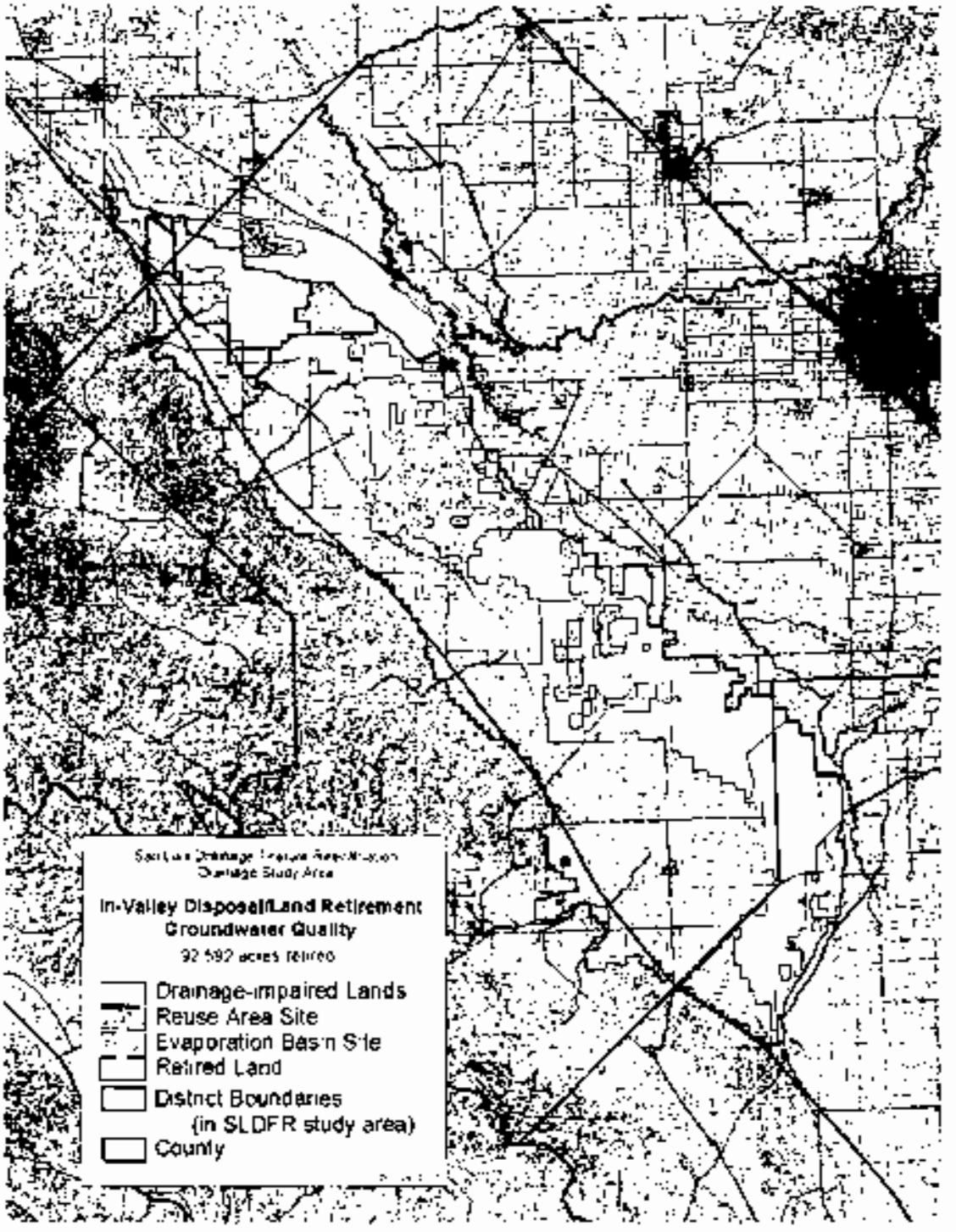
List of Maps



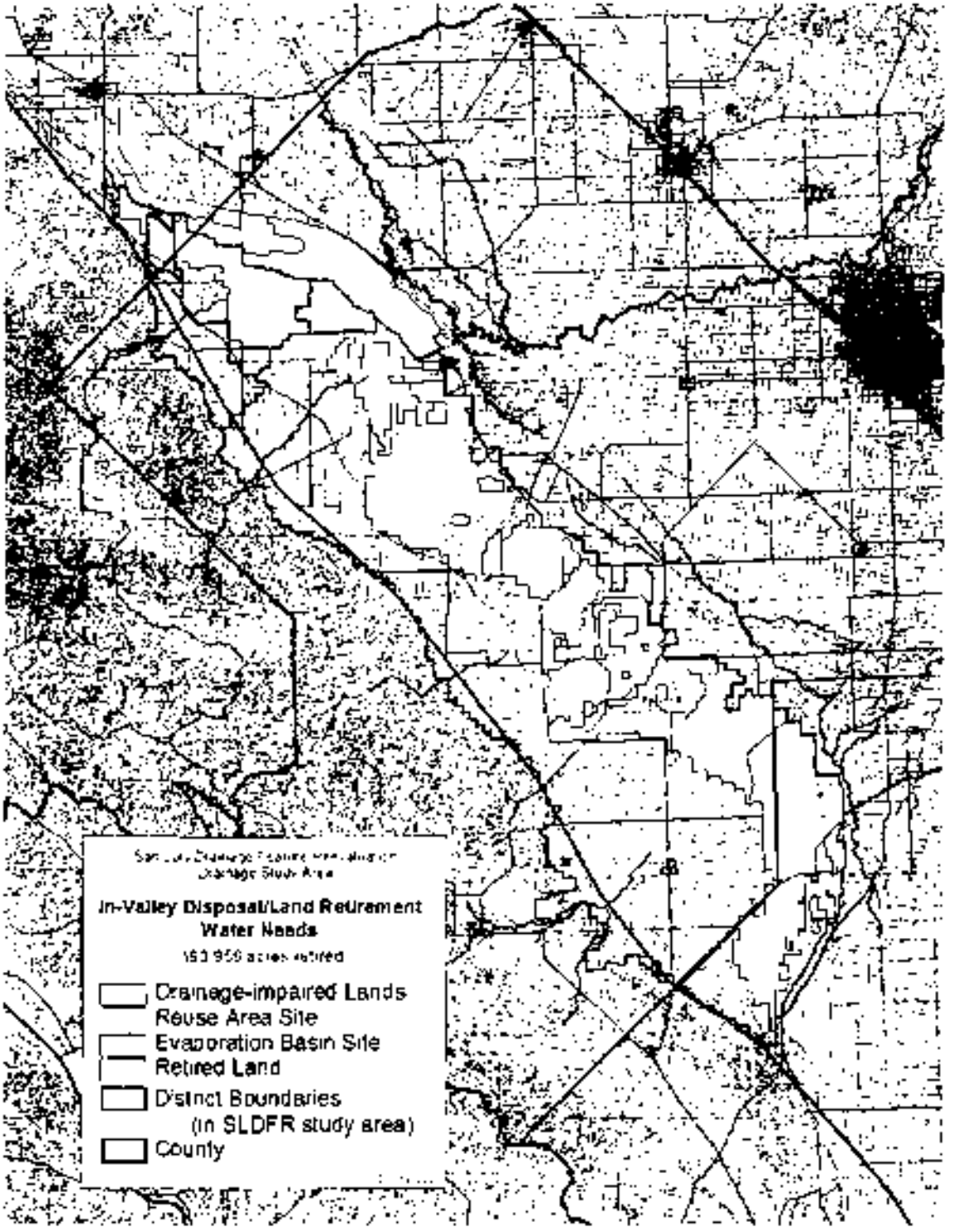
Map 1. San Luis Drainage Feature Re-evaluation Drainage Study Area (Source: USBR 2005b:Figure 4-1).



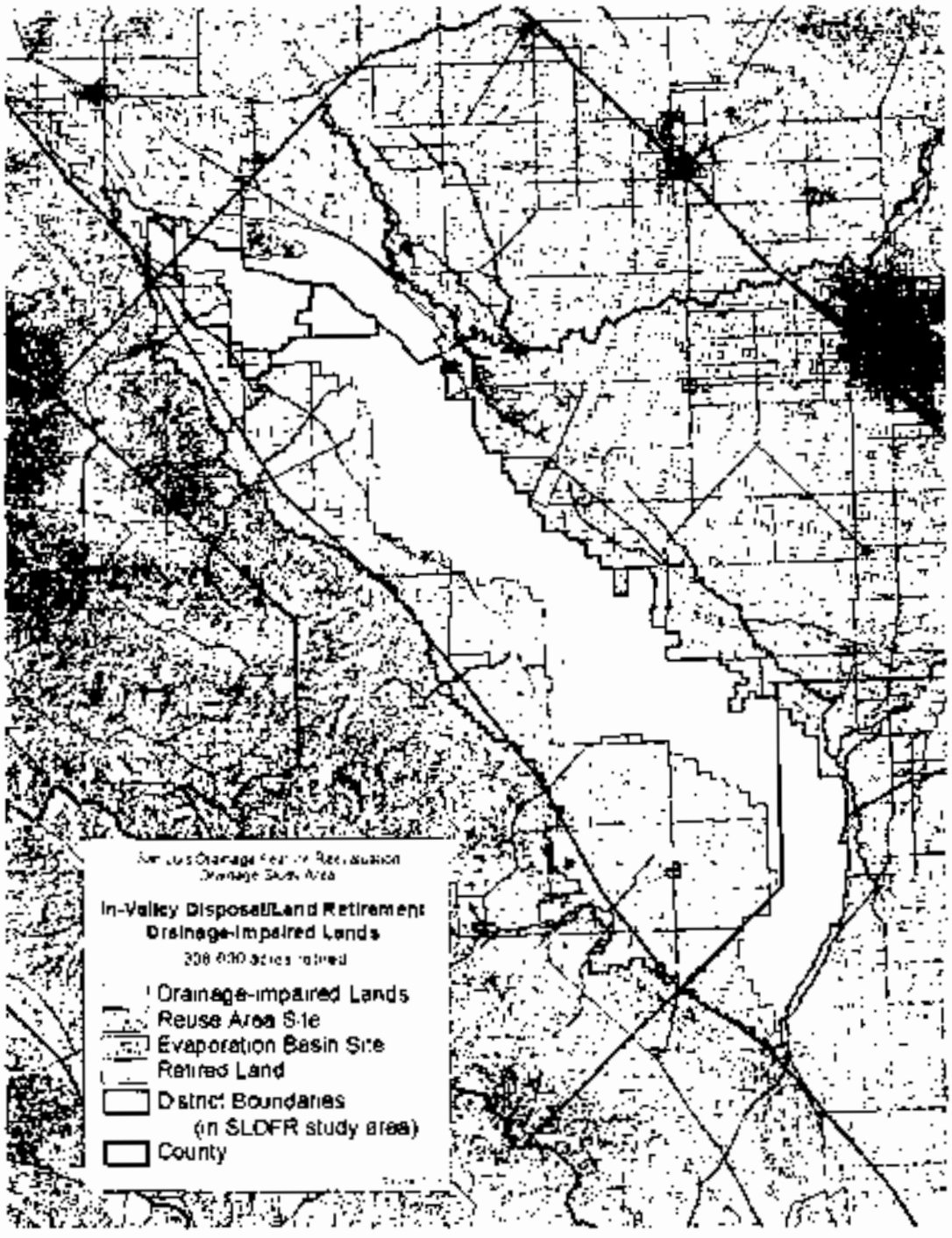
Map 2. In-Valley Disposal Alternative (44,106 acres retired; Source: USBR 2005b:Figure 6-2).



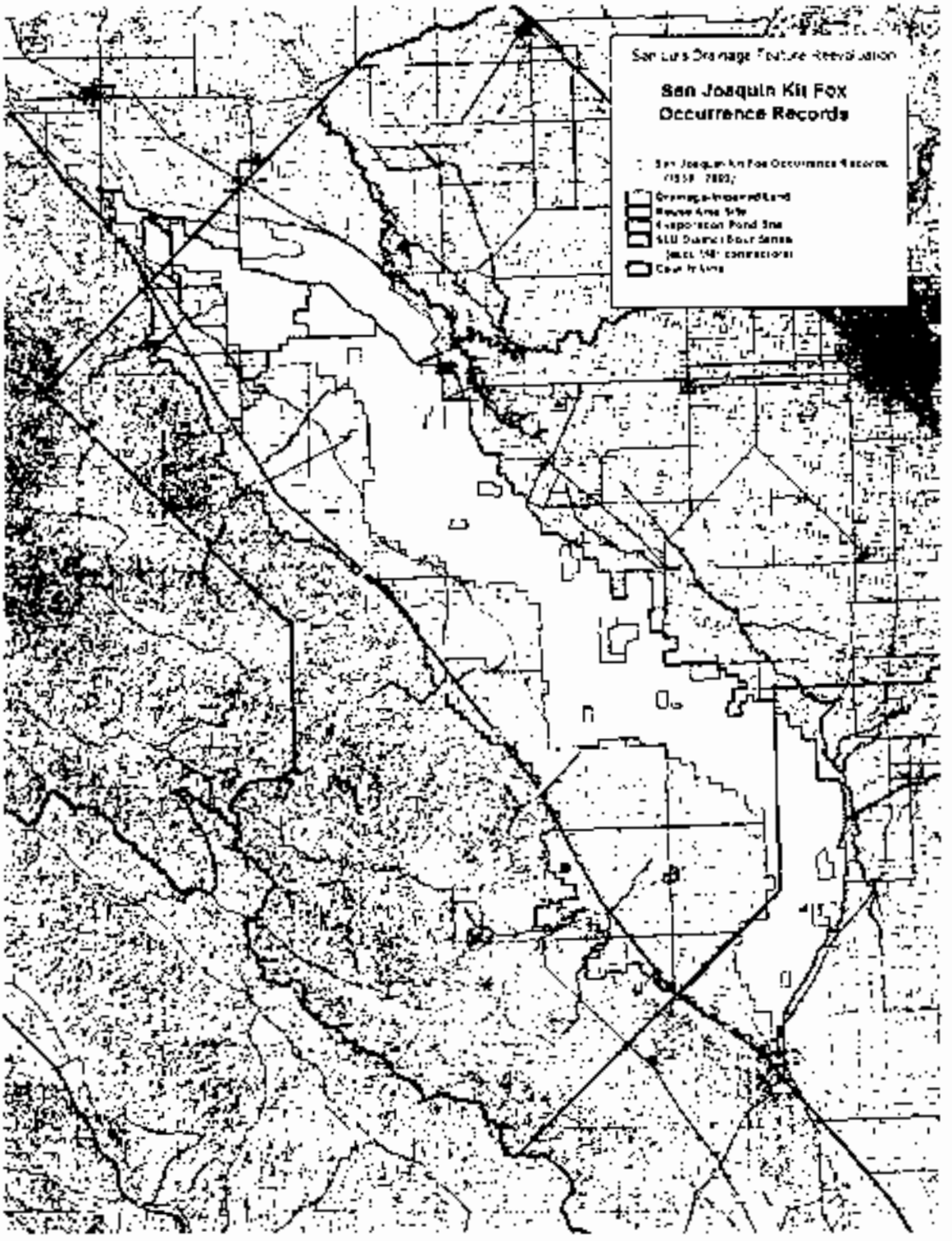
Map 3. In-valley Disposal/Land Retirement – Groundwater Quality Alternative (92,592 acres retired; Source: USBR 2005b:Figure 6-3).



