SAN JOAQUIN KIT FOX SURVEY REPORT

ROCKWELL POND SPECIFIC PLAN PROJECT

(SELMA, FRESNO COUNTY, CALIFORNIA)

Prepared for

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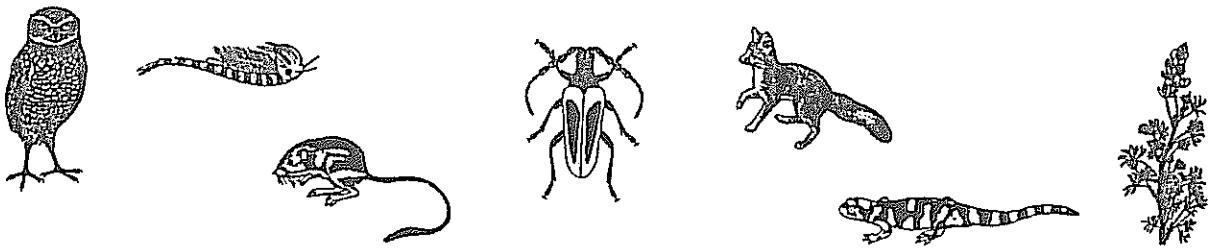

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1. Summary

Land Use Associates is preparing environmental documents for approximately a 251-acre specific plan project for future commercial, industrial, and residential development. The development is known as the Rockwell Pond Specific Plan Project. This report presents the results of our protocol surveys to determine if the San Joaquin Kit Fox, a federally endangered and state threatened species, inhabits the project site or uses it for foraging. No kit fox were found on the project site using den and track searches, spotlighting, and scent station survey methods. We found nothing to indicate that kit fox occurs on the project site, uses it for foraging, or occurs adjacent to the project site. We conclude that kit fox does not inhabit or forage upon the project site, or occur adjacent to the project site. No kit fox critical habitat, designated recovery areas, or movement corridors occur on the site. The project will not cause negative direct, indirect, interrelated, interdependent, or cumulative adverse impacts to the kit fox since it does not occur on the site, forage upon the site, or occur adjacent to the project site. Thus, since kit fox will not be harmed, take permits and compensation mitigation for impacts are not necessary for the kit fox. As a preventive avoidance measure and to protect and preserve the San Joaquin kit fox, a preconstruction survey will be conducted about 30 days prior to ground disturbing activities in and around the Rockwell Pond recharge basin. The survey protocol will follow the USFWS's (1999) guidelines as denoted in Appendix H. If kit fox are found, the USFWS will be consulted an their protective and mitigative measures as noted in Appendix H will be enacted. Also, Standard Recommendation #1-13 (Appendix H) are incorporated into the project and will be implemented to avoid potential impacts to the kit fox. As per Standard Recommendation #8, the representative is Mr. Jeffrey A. Halstead and he can be contacted at (559) 298-2334 or (559) 903-5703.

2. Parties Involved

Land Use Associates (286 W. Cromwell Avenue, Fresno, California, 93711, (559) 256-4250) is preparing environmental documents for approximately a 251-acre specific plan project for future commercial, industrial, and residential development. The development is known as the Rockwell Pond Specific Plan Project. Halstead and Associates, Environmental/Biological Consultants was hired by Land Use Associates to conduct a protocol San Joaquin Kit Fox survey and prepare a report on our findings.

3. Project Location

The project site is located just west of the City of Selma (Fresno County, California) (Appendix A). The site occurs along west side of Highway 99 and is bordered on the south by Floral Avenue and on the east by De Wolf Avenue. Specifically, the site occurs in Section 36, Township 15 South, and Range 21 East of the Conejo 7.5 minute quadrangle map of the U. S. Geological Survey (Appendix A).

4. Project Description

Land Use Associates is preparing specific plan environmental documents for approximately a 251-acre parcel for future commercial, industrial, and residential development. The development is known as the Rockwell Pond Specific Plan Project (Appendix A).

5. Project Site Description

The project site is approximately a 251-acre parcel adjacent to the City of Selma. The site is comprised of vineyards, onion and squash fields, fallow fields which are recently pulled vineyards, the Rockwell Pond recharge basin, and a few single-family farm residences (Appendices B and C). Adjacent lands include vineyards, fallow fields which are recently pulled vineyards, single-family farm residences, the Rockwell Pond recharge basin, and a commercial development near Highway 99 with businesses such as Walmart, Penneys, Sears, Burger King, and an Arco gas station (Appendices A and B). Lands in the general vicinity include agricultural lands such as vineyards and row crops, single-family farm residences, commercial developments along Highway 99, and the City of Selma.