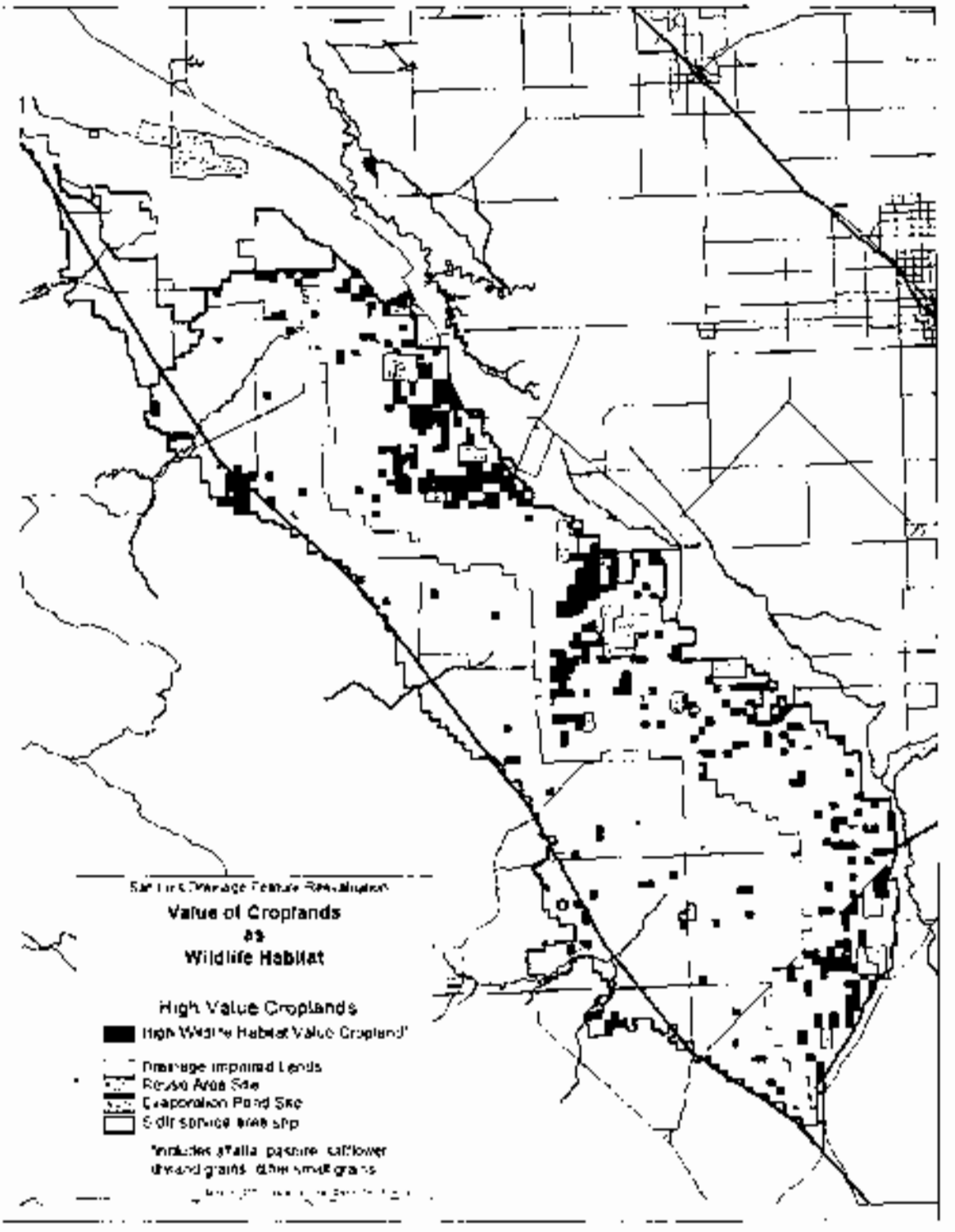
Map 4. In-valley Disposal/Land Retirement Water Needs Alternative (193,956 acres retired; Source: USBR 2005b:Figure 6-4).



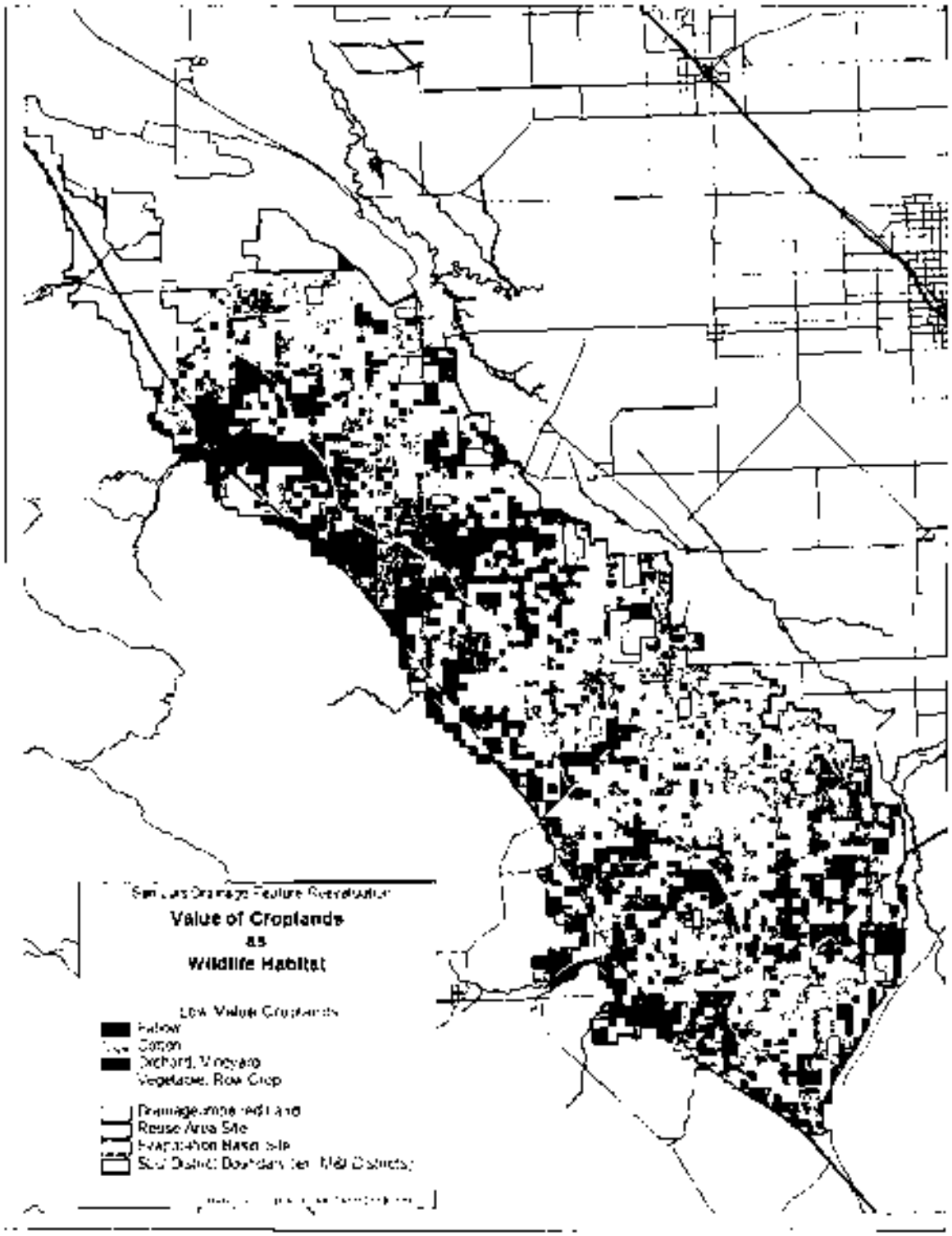
Map 5. In-valley Disposal/Land Retirement – Drainage Impaired Lands Alternative (308,000 acres retired; Source: USBR 2005b:Figure 6-5).



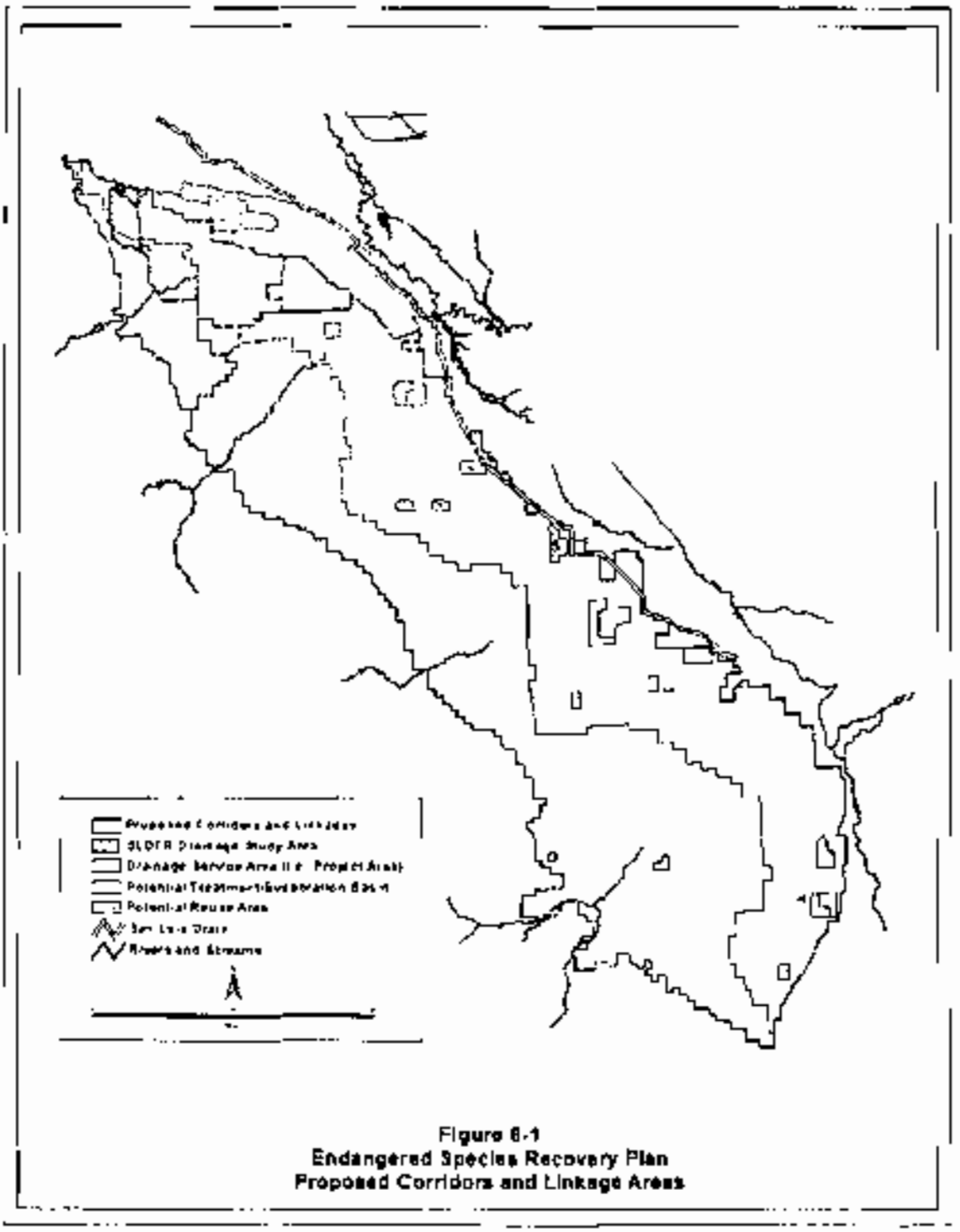
Map 6. San Joaquin kit fox occurrence records (1950 – 2003; Source: USBR 2005b: Figure 7-1).



Map 7. Value of croplands as wildlife habitat, high value croplands (Source: USBR 2005b:Figure 8-1).



Map 8. Value of croplands as wildlife habitat, low value croplands (Source: USBR 2005b:Figure 8-2).



Map 9. Endangered species recovery plan proposed corridors and linkage areas (Source: USBR 2005b:Figure 8-3).

Appendices

Appendix A. Reference summary of common abbreviations

Appendix B. Species not affected by the project or not likely to be adversely affected

Appendix C. USGS Quads of SLDFR Project Area (Source: USBR 2005b:Appendix B).

Appendix D. List of USGS 7½' Quads Comprising Drainage Study Area for In-Valley Alternatives (Source: USBR 2005b:Appendix B).

APPENDIX A

REFERENCE SUMMARY OF COMMON ABBREVIATIONS

Acre feet/y	Acre feet per year (a surface area of 1 acre covered by 1 foot of water)
ADEIS	Administrative draft environmental impact statement
AMM	Adaptive management measures
BNLL	Blunt-nosed leopard lizard (*Gambelia silus*)
CALFED	CALFED Bay-Delta Program; 25 state and federal agencies working cooperatively to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem
CCID	Central California Irrigation District
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CNDDB	California Natural Diversity Database
CTS	California tiger salamander (*Ambystoma californiense*)
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVPIA PRO	Central Valley Project Improvement Act Programmatic Biological Opinion
CAR	Coordination Act Report
DEIS	Draft environmental impact statement
DM	Delta-Mendota Canal
DOM	Project Design, Facility Operations Measures
DOS-IR	Drain of sub-irrigation riser
DPA	"Grasslands Drainage Area"
e.g.	For example
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act (Act)
ESRP	Endangered Species Recovery Program
°F	Temperature (degrees Fahrenheit)
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FR	Federal Register
GBP	Grasslands Bypass Project
GDA	Grassland Drainage Area
HCP	Habitat Conservation Plan
i.e.	that is
L	Liter

Appendix A. cont.

LOAEC	Lowest observed adverse effect concentration
mg/kg d.w.	milligrams per kilogram dry weight (equivalent to ppm)
mg/L	milligrams per liter (equivalent to ppm)
M&I	Municipal and industrial
MWG	Mitigation Work Group
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge (unit of USFWS)
OCAP	Operations Criteria and Plan
O&M	Operations and maintenance
PBO	Programmatic Biological Opinion
P.L.	Public Law
ppb	Parts per billion (equivalent to ug/L)
ppm	Parts per million (equivalent to mg/L)
ppth	Parts per thousand
RO	Reverse osmosis
SFEI	San Francisco Estuary Institute
SFWO	Sacramento Fish and Wildlife Office (unit of USFWS)
Se	Selenium
SJRIP	San Joaquin River Improvement Project
SJVDP	San Joaquin Valley Drainage Program
SLC	San Luis Canal (see also, San Luis Unit)
SLDFR	San Luis Drainage Feature Re-evaluation
SLU	San Luis Unit (see also, San Luis Canal)
spp.	Plural of species (sp.)
SWP	State Water Project
TDS	Total dissolved solids
U.S.C.	United States Code
USBR	U.S. Bureau of Reclamation (Reclamation; also BOR)
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service (Service)
VELB	Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)
WMA	Wildlife Management Area
WNA	Water needs assessment
WWD	Westlands Water District
µg/L	micrograms per liter (equivalent to ppb)

APPENDIX B

SPECIES NOT AFFECTED BY THE PROJECT OR NOT LIKELY TO BE ADVERSELY AFFECTED

Buena Vista Lake Shrew and Buena Vista Lake Shrew Critical Habitat: No effect
Sorex ornatus relictus
Federal status: endangered

The Buena Vista Lake shrew has not been documented in the action area. The ornate shrews known from the Tranquillity site of the Land Retirement Demonstration Project are of a different subspecies, as shown by recent genetic analysis of different ornate shrew populations in the San Joaquin Valley (P. Kelly, pers. comm.; 2006). Therefore, even though ornate shrews may reside on actively farmed ground, or may have a greater ability to disperse than previously known (Williams and Harpster 2001), there will be no effect of the proposed action on the Buena Vista Lake shrew, due to its absence from the action area.

All critical habitat for the Buena Vista Lake shrew (Kern Lake Unit) is entirely contained within Kern Delta Water District, well south of the action area. The primary constituent elements for Buena Vista Lake shrew critical habitat are: (i) Riparian or wetland communities supporting a complex vegetative structure with a thick cover of leaf litter or dense mats of low-lying vegetation; (ii) Suitable moisture supplied by a shallow water table, irrigation, or proximity to permanent or semi-permanent water; and (iii) A consistent and diverse supply of prey (USFWS 2005b).

Critical habitat does not occur in the action area and none of the primary constituent elements can otherwise be impacted by the proposed action; therefore, critical habitat will not be adversely affected.

Based on the probable absence of the Buena Vista Lake shrew in the action area, the proposed action would have no effect on the Buena Vista Lake shrew.

Fresno Kangaroo Rat and Fresno Kangaroo Rat Critical Habitat: No Effect
Dipodomys nitratoides exilis
Federal status: endangered

Even if the Fresno kangaroo rat still occurs in low numbers on the Alkali Sink Ecological Reserve or neighboring privately owned parcels, unsuitable habitat between the reserve and the action area would prevent the species from colonizing the action area. Therefore, the Fresno kangaroo rat will not be affected by any component of any of the alternatives for the proposed action.

Critical habitat for the Fresno kangaroo rat consists of: an area of land, water, and airspace in Fresno County, with the following components (Mt. Diablo Base Meridian): T 14 SR 15 E, E1/2

NW1/4 and NE1/4 Sec. 11, that part of W1/2 Sec. 12 north of the Southern Pacific Railroad, E1/2 Sec. 12; T14S R16E, that part of Sec. 7 south of the Southern Pacific Railroad. Within this area, the major constituent elements that are known to require special management considerations or protection are the hummocks and substrate that provide sites for burrow construction and the natural alkali sink open grassland vegetation that provides food and escape cover (USFWS 1985b).

Critical habitat for the species will not be affected by this project. This critical habitat is outside the action area and the constituent elements will not otherwise be impacted.

Based on the probable absence of the Fresno kangaroo rat in the action area, the proposed action would have no effect on the Fresno kangaroo rat.

Giant Kangaroo Rat: No Effect
Dipodomys ingens
Federal status: endangered

The nearest population is in the Panoche Region. Although kangaroo rats may colonize fallowed fields (Culbertson 1946; Thomas 1975; Moore-Craig 1984; M.V. Price, pers. comm.; 2005), the lands to be retired are too far away from occupied habitat. The drainage-impaired lands are separated from the Panoche Region by agricultural lands that are not drainage-impaired and will stay in production. Additionally, Interstate 5 presents a major barrier to dispersal of kangaroo rats. The Kettleman Hills population is even farther away and is also separated from the action area by Interstate 5. Therefore, the giant kangaroo rat will not be affected by any of the alternatives for the proposed action. Critical habitat has not been designated for this species.

Based on the probable absence of the giant kangaroo rat in the action area, the proposed action would have no effect on the giant kangaroo rat.

Riparian Woodrat: No Effect
Neotoma fuscipes riparia
Federal status: endangered

There is no suitable habitat and there are no species occurrences within or near the action area. There is some riparian vegetation along Mud Slough in places, but these areas are unoccupied fragments, separated from the few known populations along the Stanislaus River. Therefore, none of the alternatives for the proposed action will have any effects on the riparian woodrat. Critical habitat has not been designated for this species.

Based on the probable absence of the riparian woodrat in the action area, the proposed action would have no effect on the riparian woodrat.

Bald Eagle: No Effect
Haliaeetus leucocephalus
Federal status: threatened

There will be no suitable perch sites near the evaporation ponds, and the primary prey of the species (larger fish) will not occur in the evaporation ponds. This makes use of the action area by bald eagles very unlikely; therefore, the bald eagle will not be affected by any of the alternatives of the proposed action.

Based on the probable absence of the bald eagle in the action area, the proposed action would have no effect on the bald eagle.

California Condor and California Condor Critical Habitat: No Effect
Gymnogyps californianus
Federal status: endangered

The California condor was federally listed as endangered on March 11, 1967 (32 FR 4001), and state listed as endangered on June 27, 1971. Critical habitat was designated on September 24, 1976 (41 FR 187), in Tulare, Kern, Los Angeles, Ventura, Santa Barbara, and San Luis Obispo Counties. The Condor Recovery Plan (USFWS 1996) was revised in 1996. The action area does not provide suitable habitat for the California condor. There are no cliffs, large trees, or snags in the action area, so the species will not be affected by any increase in the availability of carrion that may result from sheep being brought into the area following land retirement. Designated critical habitat does not occur in the project area and will not otherwise be affected; therefore, the proposed action will not result in the adverse modification or destruction of critical habitat for this species.

Based on the probable absence of the California condor in the action area, the proposed action would have no effect on the California condor.

California Red-legged Frog and California Red-legged Frog Proposed Critical Habitat; No Effect
Rana aurora draytonii
Federal status: threatened

No observations of red-legged frogs have been recorded within the boundaries of the project area (CDFG 2005), and no suitable habitat would be directly or adversely affected by project facilities. Because the species is no longer known to occur in the area, project activities would not affect this species. Furthermore, no proposed California red-legged frog critical habitat units are located within or in close proximity to the action area.

The frog may never have been widespread on the Central Valley floor as specimen-based records are scarce north of the Kern River drainage. Red-legged frogs are believed to have been extirpated from the floor of the Central Valley since 1960 (USFWS 2002a). Surveys in drainages at valley elevations on the west side of the San Joaquin Valley along the SLC have not found this species.

Based on the probable absence of the California red-legged frog from areas that would be affected by construction activities and absence of operational effects that would directly or indirectly affect the species, the proposed action would have no effect on the California red-

legged frog.

Blunt-nosed Leopard Lizard: No Effect
Gambelia silus
Federal status: endangered

Over 50 documented occurrences of the blunt-nosed leopard lizard were reported from the CNDDB within the 37 quads that encompass the drainage project area and adjacent lands. The majority are located in the low foothills to the west and southwest of the project area, with the remainder located outside the action area in and near the Mendota Wildlife Refuge (CDFG 2004). No recent occurrence records are located within areas that would be directly affected by project facilities or operation.

The lizard inhabits open, sparsely vegetated areas of low relief on the valley floor and the surrounding foothills (Smith 1946, Montanucci 1965). It also inhabits alkali playa and valley saltbush scrub described by Holland (1986). In general, it is absent from areas of steep slope, dense vegetation, or areas subject to seasonal flooding (Montanucci 1965). The action area consists of intensively farmed agricultural land and does not contain any areas of suitable habitat for the blunt-nosed leopard lizard.

Livestock grazing can result in removal of herbaceous vegetation and shrub cover and destruction of rodent burrows used by lizards for shelter. However, light or moderate grazing may be beneficial, unlike cultivation of row crops, which precludes use by leopard lizards. Land retirement options for the area could change some of the areas to be more suitable for BNLL in areas converted to grazing though the areas where land retirement is proposed are not located adjacent to any known BNLL populations so their migration onto the retired lands would not be likely to occur. There are no known source populations within close enough proximity to the proposed retired, grazed, or fallowed lands, or to the areas proposed for reuse or evaporation ponds, that would be able to colonize the areas.

Based on the probable absence of the blunt-nosed leopard lizard from areas that would be affected by construction activities, the absence of operational effects that would directly or indirectly impact the species, and the lack of a source population to colonize suitable habitat

within the action area, the proposed action would have no effect on the blunt-nosed leopard lizard.

Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp and their Critical Habitat: No Effect
Branchinecta lynchi and *Lepidurus packardi*
Federal status: threatened and endangered (respectively)

Occurrences of vernal pool crustaceans, including the two listed above, are restricted to vernal pools/swales, an ephemeral freshwater habitat that forms in Mediterranean climates where slight depressions become seasonally saturated or inundated following fall and winter rains. Due to local topography and geology, the pools are usually clustered into pool complexes. Vernal pool

dependent species are not known to occur in permanent bodies of water, riverine waters, or marine waters (USFWS 2001). Vernal pools occur as small poorly drained depressions perched above an impermeable or very slowly permeable soil horizon or bedrock (Chetham 1976; Weitkamp *et al.* 1996). Vernal pools are separated from groundwater or stream channel inflow; they fill by slowly collecting precipitation (Hanes *et al.* 1990; Zedler 1987).

Critical habitat for vernal pools has been designated. No vernal pool critical habitat is located with or adjacent to the action area. No CNDDB occurrence records for vernal pool habitat, vernal pool crustaceans, or associated vernal pool plants have been reported in the 37 quads that encompass the drainage project area (CDFG 2004); however, vernal pool habitat is known to exist in grassland-wetland areas located in the action area (e.g., in San Luis NWR, adjacent to Mud Slough). Because construction of all project facilities and retirement parcels will be restricted to active or fallowed agricultural lands within the study area, no construction-related adverse effects to vernal pool dependent species are anticipated. Similarly, no operation-related adverse effects to vernal pool dependent species located either inside or outside the study area in refuges or other grassland-wetland areas are anticipated including indirect operational effects such as future changes in crop mixes and reallocations of irrigation water from retired lands.

Construction of the initial phases of the GBP has permitted the discharge of selenium-contaminated drainwater from Grasslands' area farmers into Mud Slough, a perennial stream that supports potential vernal pool habitat. Current GBP operating agreements will expire in December 2009, potentially terminating the discharging selenium-contaminated water into Mud Slough. Implementation of the proposed action will expand upon the current GBP facilities and replace the current Mud Slough disposal of drainwater with disposal into the proposed Northerly Area evaporation basin. In addition, selenium loading in the DMC (and downstream at Mendota Pool on the San Joaquin River) will decrease as a result of the interception of lateral seepage from the South Grasslands area following construction of the Firebaugh Sumps, a component of the proposed action, collection system. Due to the hydraulic isolation of vernal pools from groundwater and stream channel inflow, the changes that would occur from termination of the GBP would have no effect upon the vernal pools located near the project area (e.g., in San Luis NWR).
Based on the probable absence of the vernal pool species from areas that would be affected by construction activities, and the absence of operational effects that would directly or indirectly impact the species, the proposed action would have no effect on the vernal pool fairy shrimp or the vernal pool tadpole shrimp or their designated critical habitat.