6. Previous Surveys and Informal Consultation

San Joaquin Kit Fox surveys have not been previously conducted on the site. Informal consultations have not occurred with resource or regulatory agencies about the project.

7. Background Information on San Joaquin Kit Fox

Background information on the San Joaquin Kit Fox is presented in Appendices D and E. In summary, the San Joaquin Kit Fox is one of the eight recognized subspecies of kit fox. It resembles a small lanky dog in appearance, is cat-size, and has disproportionately large ears with an abundance of large white guard hairs. Total length is about 32 inches, including a 12-inch black-tipped tail. Coloration ranges from light buff to grayish along the back and tail; gray, rust, or yellowish along the sides; and white along the belly.

Kit fox dens are typically excavated in loose soil. Individual animals may utilize from 3 to 24 separate dens. The number of den entrances ranges from 1 to 36 and they may extend into several individual tunnels and chambers reaching depths of 10 feet. Man-made structures such as culverts and pipes may also be used as dens. The den entrance is characteristically higher than wide, and is sufficiently small to prevent access by large carnivores such as coyotes and dogs.

The den entrance holes are generally about 8 to10 inches in height and less than 8 inches in width, but may be as small as 4 inches in width. Burrows of other animals particularly California Ground Squirrel, may also be enlarged and utilized as den sites. Although occupied dens commonly show freshly excavated soil, scats, and prey remains, such obvious sign may be inconspicuous or absent.

Kit fox forage and live in an area of 1 to 2 square miles. They typically hunt for rodents, rabbits, and other prey by night. Typical prey include California Ground Squirrel, Audubon's Cottontail, Black-tailed Hare, kangaroo rats, pocket mice, other small mammals, insects, and ground-nesting birds. Mating occurs in December to January. Pups are born in February to March, and begin to disperse at around five months of age. Survival rates of pups are low, about 75 percent of them die before the age of eight months.

The kit fox is distributed over a large portion of central California, extending roughly from southeastern Contra Costa County south along the eastern edge of the Interior Coast Range to the southern San Joaquin Valley, including major portions of western Kern County and Tulare County. Kit fox are also distributed through adjacent valleys, foothills, and plains, including portions of San Luis Obispo County, Monterey County, and the Santa Clara Valley on the western side of the Interior Coast Range. Distribution maps occur in Appendices D and E.

Habitat conversion has been the principal reason for both state and federal listings of the kit fox. Agricultural development is the principal contribution factor to this decline and approximately half of the suitable kit fox habitat has been lost. Mortality to kit fox has been documented from attacks by coyotes, road kills, conversion of habitat, shooting, drowning, entombment, pneumonia, and starvation. Additionally, widespread use of rodenticides may result in mortality, since kit fox are extremely vulnerable to secondary poisoning through consumption of poisoned ground squirrels or other scavenged rodents.

8. Survey Methods

Protocol kit fox surveys were conducted by Pamela and Jeffrey Halstead, with assistance from Biological Technician Mr. Andrew Roberts to determine if the San Joaquin Kit Fox occurs on the site, uses the site as foraging habitat, and could be impacted by the project. The survey protocol of the CDFG (1990, Appendix F) for kit fox den and track searches, spotlighting, and scent stations was reviewed, planned, and conducted for the project. The survey protocol for the kit fox in its northern range (USFWS, 1999, Appendix G) and the standard recommendations for kit fox protection (USFWS 1999, Appendix H) were also reviewed. Survey information was recorded on standardized data sheets. Aerial photographs of the site were used to locate on-the-ground field positions, scent stations locations, spotlighting routes, and habitat types. The sampling sites were marked on standardized maps (Appendices I and J).

Den and Track Searches

Den and track searches were conducted as specified in the protocol guidelines (Appendix F). Den and track surveys were conducted on August 29 and 31, 2007. The entire site was

visually surveyed by driving and walking the area (Appendix J). Potential burrows were examined for kit fox evidence (i.e., feces, prey remains, tracks, diggings, hair). These burrows were considered "potential" kit fox dens. Examples of such potential dens were photographed and are shown in Appendix M. Tracks were examined throughout the site and on adjacent lands, especially on dusty dirt roads. Tracks were identified using a variety of literature (see Section 12).

Spotlighting

Spotlight surveys were conducted as specified in the protocol guidelines for six nights (Appendix F). Spotlight surveys were conducted on August 27-September 1, 2007. Spotlighting was conducted by three biologists, shortly after dark, for at least 2 hours each night, with two 1,000,000 candle-light power spotlights, and along different routes each night. Spotlighting was conducted from a Chevrolet Silverado 1500 crew-cab pickup truck. Lands on and adjacent to the project site, and within Rockwell Pond itself were spotlighted.