Valley Elderberry Longhorn Beetle and Valley Elderberry Longhorn Beetle Critical Habitat: No Effect
Desmocerus californicus dimorphus
Federal status: threatened

The current distribution of the valley elderberry longhorn beetle (VELB) is patchy throughout the remaining riparian forests of the Central Valley from Redding to Bakersfield. Within its current range, critical habitat has been designated at two small areas: a site within the city of Sacramento, and an area of the American River Parkway (USFWS 1980). Both critical habitat areas are located well outside the action study area and would not be affected in any way by

project implementation.

The VELB is completely dependent on the elderberry as its plant host. Elderberry bushes are a common component of remaining riparian forests and adjacent upland sites in the Central Valley. The action area consists of intensively farmed agricultural land and does not contain any areas of riparian forest or upland sites near riparian areas typical of VELB habitat.

Construction of the collection system may require crossing a small number of permanently watered, poorly maintained irrigation and drainage canals; however, no collection system crossings would take place in major permanent natural waterways or wetlands that have the potential to support elderberry plants. Operation of the collection system and treatment facilities would have no effect on the VELB, and operation of the hypersaline evaporation basins and the reuse areas would not provide suitable habitat for the elderberry plant.

Construction of the initial phases of the GBP has permitted the discharge of selenium-contaminated drainwater from Grasslands' area farmers into Mud Slough, a perennial stream that supports potential vernal pool habitat. Current GBP operating agreements will expire in December 2009, potentially terminating the discharging selenium-contaminated water into Mud Slough. Implementation of the proposed action will expand upon the current GBP facilities and replace the current Mud Slough disposal of drainwater with disposal into the proposed Northerly Area evaporation basin. In addition, selenium loading in the DMC (and downstream at Mendota Pool on the San Joaquin River) will decrease as a result of the interception of lateral seepage from the South Grasslands area following construction of the Firebaugh Sumps, a component of the proposed action, collection system. The only CNDDB occurrence downstream of the GBP and upstream of Vernalis is along the San Joaquin River immediately south of Vernalis. Due to the location of the occurrence and the lack of measurable levels of selenium at Vernalis, changes that would occur from termination of the GBP would have no effect upon VELB.

Based on the probable absence of the VELB from areas that would be affected by construction activities and absence of operational effects that would directly or indirectly impact the species, the proposed action would have no effect on the VELB.

Palmate-bracted Bird's-beak: No Effect
Cordylanthus palmatus
Federal status: endangered

The species was listed in 1986 as Endangered (USFWS 1986), citing a reduction in range and population numbers due to conversion of native habitat to agricultural lands, intensive livestock grazing, and urban development. At the time of the species listing, only three populations were known to exist, in Alameda, Fresno, and Yolo Counties. Additional surveys and repopulation efforts identified in the 1998 Recovery Plan for Upland Species of the San Joaquin Valley (SJVRP) (USFWS 1998), seven metapopulations were described, primarily on National Wildlife Refuges, Ecological Reserves, and Wildlife Management Areas.

The lands described in the project description and action area for this project do not currently support any populations of this species. The intensively managed agricultural uses of the lands

preclude colonization by the species, and the lack of a nearby source population within range of the known pollinators would not facilitate colonization of any lands suitable for the species. The species also is restricted to seasonally flooded saline-alkali soils (USFWS 1998); the use of the tile drains and water application, in combination with the infiltration rate of the soil in the project area, would not support any introduced populations of the species.

The lack of existing populations in the action area, the lack of a source population and pollinators within range, and the lack of seasonal flooding of any significant duration, therefore, indicate that the proposed action will have no effect on the species.

No critical habitat has been designated for this species.

California Jewelflower: No Effect
Caulanthus californicus
Federal status: endangered

The species was listed as Endangered in 1990 (USFWS 1990). The Final Rule cited one or more of the following as threats to the species: urbanization, conversion of native habitat for agriculture (ag-land conversion) and related water development, oil and gas development and exploration, livestock grazing, competition from alien plants, utilization of habitat for groundwater recharge basins or for disposal of agricultural effluent or runoff, flood control projects, off-road vehicle use, mining, telecommunication and electrical line construction, alteration of the natural fire regime, poor air quality, and stochastic extinction by virtue of the small isolated nature of the remaining populations. At the time of the species' listing, only one population was known in the San Joaquin Valley, an introduced population in Kern County. The species was regarded as extirpated from Fresno, Kings, and Tulare Counties. The species is included in the SJVRP, and is described as existing in the San Joaquin Valley only in that introduced population and in the Kreyenhagen Hills in Fresno County (USFWS 1998).

The effects to this species from the proposed action would be similar to those described for the palmate-bracted bird's-beak. There is no extant population in the highly agricultural lands of the project or action area, there is no source population that could colonize any of the lands in the project area, and there are no effects from the proposed action on the hydrology of the area that would affect any unknown populations. There would be, therefore, no effect from the proposed action to this species.

There is no critical habitat designated for this species.

San Joaquin Wooly-threads: No Effect
Monolopia (=Lembertia) congdonii
Federal status: endangered

The species was listed as Endangered in 1990 (USFWS 1990), citing the same threats as described for California jewelflower. Twelve populations were known at the time of listing in the San Joaquin Valley. Additional populations had been identified by the date of publication of the SJVRP along the I-5 corridor.

Similar to the other two plant species, there are no known populations in the intensively managed agricultural lands of the project area, nor are there any known source populations close enough to allow for colonization of the project area. As with the other plant species, there would, therefore, be no effect to the species from the proposed action.

Critical habitat has not been designated for this species.

Delta Smelt and Delta Smelt Critical Habitat: No Effect
Hypomesus transpacificus
Federal status: threatened

The species was listed as Threatened in 1993 (USFWS 1993c), critical habitat was designated in 1994 (USFWS 1994c), and a recovery plan was approved in 1996 (USFWS 1996b). Service described threats to the species as changes to seasonal hydrology, freshwater exports, and the accompanying changes in the temporal, spatial, and relative ratios of water diversions, in combination with severe drought years, introduced non-indigenous aquatic species, and reduction in abundance of key food organisms (often related to the aperiodic flushing of high concentrations of pesticides through the system). The critical habitat designation and recovery plan identified similar threats and causes for decline.

Concentrations of selenium in the San Joaquin River, and from there into the Delta, may affect Delta smelt either directly or by bioaccumulation in the plankton that makes up the smelt's food. The recovery plan, however, noted that it was unknown if the toxic substances discussed were actually affecting the species. Moyle (2002) also noted the possibility of poorly known effects of low levels of toxic substances on larval smelt and plankton.

The species is known for its tendency to move through the Delta, following the "good conditions" required for its life cycle. A reduction of 7% of the salt and 17% of the boron at Vernalis would not be expected to have significant effects to the water quality in the Delta to the extent that Delta smelt would be affected. Too many other sources of those substances are found in the San Joaquin River between the Delta and Vernalis to be able to appreciably affect the water quality concentrations of salt and boron.

The concentration of selenium with the project is expected to remain below 2 ppb at Crows Landing. This reduction in the amount of selenium could be expected to be a benefit to the species, as it would mean lower concentrations of selenium in the Delta itself. There is still insufficient information, however, to determine what, if any, effects selenium has in the life history of the species. The 2005 OCAP Biological Opinion (USFWS 2005a) noted that selenium and "numerous pesticides and herbicides as well as oil and gasoline products associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for smelt, these contaminants may adversely affect fish reproductive success and survival rates."

There are, therefore, no effects expected with the project on the Delta smelt.

Critical habitat was designated by Service to include the following Primary Constituent Elements (PCE's): spawning habitat, larval and juvenile transport, rearing habitat, and adult migration. The project will not affect the quantity of water in the Sacramento-San Joaquin Delta, and therefore no effects to the transport and migration PCE's will occur. The spawning habitat identified in the Final Rule occurs primarily in tributaries to the two rivers, and not in the San Joaquin River itself; there will, therefore, be no effect to this PCE from the proposed action. The rearing habitat PCE is related to a 2 ppth isohaline, which will also not be affected by the proposed action, as the reduction in salt loads to the San Joaquin River as a result of this project will not be detectable as far downstream as the estuary.

Tipton Kangaroo Rat: Not Likely to Adversely Affect
Dipodomys nitratoides nitratoides
Federal status: endangered

The Tipton kangaroo rat occupies arid communities on alluvial fan and floodplain soils having level or near-level topography, with elevated soil structures such as mounds, berms or embankments that can be used for the construction of burrows (Brylski *et al.* 1994, FWS 1998).

The Tipton kangaroo rat is known to occur at Tumbleweed Park (Wildlife Area 5) at Lemoore Naval Air Station, immediately north of the boundary of the SLU and is the northernmost extant population of this species (ESRP 2000). It no longer occurs in Wildlife Area 4 (ESRP 2000). This population is threatened by dense annual grass cover, flooding from agricultural drainwater, lack of moderate shrub cover and environmental and demographic stochasticity (due to the small population size). There are also other small populations near Lemoore (concentrated around the intersection of Highway 41 and Jackson Avenue) (P. Kelly, pers. comm.; 2006).

It may be possible for Tipton kangaroo rats to colonize fallowed lands within as little as eight months when they occur on adjacent habitat. The Fresno kangaroo rat has been reported as being able to colonize fallowed agricultural lands (Culbertson 1946) and Stephens' kangaroo rats have been observed to recolonize land after discing was stopped (Thomas 1975; M.V. Price, pers. comm.; 2005), even within as little as eight months (Moore-Craig 1984) The Stephens' kangaroo rat is a fairly typical kangaroo rat in terms of its demography and life history (Price and Kelly 1994). There is no quantitative information on home range size in Tipton kangaroo rat and very little for the species as a whole. Limited information for the Fresno kangaroo rat (Warner 1976 *in* FWS 1998) would suggest the species is probably not a particularly vagile kangaroo rat; home range size was estimated at 566 m^2. However, Merriam's kangaroo rat is quite vagile and may change burrows daily. Blair (1946 *in* FWS 1998) estimated the home range size of Merriam's kangaroo rat to be about 16,000m^2. A better estimate of the home range sizes of Tipton kangaroo rats is considered to be closer to that of its close relative, Merriam's kangaroo rat (P. Kelly, pers. comm.; 2006), and research on the short-nosed kangaroo rat supports this assumption (Williams and Germano 1992). Stephens' kangaroo rat is a sedentary kangaroo rat species, with a home range size of about 951 m^2, or a diameter of approximately 35 m when modeled as a circle (M.V. Price, pers. comm.; 2005). Therefore, if Stephens' kangaroo rat is known to colonize fallowed agricultural lands within eight months, this is likely a conservative estimate for the Tipton kangaroo rat.

Under the In-Valley Drainage-Impaired Area Land Retirement Alternative, the species may colonize retired lands from the Lemoore Naval Air Station that are within the SLU and are contiguous with Tumbleweed Park. Land retirement itself could directly benefit Tipton kangaroo rats under this alternative in the long term, due to a reduction in flooding from agricultural drainwater. If these lands are grazed lands, which will be stable and not subject to discing, there will be beneficial long-term indirect effects on the species. In the San Joaquin Valley, islands of suitable habitat as small as four hectares can at least temporarily harbor kangaroo rats (Williams and Germano 1992). Fallowing will have no effect, due to the assumption of twice-annual discing, which will prevent kangaroo rats from colonizing the land and then being killed by discing later. Dryland farming will also have no effect. Dry grain fields will have dense, tall cover that is unsuitable for kangaroo rats. The existing croplands are similarly unsuitable (Culbertson 1946; Williams and Germano 1992). The facilities will not be constructed in existing habitat and the reuse areas will not provide habitat, particularly due to the assumption that they will have dense cover. In general, kangaroo rats have a strong preference for open space (low percent cover) (Reynolds 1958; O'Farrell and Uptain 1987; Williams and Germano 1992; Reichman and Price in Genoways and Brown 1993). The evaporation basins will not be utilized by kangaroo rats. None of the other alternatives have the potential to affect the species.

Based on the probable absence of the Tipton kangaroo rat from areas that would be affected by construction activities, the absence of operational effects that would directly impact the species, and the potential beneficial effects of land retirement, the proposed action would not likely adversely affect the Tipton kangaroo rat. Critical habitat has not been designated.

Central Population of the California Tiger Salamander and California Tiger Salamander Critical Habitat: Not Likely to Adversely Affect
Ambystoma californiense
Federal status: threatened

Within its remaining range, the California tiger salamander (CTS) is found in various moist habitats in annual grasslands, oak savannas, and oak woodlands. Populations persist in disjunct remnant vernal pool or seasonal wetland complexes in Sonoma and Santa Barbara counties, in vernal pool complexes and isolated ponds scattered along narrow strips of rangeland on the sides of the Central Valley from Colusa County to Kern County, and in human-maintained stock ponds in the Coast Ranges from Suisun Bay south to the Temblor Range. CTS are not generally thought to occur in the intensively managed agricultural lands that comprise the project area, although extensive surveys to locate isolated marginal habitats (e.g., stock ponds, agricultural wetlands) have not been completed. Salamanders require seasonally wet areas for breeding and nearby mammal burrows (e.g., California ground squirrel) for aestivation during hot dry periods. No occurrence records of CTS have been recorded in the CNDDB within the project area (CDFG 2004). Because the proposed project area has long been converted to agricultural production, it is very unlikely that many areas that provide all of the required habitat characteristics persist. Furthermore, no CTS critical habitat units are located within or in close proximity to the project area.

Prior to construction, a plan will be developed with the Service and CDFG to identify any areas of potentially suitable habitat that may be affected by project construction or operation. If suitable habitat is located in areas that may be affected by project development, the sites would be surveyed prior to construction and, if CTS presence can be confirmed, consultation with the Service on appropriate avoidance or conservation measures would be completed.

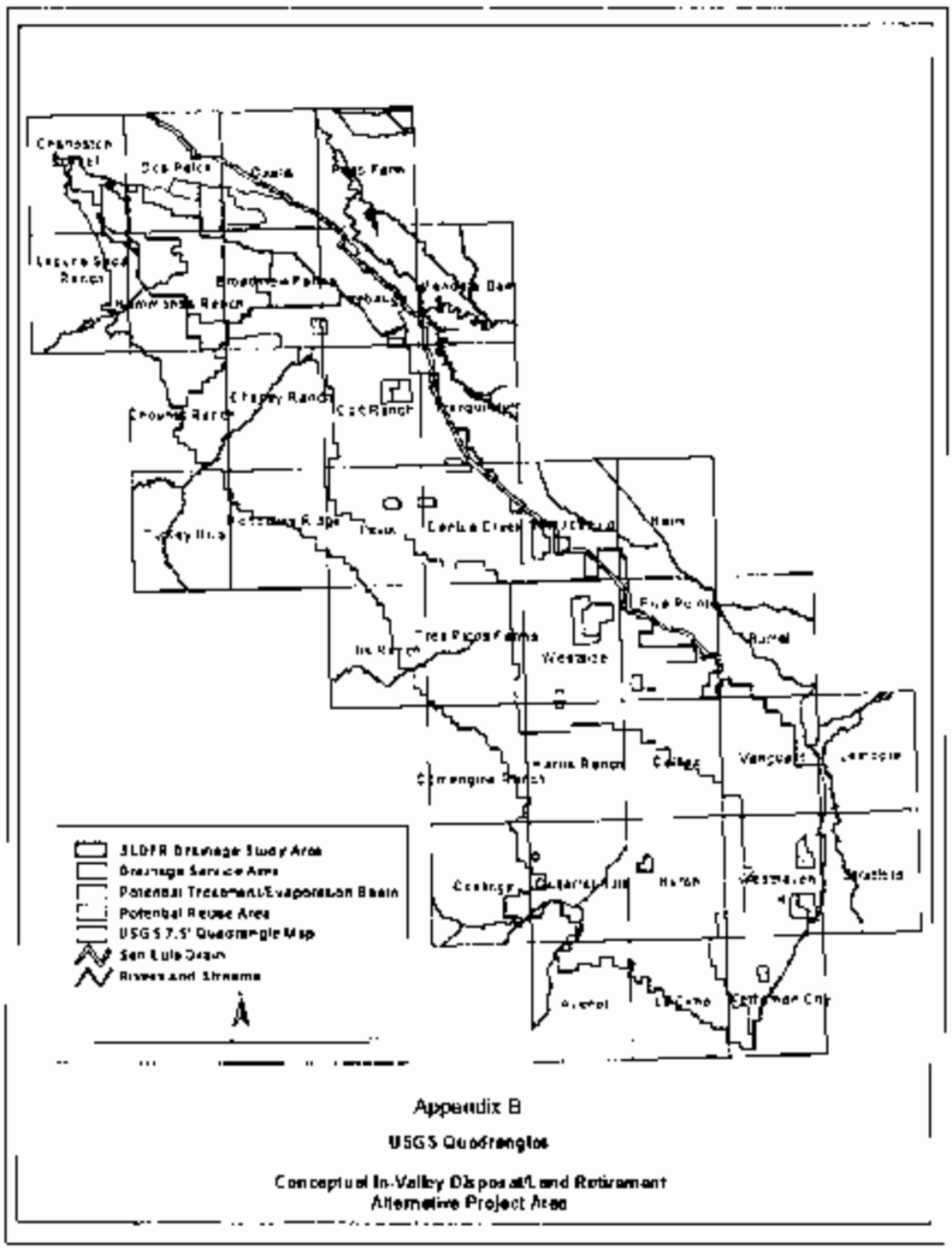
Once project facilities have been constructed, long term operation is not expected to have any effect on the CTS. Operation of the buried collection system and enclosed treatment facilities would have no effect on the California tiger salamander; long term operation of the evaporation basins and reuse areas would not provide suitable habitat for the salamander; and planned uses for retired lands would not provide the ephemeral pond habitat that the salamander requires.

Construction of the initial phases of the GBP has permitted the discharge of selenium-contaminated drainwater from Grasslands' area farmers into Mud Slough, a perennial stream that supports potential CTS habitat. Current GBP operating agreements will expire in December 2009, terminating the potentially adverse effects of discharging selenium-contaminated water into Mud Slough. Implementation of the proposed action will expand upon the current GBP facilities and replace the current Mud Slough disposal of drainwater with disposal into the proposed Northerly Area evaporation basin. In addition, selenium loading in the DMC (and downstream at Mendota Pool on the San Joaquin River) will decrease as a result of the interception of lateral seepage from the South Grasslands area following construction of the Firebaugh Sumps, a component of the proposed action, collection system.

Based on the probable absence of the California tiger salamander from areas that would be affected by construction activities, the absence of operational effects that would directly impact the species, and the potential beneficial effects of reduced selenium loading into Mud Slough, the proposed action would not likely adversely affect the California tiger salamander or its designated critical habitat.

APPENDIX C

USGS QUADS OF SLDFR PROJECT AREA (SOURCE: USBR 2005B:APPENDIX B).



Appendix B

USGS Quadrangles

Conceptual In-Valley Disposal/Land Retirement
Alternative Project Area

APPENDIX D

LIST OF USGS 7½' QUADS COMPRISING DRAINAGE STUDY AREA FOR IN-VALLEY ALTERNATIVES (SOURCE: USBR 2005B:APPENDIX B).

QUAD_NAME	USGS_QD_ID	DWR_CODE
Avenal	36120-A2	314C
Broadview Farms	36120-G5	382D
Burrel	36119-D8	336B
Calflax	36120-C1	337D
Cantua Creek	36120-E3	360D
Chancy Ranch	36120-F5	361A
Charleston School	36120-H7	383A
Chounet Ranch	36120-F6	361B
Coalinga	36120-B3	315A
Coit Ranch	36120-F4	360B
Domengine Ranch	36120-C3	338D
Dos Palos	36120-H6	382B
Firebaugh	36120-G4	381C
Five Points	36120-D1	337A
Guijarral Hills	36120-B2	314B
Hammonds Ranch	36120-G6	382C
Harris Ranch	36120-C2	337C
Helm	36120-E1	359D
Huron	36120-B1	314A
Kettleman City	36119-A8	313C
La Cima	36120-A1	314D
Laguna Seca Ranch	36120-G7	383D
Lemoore	36119-C7	336D
Levis	36120-E4	360C
Lillis Ranch	36120-D4	338B
Mendota Dam	36120-G3	381D
Monocline Ridge	36120-E5	361D
Oxalis	36120-H5	382A
Poso Farm	36120-H4	381B
San Joaquin	36120-E2	359C
Stratford	36119-B7	313A
Tranquillity	36120-F3	360A
Tres Picos Farms	36120-D3	338A
Tumey Hills	36120-E6	361C
Vanguard	36119-C8	336C
Westhaven	36119-B8	313B
Westside	36120-D2	337B

LITERATURE CITED

American Farmland Trust. 1999. California's Central Valley Urban Sprawl 2040 Zone of Conflict. Farmland Information Library. http://farm.fic.niu.edu/fic/fl/cv.html

Archon, M. 1992. Ecology of the San Joaquin kit fox in western Merced County, California. M.A. thesis, California State University, Fresno, California, 62 pp.

Atwood, J.L. and P.R. Kelly. 1984. Fish dropped on breeding colonies as indicators of Least Tern food habits. Wilson Bulletin 96:34-47.

_____, and B.W. Massey. 1988. Site fidelity of least terns in California. The Condor 90:389-394.

Barrett, L. 1990. Annual review of animal rabies in California. 1989. California Veterinarian 44:52-54.

Beckon, W.N., M.C.S. Facock, A. Gordus, and J.D. Henderson. 2003. Biological effects of the Grassland Bypass Project. Chapter 7 in Grassland Bypass Project Annual Report 2001-2002. San Francisco Estuary Institute, San Francisco.

Berry, W.H., J.H. Scrivner, T.P. O'Farrell, C.E. Harris, T.T. Kato, and P.M. McCue. 1987. Sources and rates of mortality of the San Joaquin kit fox, Naval Petroleum Reserve #1, Kern County, California, 1980-1986. U.S. Dept. of Energy Topical Report, EG&G/EM Santa Barbara Operations Report No. EGG 10282-2154. 34 pages.

_____, W.G. Standley, T.P. O'Farrell, and T.T. Kato. 1992. Effects of military-authorized activities on the San Joaquin kit fox (*Vulpes velox macrotis*) at Camp Roberts Army National Guard Training Site, California. U.S. Department of Energy Topical Report No. EGG 10617-2159, EG&G/EM Santa Barbara Operations, National Technical Information Service, Springfield, Virginia.

Bjurlin, C.D., B.L. Cypher, C.M. Wingert, and C.L. Van Horn Job. 2005. Urban roads and the endangered San Joaquin kit fox. Final Report Submitted to the California Department of Transportation, Contract Number 65A0136.

Bolger, D.T., A.C. Alberts, and M.E. Soule. 1991. Occurrence Patterns of Bird Species in Habitat Fragments: Sampling, Extinction, and Nested Species Subsets. American Naturalist 137:155-156.

Briden, L.E., M. Archron, and D.L. Chesemore. 1987. Ecology of the San Joaquin kit fox in western Merced County. California State University, Fresno, 16 pp.

Brode, J.M. and G.E. Hansen. 1992. Status and future management of the giant garter snake

(*Thamnophis gigas*) within the southern American Basin, Sacramento and Sutter Counties, California. California Department of Fish and Game, Inland Fisheries Division (January 1992).

Burger, J. 1988. Social attraction in nesting Least terns: effects of numbers, spacing, and pair bonds. The Condor 90:575-582.

California Department of Conservation (CDC). 1994. Division of Land Resource Protection Farmland Mapping and Monitoring Program, Sacramento, California.

_____ 1996. Division of Land Resource Protection Farmland Mapping and Monitoring Program, Sacramento, California.

_____ 1998. Division of Land Resource Protection Farmland Mapping and Monitoring Program, Sacramento, California.

California Department of Fish and Game (CDFG). 1980. At the crossroads, a report on California's endangered and rare fish and wildlife. Sacramento, California. 147 pp.

_____. 1988. Review of the status of the giant garter snake (*Thamnophis couchi gigas*) and its support habitat during 1986-1987. Final report for California Department of Fish and Game, Contract C-2060. Unpublished report, 31 pp.

_____. 1993. Selenium in Wildlife From Agroforestry Plantations in the San Joaquin Valley. Draft Report to the California Department of Water Resources. CDFG Bay Delta and Special Water Projects Division.

___. 1999a. Rodenticide use in distribution and abundance of the San Joaquin kit fox, draft report by Heather M. Bell, Jeffrey A. Alvarez, Lee L. Eberhardt, and Katherine Ralls. Unpublished draft report, Sacramento, California.

____. 1999b. California least tern breeding survey, 1998 season. Habitat Conservation and Planning Branch Report 2000-01. Prepared by Kathleen Keane, California State University Long Beach Foundation, Long Beach, California, Contract FG6138 (FY98/99).

_____. 2006. Agroforestry Biomonitoring Data San Joaquin Valley Collection Years 1991 and 1997-1998. CDFG Central Valley Bay Delta Branch Stockton CA

California Department of Pesticide Regulation. 2006. Information available at: www.cdpr.ca.gov/docs/pur/purmain.

California Natural Diversity Data Base (CNDDB). 2004. Natural Heritage Division, California Department of Fish and Game. Sacramento, California.

_____. 2005. California Natural Diversity Data Base. RareFind 3. Natural Heritage Division,

California Department of Fish and Game. Sacramento, California.

California Regional Water Quality Control Board, Central Valley Region. 1992. Agricultural drainage contribution to water quality in the Grasslands Area of western Merced County, California: October 1990 to September 1991.

California State Water Resources Control Board. March 2000. Revised Water Right Decision 1641 in the Matter of: Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; a Petition to Change Points of Diversion of the Central Valley Project and the State Water Project in the Southern Delta; and a Petition to Change Places of Use and Purposes of Use of the Central Valley Project. California Environmental Protection Agency, State Water Resources Control Board, Sacramento, California. 206 pp.

Caughley, G., and A. Gunn. 1993. Dynamics of large herbivores in deserts: kangaroos and caribou. Oikos 67:47-55.

Chesemore, D.L., T.D. Kelly, and A.R. Dyer. 1990 Wildlife use of agroforestry plantations in the San Joaquin Valley of California 1987-1989. San Joaquin Valley Drainage Program. Sacramento, California.

Clark, D.R., Jr. 1987. Selenium accumulation in mammals exposed to contaminated California irrigation drainwater. The Science of the Total Environment 66:147-168.

Culbertson, A.E. 1946. Observations of the natural history of the Fresno kangaroo rat. Journal of Mammalogy 27:189-203.

Cuthbert, F.J. and L.R. Wires. Caspian Tern (*Sterna caspia*). 1999. The Birds of North America 403:1-31.

Cypher, B.L. 2000. Effects of roads on San Joaquin kit foxes: a review and synthesis of existing data. Endangered Species Recovery Program, Fresno, California, 59 pp.

_____. 2003. Foxes. *In:* G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (eds.), Wild Mammals of North America: Biology, Management, and Conservation. Second edition. The Johns Hopkins University Press, Baltimore, Maryland, pp. 511-546.

_____, and Scrivner, J. H. 1992. Coyote control to protect endangered San Joaquin kit foxes at the Naval Petroleum Reserves, California. Pp. 42-47 *in* J. E. Borrecco and R. E. Marsh (eds.). Proceedings of the 15th Vertebrate Pest Conference, March 1992, Newport Beach, California. University of California, Davis, California.

_____, and Spencer, K. A. 1998. Competitive interactions between coyotes and San Joaquin kit foxes. Journal of Mammalogy 79:204-214.

_____, P.A. Kelly, and D.F. Williams. 2003. Factors influencing populations of endangered San

Joaquin kit foxes: implications for conservation and recovery. *In:* M.A. Sovada and L. Carbyn (eds.), The Swift Fox: Ecology and Conservation in a Changing World. Canadian Plains Research Center, Regina, Saskatchewan, pp. 125-137.