Scent Stations

Scent station surveys were conducted as specified in the protocol guidelines for six nights (Appendix F). Scent station surveys were conducted on August 28-September 3, 2007. On August 30, rain damaged the tracking surface of the stations and they were not readable. Stations were located along dirt roads throughout the 251-acre project site. A total of 12 stations were operated on the site (Appendix I). Stations were leveled, vegetation removed, soil compacted, soil prepared to a powdery texture, diatomaceous earth medium added, smoothed with a broom, at least 6-feet in diameter, and a can of chicken-flavored cat food placed in the center. Stations were checked and readied each evening after dark, and tracks were read and recorded the following morning. Cat food was replaced when it was gone, had been eaten, or it became dry. Cat food was changed at all stations at least twice during the survey. Examples of scent stations were photographed and are shown in Appendix M.

9. Survey Results

The scientific literature shows that kit fox are known to occur in the general region of the site (Appendices D and E). No designated kit fox recovery areas or movement corridors occur on the site. Protocol surveys (scent stations, spotlighting, den and track searches) were conducted for the San Joaquin Kit Fox, but none were found on or adjacent to the site. We found nothing to indicate that kit fox occur on the site or use it for foraging. Results from the three survey methods are reported below.

Den and Track Searches

Den and track searches were conducted throughout the site (Appendix J). Extra effort was spent surveying the banks of the Rockwell Pond recharge basin where numerous potential dens were found. Kit fox dens or tracks were not found on the site. Burrows of the California Ground Squirrel, Audubon Cottontail, and Coyote were found on the site, but none showed any evidence of use by kit fox. Tracks of animals such as Audubon Cottontail, California Ground Squirrel, Domestic Dog, Coyote, Domestic Cat, bird, and Western Toad were found.

Scent Stations

Twelve scent stations were operated on the site for six nights (Appendices I and K). Thus, a total of 72 scent station-sampling nights were conducted. All stations were functional each night during the survey, except on August 30 when rain damaged the tracking surface of the stations and they were not readable. Kit fox tracks were not found on any of the scent stations. Results of the scent station surveys are presented by station number and by animal in Appendix K. A total of 29 station visits were recorded. Tracks recorded on stations include: Domestic Cat, Domestic Dog, Audubon's Cottontail, California Ground Squirrel, Western Toad, bird, and ants. The most commonly recorded animals were California Ground Squirrel, Domestic Dog, Audubon's Cottontail, and ants. The other animals noted above were infrequently recorded at the scent stations.

Spotlighting

The spotlight surveying was conducted on and adjacent to the site for six nights (Appendix L). Spotlighting routes varied each night and were limited by a lack of roads, canals, commercial developments, and Highway 99. Spotlighting was conducted for approximately 3 hours each night and the route included the project site and adjacent lands. The effort (time) and distance (mileage) was distributed mostly on the project site as numerous potential burrows were located in the banks of Rockwell Pond. Adjacent lands were actively farmed agricultural lands, commercial developments, or residences and did not have potential kit fox dens. A total of 13.25 hours of effort and 71.90 miles of distance were conducted during the spotlight survey. Kit fox were not observed on or adjacent to the site. Results of the spotlighting surveys are presented in Appendix L. Animals observed during spotlighting include: Domestic Cat, Domestic Dog, Audubon's Cottontail, Opossum, Great Blue Heron, Barn Owl, Killdeer, Coyote, and Black-crowned Night Heron. The most commonly observed animals were Audubon's Cottontail, Killdeer, Domestic Cat, and Domestic Dog.

10. Conclusions

The San Joaquin Kit Fox, its evidence, or foraging was not found on or adjacent to the site using protocol survey methods of den and track searches, scent stations, and night spotlighting. We conclude that kit fox does not inhabit or forage upon the project site. No kit fox critical habitat, designated recovery areas, or movement corridors occur on the site. The project will not cause negative direct, indirect, interrelated, interdependent, or cumulative adverse impacts to the kit fox since it does not occur on the site, forage upon the site, or occur adjacent to the project site. Thus, since kit fox will not be harmed, take permits and compensation mitigation for impacts are not necessary for the kit fox.

11. Recommendations

Information from this report should be used in the environmental documents for the specific plan project to prove compliance with the California Environmental Quality Act.

Habitat compensation mitigation or take permitting should not be required for the San Joaquin Kit Fox - as no significant negative impacts will occur to it or its habitat. As a preventive avoidance measure and to protect and preserve the San Joaquin kit fox, a preconstruction survey will be conducted about 30 days prior to ground disturbing activities in and around the Rockwell Pond recharge basin. The survey protocol will follow the USFWS's (1999) guidelines as denoted in Appendix H. If kit fox are found, the USFWS will be consulted an their protective and mitigative measures as noted in Appendix H will be enacted. Also, Standard Recommendation #1-13 (Appendix H) are incorporated into the project and will be implemented to avoid potential impacts to the kit fox. As per Standard Recommendation #8, the representative is Mr. Jeffrey A. Halstead and he can be contacted at (559) 298-2334 or (559) 903-5703.