_____, H.O. Clark, Jr., P.A. Kelly, C. Van Horn Job, G.W. Warrick, and D.F. Williams. 2001. Interspecific interactions among mammalian predators: implications for the conservation of endangered San Joaquin kit foxes. Endangered Species Update 18:171-174.

_____, P.A. Kelly, D.F. Williams, H.O. Clark, Jr., A.D. Brown, and S.E. Phillips. 2005. Foxes in farmland: recovery of the endangered San Joaquin kit fox on private lands in California. California State University-Stanislaus, Endangered Species Recovery Program, Fresno, California.

_____, G.D. Warrick, M.R. Otten, T.P. O'Farrell, W.H. Berry, C.E. Harris, T.T. Kato, P.M. McCue, J.H. Scrivner, and B.W. Zoellick. 2000. Population dynamics of San Joaquin kit foxes at the Naval Petroleum Reserves in California. Wildlife Monographs No. 145, 43 pp.

Dickert, C. 2002. San Joaquin Valley giant garter snake project 2001. California Department of Fish and Game. 14 pp.

_____. 2003. Progress report for the San Joaquin Valley giant garter snake conservation project -- 2003. California Department of Fish and Game. 37 pp.

Egoscue, H.J. 1962. Ecology and Life History of the Kit Fox in Tooele County, Utah. Ecology 43:481-497.

Endangered Species Recovery Program. 2000. Habitat Management Plan: San Joaquin kangaroo rats (*Dipodomys nitratoides*) on Naval Air Station, Lemoore. Report prepared for Commanding Officer, Naval Air Station, Lemoore, California, by Patrick A. Kelly, Ellen Cypher, Daniel F. Williams and Curtis E. Uptain, Endangered Species Recovery Program, Fresno, California, January, 2000.

Eppinger, J. and J. Chilcott. 2002. Review of Selenium Concentrations in Wetlands Water Supply Channels in the Grassland Watershed (Water Years 1999 and 2000). Staff Report of the California Environmental Protection Agency, Regional Water Quality Control Board, Central Valley Region, Sacramento, California. 31 pp.

Fahrig, L. 1997. Relative Effects of Habitat Loss and Fragmentation on Population Extinction. Journal of Wildlife Management 61:603-610.

Fitch, H.S. 1940. A biogeographical study of the ordinoides artenkreis of giant garter snake (genus *Thamnophis*). Univ. Calif. Pub. Zool. 44:1-150.

_____. 1941. Geographic variation in garter snakes of the genus *Thamnophis sirtalis* in the Pacific coast region of North America. American Midland Naturalist 26:570-592.

Fox, W. 1948. The relationships of the garter snakes of the garter snake *Thamnophis ordinoides*. Copeia 1948:113-120.

Frankham, R., and K. Ralls. 1998. Inbreeding leads to extinction. Nature 241:441-442.

Frayer, W.E., D.D. Peters, and H.R. Pywell. 1989. Wetlands of the California Central Valley: status and trends, 1939 to mid-1980's. U.S. Fish and Wildlife Service. Region 1: Portland, Oregon.

Goldingay, R.L., P.A. Kelly, and D.F. Williams. 1997. The kangaroo rats of California: endemism and conservation of keystone species. Pacific Conservation Biology 3:47-60.

Golightly, R.T. and R.D. Ohmart. 1983. Metabolism and body temperature of two desert canids: coyotes and kit foxes. Journal of Mammalogy 64:624-635.

Goodman, D. 1987. The demography of chance extinction. Pages 11-19 *in*: M. E. Soulé (ed.). Conservation Biology: the science of scarcity and diversity. Sinauer Associates, Inc., Sunderland, Massachusetts.

Grinnell, J., J.S. Dixon, and J.W. Linsdale. 1937. Fur-bearing mammals of California. 2 Volumes University of California Press, Berkeley.

Hall, E.R. 1946. Mammals of Nevada. University of California Press, Berkeley, California.

Hansen, E.C. 2003. Year 2002 investigations of the giant garter snake (*Thamnophis gigas)* in the Middle American Basin: Sutter County, California. Prepared for Sacramento Area Flood Control Agency, Sacramento, California.

__ . 2004. Year 2003 investigations of the giant garter snake (*Thamnophis gigas)* in the Middle American Basin: Sutter County, California. Prepared for Sacramento Area Flood Control Agency, Sacramento, California.

Hansen, G.E. 1988. Review of the status of the giant garter snake (*Thamnophis couchi gigas*) and its supporting habitat during 1986-1987. Final report for California Department of Fish and Game Contract C-2060, Sacramento, California. Unpublished Report, 31 pp.

_. 1995. Status of the giant garter snake (*Thamnophis gigas*) in the San Joaquin Valley-1995. Final Report for California Department of Fish and Game Standard Agreement No. FG4052IF. Section 6 Project EF94-XX, Objectives 3 and 5, November 1996, Sacramento, California.

_, and J.M. Brode. 1980. Status of the giant garter snake *Thamnophis couchi gigas* (Fitch). California Department of Fish and Game, Inland Fisheries Endangered Species Program Special Publication 80-5, Sacramento, California. 14 pp.

___, and _____. 1993. Results of relocating canal habitat of the giant garter snake (*Thamnophis gigas*) during widening of SR 99/70 in Sacramento and Sutter Counties, California. Final report for Caltrans Interagency Agreement 03E325 (FG7550) (FY 87/88-91-92). Rancho Cordova, California. 36 pp.

Hansen, R.B. 1988. Porterville urban area boundary biotic survey. Unpublished report, Hansen's Biological Consulting, Visalia, California, 219 pp.

Hansen, R.W. 1980. Western aquatic garter snakes in central California: an ecological and evolutionary perspective. Master of Arts thesis, California State University, Fresno, California, 78 pp.

_____, and G.E. Hansen. 1990. *Thamnophis gigas* (giant garter snake) reproduction. Herpetological Review 21(4):93-94.

Hanson Environmental, Inc. 2003. Performance assessment of mitigation actions implemented at the Tulare Lake Drainage District evaporation basins: 1993 2001. Technical report prepared for Tulare Lake Drainage District for submittal to California Regional Water Quality Control Board -- Central Valley Region, Walnut Creek, California.

Herbel M.J., T.J. Johnson, K.K. Tanji, S. Gao, and T.D. Bullen. 2002. Selenium isotope ratios in California drainage water management systems. Journal of Environmental Quality. 31:1146-1156

Hermanutz, R.O. 1992. Malformation of the fathead minnow (*Pimephales promelas*) in an ecosystem with elevated selenium concentrations. Bulletin of Environmental Contamination and Toxicology Report 49:290-294.

___ .., K.N. Allen, T.H. Roush, and S.F. Hedtke. 1992. Effects of elevated selenium concentrations on bluegills (*Lepomis macrochirus*) in outdoor experimental streams. Environmental Toxicology and Chemistry 11:217-224.

Hersteinsson, P., and D.W. Macdonald. 1982. Interspecific competition and the geographical distribution of red and arctic foxes (*Vulpes vulpes* and *Alopex lagopus*). Oikos 64:505-515.

Hinds, N. E. A. 1952. Evolution of the California landscape. California Division of Mines Bulletin No. 158, Sacramento, California. 240 pp.

Holland, R. F. and S. Jain. 1988. Vernal pools. Pages 515-533 *in*: M. G. Barbour and J. Major (eds.), Terrestrial vegetation of California. Wiley-Interscience, New York, New York.

Hopkins, W.A., J.H. Roe, J.W. Snodgrass, B.P. Staub, B.P. Jackson, and J.D. Congdon. 2002. Effects of chronic dietary exposure to trace elements on banded water snakes (*Nerodia fasciata*). Environmental Toxicology and Chemistry 21:906-913.

Hothem, R.L., and H.M. Ohlendorf. 1989. Contaminants in foods of aquatic birds in Kesterson Reservoir, California, 1985. Archives of Environmental Contamination and Toxicology 18:773-786.

Jackson, V.L. and J.R. Choate. 2000. Dens and den sites of the swift fox, *Vulpes velox*. The Southwestern Naturalist 45:212-220.

Jensen, C.C. 1972. San Joaquin kit fox distribution. U.S. Fish and Wildlife Service, Sacramento, California, Unpubl. Rep., 18 pp.

Kato, T.T. 1986. Survey of potential habitat for the endangered San Joaquin kit fox (*Vulpes macrotis mutica*) in the Carrizo Plain, San Luis Obispo County, CA. Rep. No. EGG 10282-2124, EG&G Energy Measurements, Goleta, CA, 24 pp.

Kareiva, P. 1990. Population dynamics in spatially complex environments: theory and data. Philosophical Transactions of the Royal Society of London, Series B. 330:175-190.

Knapp, D.K. 1979. Effects of agricultural development in Kern County, California, on the San Joaquin kit fox. In 1977 Final Report, Project E-1-1, Job V-1.21, Non-game Wildlife Investigations, California Department of Fish and Game, Sacramento, California, 48 pages.

Koopman, M.E., B.L. Cypher, and J.H. Scrivner. 2000. Dispersal patterns of San Joaquin kit foxes (*Vulpes macrotis mutica*). Journal of Mammalogy 81:213-222.

Lande, R. 1988. Genetics and demography in biological conservation. Science 241:1455-1460.

Laughrin, L. 1970. San Joaquin kit fox: its distribution and abundance. California Dept. Fish and Game, Sacramento, Wildlife Management Branch, Admin. Rep. No. 70-2, 20 pp.

Lewis, J.C., K.L. Sallee, and R.T. Golightly, Jr. 1993. Introduced red fox in California. California Dept. Fish and Game, Sacramento, Nongame Bird and Mammal Sec., Rep. 93-10, 70 pp.

Luoma, S.N. and T.S. Presser. 2000. Forecasting Selenium Discharges to the San Francisco Bay-Delta Estuary: Ecological Effects of a Proposed San Luis Drain Extension. U.S. Geological Survey, Water Resources Division, Open-File Report 00-416, Menlo Park, California. 157 pages and 6 appendices.

Macdonald, D.W., and D.R. Voigt. 1985. The biological basis of rabies models. Pp. 71-108 *in* P.J. Bacon (ed.). Population dynamics of rabies in wildlife. Academic Press, London, Great Britain.

Massey, B.W. 1974. Breeding biology of the California least tern. Proc. Linnaean Society 72:1-24.

Matlack, R.S., P.S. Gipson, and D.W. Kaufman. 2000. The swift fox in rangeland and cropland in western Kansas: relative abundance, mortality, and body size. The Southwestern Naturalist 45:221-225.

McCarten, N.F. and C.A. Patterson. 1987. Vegetation Quality and Rare Plant Study of Riparian Plant Communities along the Middle Sacramento River, California. California Department of Fish and Game Non-game Heritage Program, Sacramento, California. November.

McCue, P.M., and T.P. O'Farrell. 1988. Serological survey for selected diseases in the endangered San Joaquin kit fox (*Vulpes macrotis mutica*). Journal of Wildlife Diseases 24(2):274-281.

_____, T. Kato, M.L. Sauls, and T.P. O'Farrell. 1981. Inventory of San Joaquin Kit Fox on land proposed as Phase II, Kesterson Reservoir, Merced County, California. Report Number EGG 1183-2426, EG&G, Energy Measurements, Goleta, CA, 16 pp.

McDaniel, B., and S. McDaniel. 1963. Feeding of Least Terns over land. Auk 80:544.

McGahan, J.C. 2005. Grassland Bypass Project Floodwaters Report. Report submitted by the Grassland Area Farmers, Los Banos, California, to USBR and the Central Valley

Regional Water Quality Control Board, May 31, 2005. 8 page report and 2 page transmittal memo.

McGill, R.R., Jr. 1975. Land Use Changes in the Sacramento River Riparian Zone, Redding to Colusa. State of California, Resources Agency, Department of Water Resources. April, 1975. 23 pp.

McGrew, J.C. 1979. San Joaquin Kit Fox *Vulpes macrotis*. Mammalian Species 123:1-6.

McNicholl, M.K., P.E. Lowther, and J.A. Hall. 2001. Forster's Tern (*Sterna forsteri*). The Birds of North America 595:1-23.

Moore-Craig, N. 1984. Distribution and habitat preference of Stephens' kangaroo rat on the San Jacinto Wildlife Area. Unpublished senior thesis. University of California, Riverside, California.

Morrell, S.H. 1972. Life history of the San Joaquin kit fox. California Department of Fish and Game 58:162-174.

_____. 1975. San Joaquin kit fox distribution and abundance in 1975. California Department of Fish and Game, Sacramento, California, Wildlife Management Branch, Administrative Report No. 75-3, 28 pp.

Moyle, P.B. 2002. *Inland Fishes of California*. University of California Press. 502 pp.

Nakamoto, R.J., and T. Hassler. 1992. Selenium and other trace elements in bluegills from agricultural return flows in the San Joaquin Valley, California. Archives of Environmental Contamination and Toxicology 22:88-98.

Noss, R.F., E.T. LaRoe III, and J.M. Scott. 2003. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation -- April 2003. http://biology.usgs.gov/pubs/ecosys.htm

O'Farrell, M.J. and C.E. Uptain. 1987. Distribution and aspects of the natural history of Stephens' kangaroo rat (*Dipodomys stephensi*) on the Warner Ranch, San Diego Co., California. The Wasmann Journal of Biology 45:34-48.

O'Farrell, T.P. 1984. Conservation of the endangered San Joaquin kit fox (*Vulpes macrotis mutica*) on the Naval Petroleum Reserves, California. Acta Zool. Fennica 172:207-208.

__, and L. Gilbertson. 1979. Ecological life history of the desert kit fox in the Mojave Desert of southern California. Final Report. Bureau of Land Management, Riverside, California.

__ __ , and P. McCue. 1981. Inventory of San Joaquin kit fox on Bureau of Land Management lands in the western San Joaquin Valley. Final report. EG&G. U. S. Department of Energy, Goleta, California. EGG-1183-2416.

_____, T. Kato, P. McCue, and M.L. Sauls. 1980. Inventory of San Joaquin kit fox on Bureau of Land Management lands in southern and southwestern San Joaquin Valley. Final Report. EG&G, U. S. Department of Energy, Goleta, California. EGG 1183-2400.

Ohlendorf, H.M., D.J. Hoffman, M.K. Saiki, and T.W. Aldrich. 1986. Embryonic mortality and abnormalities of aquatic birds: apparent impacts of selenium from irrigation drainwater. The Science of the Total Environment 52:49-63.

__ __ , R.L. Hothem, and T.W. Aldrich. 1988. Bioaccumulation of selenium by snakes and frogs in the San Joaquin Valley, California. Copeia 1988(3):704-710.

Orloff, S., L. Spiegel, and F. Hall. 1986. Distribution and habitat requirements of the San Joaquin kit fox in the northern extreme of its range. Trans. Western Section, The Wildlife Society 22:60-70.

Paquin, M.M. 2001. Population structure of the giant garter snake *Thamnophis gigas*. Master of Arts thesis in Biology (Ecology and Systematics), San Francisco State University, San Francisco, 27 pp.

Paveglio, F.L., and S.D. Clifton. 1988. Selenium accumulation and ecology of the San Joaquin kit fox in the Kesterson National Wildlife Refuge area. Report prepared for the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, San Luis National Wildlife

Refuge, San Luis, California.

Phillips, S.E. 2006a. General overview of land functions and values for kit fox on SLDFR drainage impaired areas and proposed facility sites based on field observations. California State University-Stanislaus, Endangered Species Recovery Program, Fresno, California.

_____. 2006b. In Progress Draft Environmental Baseline of the San Luis Unit Fresno, Kings and Merced Counties, California. California State University-Stanislaus, Endangered Species Recovery Program, Fresno, California.

Primack, R.B. 1998. Essentials of Conservation Biology. Second Edition. Sinaur Associates. Sunderland, Massachusetts.

Ralls, K., and P.J. White. 1995. Predation on endangered San Joaquin kit foxes by larger canids. Journal of Mammalogy 276:723-729.

, _____, J. Cochram, and D.B. Siniff. 1990. Kit fox – coyotes relationships in the Carrizo Plain Natural Area. Annual report to the U. S. Fish and Wildlife Service. Department of Zoological Research, Smithsonian Institution, Washington, D.C.

Reese, E.A., T.T. Kato, W.H. Berry, and T.P. O'Farrell. 1992. Ground penetrating radar and thermal images applied to San Joaquin kit fox (*Vulpes macrotis mutica*) at Camp Roberts Army National Guard Training Site, CA. U.S. Department of Energy Report, No. EGG 10617-2162, EG&G/EM Santa Barbara Operations, National Technical Information Service, Springfield, VA.

Reichman, O.J., and M.V. Price. 1993. Ecological aspects of heteromyid foraging. Pp. 539-574 *in* Genoways, H.H. and Brown, J.H. (eds.), Biology of the Heteromyidae. Special Publication No. 10 of the American Society of Mammalogists, Shippensburg, Pennsylvania, 719 pp.

Reilly, K., and D. Mangiamele. 1992. California rabies surveillance. 1991. California Veterinarian 46:47-51.

Reynolds. H.G. 1958. The ecology of the Merriam kangaroo rat (*Dipodomys merriami* Mearns) on the grazing lands of southern Arizona. Ecological Monographs 28:111-127.

Rhian, M. and A.L. Moxon. 1943. Chronic selenium poisoning in dogs and its prevention by arsenic. The Journal of Pharmacology and Experimental Therapeutics 78: 249-264

Rossman, D.A. and G.R. Stewart. 1987. Taxonomic reevaluation of *Thamnophis couchii* (Serpentes: Colubridae). Occasional Papers of the Museum of Zoology, Louisiana State University 63:1-25.

_____, N.B. Ford, and R.A. Seigel. 1996. The garter snakes: evolution and ecology. University

of Oklahoma Press, Norman, 331 pp.

Saccheri, I., M. Kuussaari, M. Kankare, P. Vikman, W. Fortelius, and I. Hanski. 1998. Inbreeding and extinction in a butterfly population Nature 392:491-494.

Saiki, M.K. 1998. An ecological assessment of the Grassland Bypass Project on fishes inhabiting the Grassland Water District, California. Final Report. U.S. Fish and Wildlife Service, Sacramento, California.

_____, and T.P. Lowe. 1987. Selenium in aquatic organisms from subsurface agricultural drainage water, San Joaquin Valley, California. Archives of Environmental Contaminants and Toxicology 16:657-670.

_____, and T.W. May. 1988. Trace element residues in bluegills and common carp from the lower San Joaquin River, California, and its tributaries. The Science of the Total Environment 74:199-217.

_____, M.R. Jennings, and S.J. Hamilton. 1991. Preliminary assessment of the effects of selenium in agricultural drainage on fish in the San Joaquin Valley. Pages 369-385 in A. Dinar and D. Zilberman (eds.), The Economics and management of water and drainage in agriculture. Kluwer Academic Publishers, Boston, Massachusetts.

_____, _____, and T.W. May. 1992. Selenium and other elements in freshwater fishes from the irrigated San Joaquin Valley, California. The Science of the Total Environment 126:109-137.

_____, _____, and W.G. Brumbaugh. 1993. Boron, molybdenum, and selenium in aquatic food chains from the lower San Joaquin River and its tributaries, California. Archives of Environmental Contaminants and Toxicology 24(3):307-319.

Schultz, L.J., and L.R. Barrett. 1991. Controlling rabies in California 1990. California Vet. 45:36-40.

Scrivner, J.H., T.P. O'Farrell, and K.L. Hammer. 1993. Summary and evaluation of the kit fox relocation program, Naval Petroleum Reserve #1, Kern County, California. U.S. Department of Energy Topical Report, EG&G/EM Santa Barbara Operations Report No. EGG 10282-2168. 26 pages.

_____, _____, and T. Kato. 1987b. Dispersal of San Joaquin kit foxes, *Vulpes macrotis mutica*, on Naval Petroleum Reserve #1, Kern County, California. EG&G, Goleta, California. EGG 10282-2190.

_____, _____, T.T. Kato, and M.K. Johnson. 1987a. Diet of the San Joaquin kit fox, *Vulpes macrotis mutica*, on Naval Petroleum reserve #1, Kern County, California. EG&G, Goleta, California. EGG 10282-2190, 26 pp.

Schwartz, M.K., K. Ralls, D.F. Williams, B.L. Cypher, K.L. Pilgrim, and R.C. Fleischer. 2005. Gene flow among San Joaquin kit fox populations in a severely changed ecosystem. Conservation Genetics 6:25-37.

Smith, D.A., K. Ralls, B.L. Cypher, and J.E. Maldonado. 2005. Assessment of scat-detection dog surveys to determine kit fox distribution. Wildlife Society Bulletin 33:897-904.

Smith, H.M. 1946. Handbook of lizards. Lizards of the United States and Canada. Comstock Publishing Co., Ithaca, NY, 557 pp.

Spencer, K.A., W.H. Berry, W.G. Standley, and T.P. O'Farrell. 1992. Reproduction of the San Joaquin kit fox on Camp Roberts Army National Guard Training site, California. U.S. Department of Energy Topical Report EGG 10617-2154.

Spiegel, L.K. 1996. Studies of the San Joaquin kit fox in undeveloped and oil-developed areas. California Energy Commission, Publ. No. P700-96-003. California Energy Commission Publication Unit, Sacramento, California.

_____, and M. Disney. 1996. Mortality sources and survival rates of San Joaquin kit foxes in oil-developed and undeveloped lands of southwestern Kern County, California. Pages 71-92 *in* L.K. Spiegel (ed.), Studies of the San Joaquin kit fox in undeveloped and oil-developed areas. California Energy Commission, Sacramento, California.

_____, and J. Tom. 1996. Reproduction of San Joaquin kit fox undeveloped and oil-developed habitats of Kern County, California. Pages 53-69 *in* L.K. Spiegel (ed.), Studies of the San Joaquin kit fox in undeveloped and oil-developed areas. California Energy Commission, Sacramento, California.

Standley, W.G., and P.M. McCue. 1992. Blood characteristics of San Joaquin kit fox (*Vulpes velox macrotis*) at Camp Roberts Army National Guard Training Site, California. U.S. Dept. of Energy Topical Rep., EG&G/EM Santa Barbara Operations Report No. EGG 10617-2160.

_____, W.J. Berry, T.P. O'Farrell, and T.T. Kato. 1992. Mortality of San Joaquin kit fox (*Vulpes macrotis mutica*) at Camp Roberts Army National Guard Training Site, California. Rep. No. EGG 10617-2157, EG&G Energy Measurements, Goleta, California, 19 pp.

Stitt, E. W., P.S. Balfour, T. Luckau, and T.E. Edwards. 2005. The southern watersnake (*Nerodia fasciata*) in Folsom, California: history, population attributes, and relation to other introduced watersnakes in North America. Final Report to U.S. Fish and Wildlife Service, Sacramento, California.

Stuart, J.N., M.L. Watson, T.L. Brown, and C. Eustice. 2001. Plastic netting: an entanglement hazard to snakes and other wildlife. Herpetological Review 32(3):162-164.

Thomas, J.R., Jr. 1975. Distribution, population densities, and home range requirements of the Stephens' kangaroo rat (*Dipodomys stephensi*). Unpublished master's thesis, California Polytechnic University, Pomona, 64 pp.

Thomkins, I.R. 1959. Life history notes on the Least Tern. Wilson Bulletin 71:313-322.

Thompson, B.C., J.A. Jackson, J. Burger, L.A. Hill, E.M. Kirsch, and J.L. Atwood. 1997. Least Tern (*Sterna antillarum*). The Birds of North America 290:1-32.

U.S. Bureau of Reclamation (USBR). 1991. Draft Environmental Impact Statement, San Luis Unit Drainage Program, Central Valley Project, California, Sacramento, California.

___. 2003-2005. Monthly data reports of the Delta-Mendota Canal Water Quality Monitoring Program for Selenium and Salinity. Mid-Pacific Region, Sacramento and Fresno, California.

_____. April 2004. Broadview Water Contract Assignment Project Environmental Assessment/Finding of No Significant Impact. Prepared by Environmental Science Associates for the South Central California Office, Fresno, California. 4 chapters and 3 appendices.

___. December 2004. Water Transfer Program for the San Joaquin River Exchange Contractors Water Authority 2005-2014 Final Environmental Impact Statement/ Environmental Impact Report. Prepared for USBR Mid-Pacific Region, Sacramento and Fresno, and the San Joaquin River Exchange Contractors Water Authority by URS Corporation, Oakland, California. 17 sections and 5 appendices.

. May 2005a. San Luis Drainage Feature Re-evaluation Draft Environmental Impact Statement and Technical Appendices. 23 sections and 13 appendices.

____. October 2005b. San Luis Drainage Feature Re-evaluation Biological Assessment (Updated and Revised). Technical Service Center, Denver, Colorado. 10 chapters and 5 appendices.

U.S. Census Bureau. 2000. Census of Population, Public Law 94-171 Redistricting Data File. Updated every 10 years. http://factfinder.census.gov

U.S. Court of Appeals for the Ninth Circuit. 2001. Firebaugh Canal USA, Case Number 95-15300.

U.S. Department of the Interior (USDI). 1994. The Impact of Federal Programs on Wetlands, Vol. II, A Report to Congress by the Secretary of the Interior, Washington, D.C., March, 1994. http://www.doi.gov/oepc/wetlands2/

____. 2005. Land Retirement Demonstration Project five-year report. Interagency Land Retirement Team, Fresno, California.

U.S. Fish and Wildlife Service (USFWS). 1967. Native fish and wildlife. Endangered species. Federal Register 32:4001. [Includes blunt-nosed leopard lizard and San Joaquin kit fox].

_____. 1980a. Recovery plan for the California least tern, *Sterna antillarum browni*. U.S. Fish and Wildlife Service, Portland, OREGON.

_____. 1980b. Blunt-nosed leopard lizard recovery plan. Portland, Oregon, 62 pp.

_____. 1983. San Joaquin kit fox recovery plan. Portland, Oregon, 84 pp.

_____. 1985a. Revised recovery plan for the California least tern, *Sterna antillarum browni*. U.S. Fish and Wildlife Service, Portland, Oregon.

_____. 1985b. Endangered and threatened wildlife and plants; determination of endangered status and critical habitat for the Fresno kangaroo rat. Federal Register 50:4222-4226.

_____. 1986. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Cordylanthus palmatus* (Palmate-Bracted Bird's - Beak). FR 51(126):23765-23769.

_____. 1990. Endangered and Threatened Wildlife and Plants; Determination of Endangered or Threatened Status for Five Plants from the Southern San Joaquin Valley. FR 55(139): 29361-29370.

_____. 1991. Proposed Rule to List the Giant Garter Snake, *Thamnophis gigas* as an Endangered Species. Federal Register 56:67048.

_____. 1993a. Biological opinion on effects of 16 vertebrate control agents on threatened and endangered species. Washington, DC, 172 pp.

_____. 1993b. Endangered and Threatened Wildlife and Plants: Determination of threatened status for the giant garter snake. Federal Register 58:54053-54066.

_____. 1993c. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Delta Smelt. FR 58(42):12854-12864.

_____. 1994a. Determination of endangered or threatened status for five plants from the southern San Joaquin valley; Final Rule. Federal Register 55:29361-29370.

_____. 1994b. Determination of endangered status for the Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool tadpole shrimp, and threatened status for the vernal pool fairy shrimp; Final Rule. Federal Register 59:48136-48153.

_____. 1994c. Endangered and Threatened Wildlife and Plants; Critical Habitat Determination for the Delta Smelt. FR 59(242):65256-65279.

_____. 1995. Biological opinion for interim water renewal contracts, Central Valley, California, with the Bureau of Reclamation, Sacramento, California. Sacramento, California, 160 pp.

_____. 1996a. California Condor Recovery Plan, Third Revision. Portland, Oregon. 62 pp.

_____. 1996b. Recovery Plan for the Sacramento-San Joaquin Delta native fishes. November 26, 1996.

_____. 1998. Recovery Plan for Upland Species of the San Joaquin Valley, California. Region 1, Portland, Oregon. 319 pp.

_____. 1999a. National Pesticide Consultation with the U.S. Environmental Protection Agency. Sacramento, California.

_____. 1999b. Draft Recovery Plan for the Giant Garter Snake (*Thamnopsis gigas*). U.S. Fish and Wildlife Service, Region 1, Portland, OREGON. ix + 192pp.

_____. 2000. Biological Opinion for the Interim Water Contract Renewal, Ref. No. 1-1-00-F-0056, February 29, 2000.

_____. 2005a. Reinitiation of Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the Central Valley Project and State Water Project and the Operational Criteria and Plan to Address Potential Critical Habitat Issues (1-1-05-F-0055). February 16, 2005.

_____. 2005b. Endangered and Threatened Wildlife and Plants; Final Rule to Designate Critical Habitat for the Buena Vista Lake Shrew (*Sorex ornatus relictus*); Final Rule. Federal Register 70(14):3437-3461.

Warrick, G.D., and B.L. Cypher. 1998. Factors affecting the spatial distribution of San Joaquin kit foxes. Journal of Wildlife Management 62:707-717.

Westlands Water District Annual Report. 2004-2005. 12 pp. http://www.westlandswater.org/long/200601/annual_report_2004_2005.pdf

White, P.J., and R.A. Garrott. 1997. Factors regulating kit fox populations. Canadian Journal of Zoology 75:1982-1988.

_____. 1999. Population dynamics of kit foxes. Canadian Journal of Zoology 77:486-493.

White, P.J., and K. Ralls. 1993. Reproduction and spacing patterns of kit foxes relative to changing prey availability. Journal of Wildlife Management 57:861-867.

_____, _____, and C.A. Vanderbilt-White. 1995. Overlap in habitat and food use between

coyotes and San Joaquin kit foxes. Southwestern Naturalist 40:342-349.

_____, C.A. Vanderbilt-White, and K. Ralls. 1996. Functional and numerical responses of kit foxes to a short-term decline in mammalian prey. Journal of Mammalogy 77(2):370-376.

_____, W.H. Berry, J.J. Eliason, and M.T. Hanson. 2000. Catastrophic decrease in an isolated population of kit foxes. Southwest Naturalist 45(2):204-211.

Williams, D.F. 1985. A review of the population status of the Tipton kangaroo rat, *Dipodomys nitratoides nitratoides*. U.S. Fish and Wildlife Service, Sacramento, Endangered Species Office, California, Final Rep., 44 pp.

_____. 1990. Assessment of potential habitat for the blunt-nosed leopard lizard and San Joaquin kit fox in western Madera County, California. U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA, 31 pp.

_____, and D.J. Germano. 1992. Recovery of endangered kangaroo rats in the San Joaquin Valley, California. Transactions of the Western Section of The Wildlife Society 28: 93-106.

_____, and A.C. Harpster. 2001. Status of the Buena Vista Lake shrew (*Sorex ornatus relictus*): final report in partial fulfillment of the Central Valley Project Improvement Act Section 3406(B)(1). Submitted to the U.S. Bureau of Reclamation, South-Central California Area Office, Fresno, California. 22 pp.

Williams, T. and V. Wunderlich. 2003. Progress report: 2003 San Joaquin Valley giant garter snake conservation project. San Luis National Wildlife Refuge Complex, Los Banos, California.

Woodbridge, B. 1998. Swainson's hawk (*Buteo swainsoni*). In "The Riparian Bird Conservation Plan: a Strategy for Reversing the Decline of riparian-associated Birds in California." California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

Wylie, G.D. 1998. Results of the 1998 survey for giant garter snakes in and around the Grasslands Area of the San Joaquin Valley. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California.

_____. 1999. Giant garter snake project: 1998 progress report. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California.

_____. 2000. Monitoring giant garter snakes at the Colusa National Wildlife Refuge: 2000 results. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California.

_____. 2003. Results of the 2003 monitoring for giant garter snakes (*Thamnophis gigas*): bank

protection project on the left bank of the Colusa Basin Drainage Canal in Reclamation District 108, Sacramento River Bank Protection Project, Phase II. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California. 13 pp.

___, and M.L. Casazza. 2001. Investigations of giant garter snakes in the Natomas Basin: 2001 field season. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California. 9 pp.

___, and L.L. Martin. 2004. Results of 2004 monitoring for giant garter snake (*Thamnophis gigas*) for the bank protection project on the left bank of the Colusa Basin Drainage Canal in Reclamation District 108, Sacramento River Bank Protection Project, Phase II. Prepared for: Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District, November 2004.

_____, M.L. Casazza, and N.M. Carpenter. 2002. Monitoring giant garter snakes at Colusa National Wildlife Refuge: 2001 progress report. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 10 pp.

_____, M.L. Casazza, and N.M. Carpenter. 2003. Diet of bullfrogs in relation to predation on giant garter snakes at Colusa National Wildlife Refuge. California Fish and Game 89(2):139-145.

_, M.L. Casazza, and J.K. Daugherty. 1997. 1996 Progress report for the giant garter snake study. Preliminary report. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California.

_____, M.L. Casazza, and L.L. Martin. 2003. Giant garter snake surveys in the Natomas Basin: 2000-2002. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 20 pp.

____, M.L. Casazza, and L.L. Martin. 2004. Monitoring Giant Garter Snakes in the Natomas Basin: 2003 Results. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 55 pp.

_____, M.L. Casazza, L.L. Martin, and M. Carpenter. 2003. Monitoring giant garter snakes at Colusa National Wildlife Refuge: 2002 progress report. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 16 pp.

____, M.L. Casazza, L.L. Martin, and M. Carpenter. 2004. Monitoring giant garter snakes at Colusa National Wildlife Refuge: 2003 progress report. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 17 pp.

_____, M.L. Casazza, L.L. Martin, and E. Hanson. 2000. Investigations of giant garter snakes in the Natomas Basin: 2000 field season. Dixon Field Station, Biological Resources Survey, U.S. Geological Survey, Dixon, California. 13 pp.

_____, T. Graham, M.L. Casazza, M.M. Paquin, and J. Daugherty. 1996. National Biological Service giant garter snake study progress report for the 1995 field season. Preliminary report. Dixon Field Station, Biological Resources Division, U.S. Geological Survey, Dixon, California.

Young, L.S. 1989. Effects of agriculture on raptors in the western United States: an overview. Proceedings of the Western Raptor Management Symposium and Workshop; Natural Science and Technology Series 12.

Unpublished Literature

Cypher, B.L. 2006. Kit fox conservation in the San Luis Drainage Unit study: ecological considerations relevant to the development of a conservation strategy for kit foxes. California State University-Stanislaus, Endangered Species Recovery Program Fresno, CA. 8 pp.

Warrick, G.D., H.O. Clark, Jr., P.A. Kelly, D.F. Williams, and B.L. Cypher. Submitted. Use of Agricultural Lands by San Joaquin kit foxes. Western North American Naturalist.

Personal Communications

Beckon, William. U.S. Fish and Wildlife Service, Sacramento, CA

Bettner, Thad. Deputy General Manager of Resources, Westlands Water District, Five Points, CA

Cypher, Brian L. Endangered Species Recovery Program, Bakersfield, CA

Forrest, Kim. Manager, San Luis National Wildlife Refuge, U.S. Fish and Wildlife Service, Los Banos, CA

Kelly, Patrick. Endangered Species Recovery Program, Fresno, CA

Leach, Steve. URS Corporation, Oakland, CA

McDonald, Shauna. U.S. Bureau of Reclamation, Fresno, CA

Olsen, Beatrice. U.S. Fish and Wildlife Service, Fresno, CA

Phillips, Scott. GIS Analyst, Endangered Species Recovery Program, Turlock, CA

Price, Mary V. Professor Emeritus, University of California, Riverside, CA (currently at Tucson, AZ)

Robbins, Gerald. Project Manager, San Luis Drainage Feature Re-Evaluation, U.S. Bureau of Reclamation, Sacramento, CA

Seay, Jeff. H.T. Harvey and Associates, Fresno, CA

Skorupa, Joseph. Clean Water Act Biologist, U.S. Fish and Wildlife Service, Division of Environmental Quality, Arlington, VA

Toto, Anthony. Water Resources Control Engineer, California Regional Water Quality Control Board, Fresno, CA

Van Horn Job, Christine. Endangered Species Recovery Program, Bakersfield, CA

White, PJ (Patrick). U.S. Fish and Wildlife Service, Sacramento, CA (currently with National Park Service, Yellowstone National park, WY)

APPENDIX M3

NOAA Fisheries Informal Consultation – Endangered Species Act Section 7

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

April 21, 2006 In response refer to:
151422SWR2005SA00343:JSM

Kathy Wood
Chief, Resources Management Decision
U.S. Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, California 93721

Dear Mrs. Wood:

This is in response to your letter of March 27, 2006, initiating informal consultation under section 7 of the Endangered Species Act (ESA) with NOAA's National Marine Fisheries Service (NMFS) for the San Luis Drainage Feature Re-Evaluation project. Your letter indicates that you believe the proposed project may affect, but is not likely to adversely affect, Federally listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley spring-run Chinook salmon (*O. tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), or their designated critical habitat. In addition, this consultation concerns the Southern Distinct Population Segment (DPS) of North American green sturgeon (*Acipenser medirostris*) which is listed as threatened (effective July 6, 2006). Your office also has determined that the proposed project may adversely affect Essential Fish Habitat (EFH) for Pacific salmon and is requesting consultation under the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The U.S. Bureau of Reclamation (Reclamation) proposes to provide drainage service for the San Luis Unit (SLU) and the Grassland Drainage Area over the next 50 years to fulfill the requirements of the Court Order filed in *Firebaugh Canal Co. et al. v. United States of America, et al.* The drainage area is located in the western San Joaquin Valley and consists primarily of the lands within the boundary of the Central Valley Project's (CVP) SLU, and includes the agricultural districts within the CVP's SLU located in the northwest portion of Kings County, in western Fresno County, and in the southwestern tip of Merced County, California. In addition, the project area includes the drainage of impaired lands for the San Joaquin Exchange Contractors and Delta-Mendota Canal Unit. Lands immediately adjacent to the Unit, in the Grassland Drainage Area have also been included.

The proposed project consists of approximately 730,000 acres, most of which are intensively managed agricultural land. Of the 730,000 acres, about 379,000 acres are, or are projected to be, drainage impaired within the 50-year planning horizon. The proposed project consists of four potential alternatives that include varying ranges of land retirement, reuse areas, conveyance collection systems, reverse osmosis treatment plants, selenium biotreatment facilities, and

evaporation basins. The alternatives include up to 71 miles of inter-facility pipelines, a maximum of 16 regional reuse facilities on as much as 19,000 acres, as many as four evaporation basins on up to 3,290 acres, and up to four reverse osmosis treatment plants and selenium biotreatment plants on a maximum of 14 acres. Effluent flow rates may be up to 5,179 acre feet per year in the Northerly area of the project, and up to 4,050 acre feet per year in the Westlands North, Central, and South areas. As the amount of land retired increases, the amount of land converted to reuse areas or evaporation basins decreases.

ESA Section 7 Consultation

The proposed project site is not within the geographic range of the Sacramento River winter-run Chinook salmon and the Central Valley spring-run Chinook salmon Evolutionarily Significant Units, or their designated critical habitat. In addition, the project site does not fall within the geographic range of the Southern DPS of the North American green sturgeon. The proposed project area is within the Central Valley steelhead DPS, and is designated critical habitat for this species.

Adverse impacts to listed salmonids and sturgeon are not expected due to the use of reverse osmosis, selenium biotreatment, and evaporation basins to reduce selenium levels of effluent to levels at or below levels considered to be toxic to salmonids and sturgeon. In addition, the proposed project alternatives include drainage reduction solutions such as recycling rainwater, managing shallow groundwater, and reducing canal seepage, reducing effluent levels and the potential for adverse effects to aquatic organisms including listed salmonids and sturgeon. Land retirement options common among all four alternatives also will reduce future effluent levels, thus reducing effects of effluent to listed salmonids and sturgeon. NMFS has determined that the proposed San Luis Drainage Feature Re-Evaluation project is not likely to adversely affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead and their designated critical habitat, as well as the Southern DPS of North American green sturgeon. This finding is based on Reclamation implementing all conservation and protective measures intended to avoid or minimize adverse effects to fish and fish habitat as identified in the project description. This concludes informal consultation for the proposed action. Reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law), and if: (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered; or (3) a new species is listed or critical habitat designated that may be affected by the action.

EFH Consultation

Based on our review of the project description and conservation and protective measures included, NMFS finds that the project activities will not adversely affect EFH for Pacific salmon. We find the project activities incorporated in the project description include conservation measures that will reduce adverse affects to EFH for Pacific salmon, as described in Amendment 14 of the Pacific Salmon Fishery Management Plan pursuant to the MSA; therefore, EFH

conservation recommendations will not be provided. Written response as required under section 305(b)(4)(B) of the MSA, and Federal regulations (50 CFR 600.920) will not be required. Should additional information reveal that the project may affect EFH and/or impact salmonids in a way not previously considered, or should the action be modified in a way that may cause additional effects to EFH, this determination may be reconsidered.

Please contact Jeff McLain at (916) 930-5648, or via e-mail at Jeff.Mclain@noaa.gov if you have any questions concerning this project or require additional information.

Sincerely,

Rodney R. McInnis
Regional Administrator

cc: NMFS-PRD, Long Beach, CA
Mike Kinsey, USBR, 1243 N Street, Fresno, CA 93721