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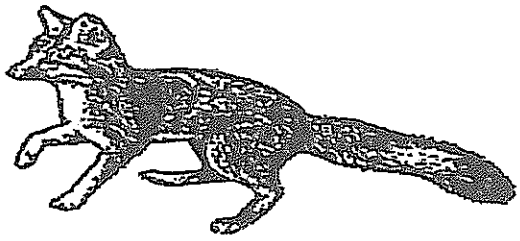
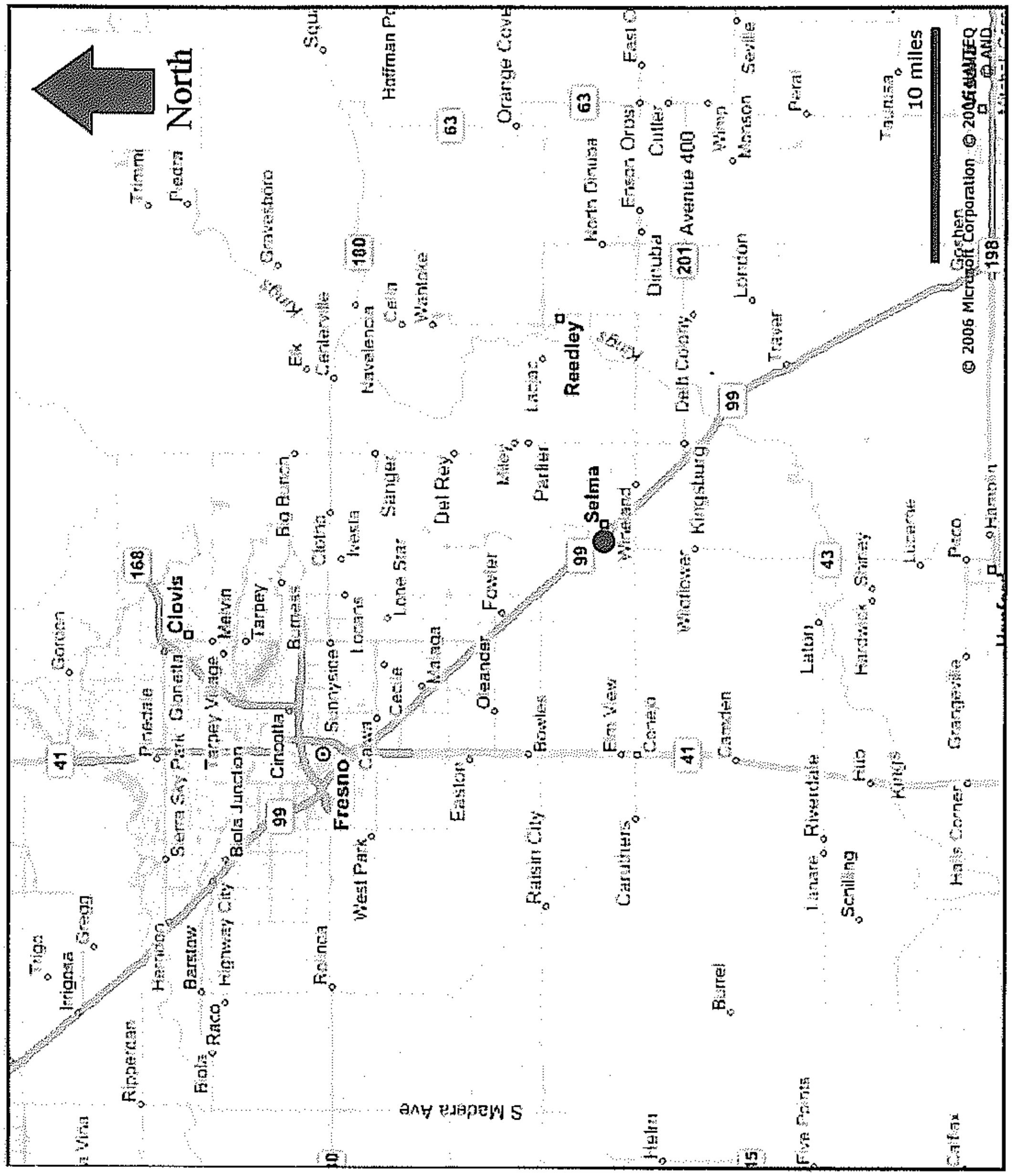
APPENDIX A

Project Location Maps





Fresno County, California

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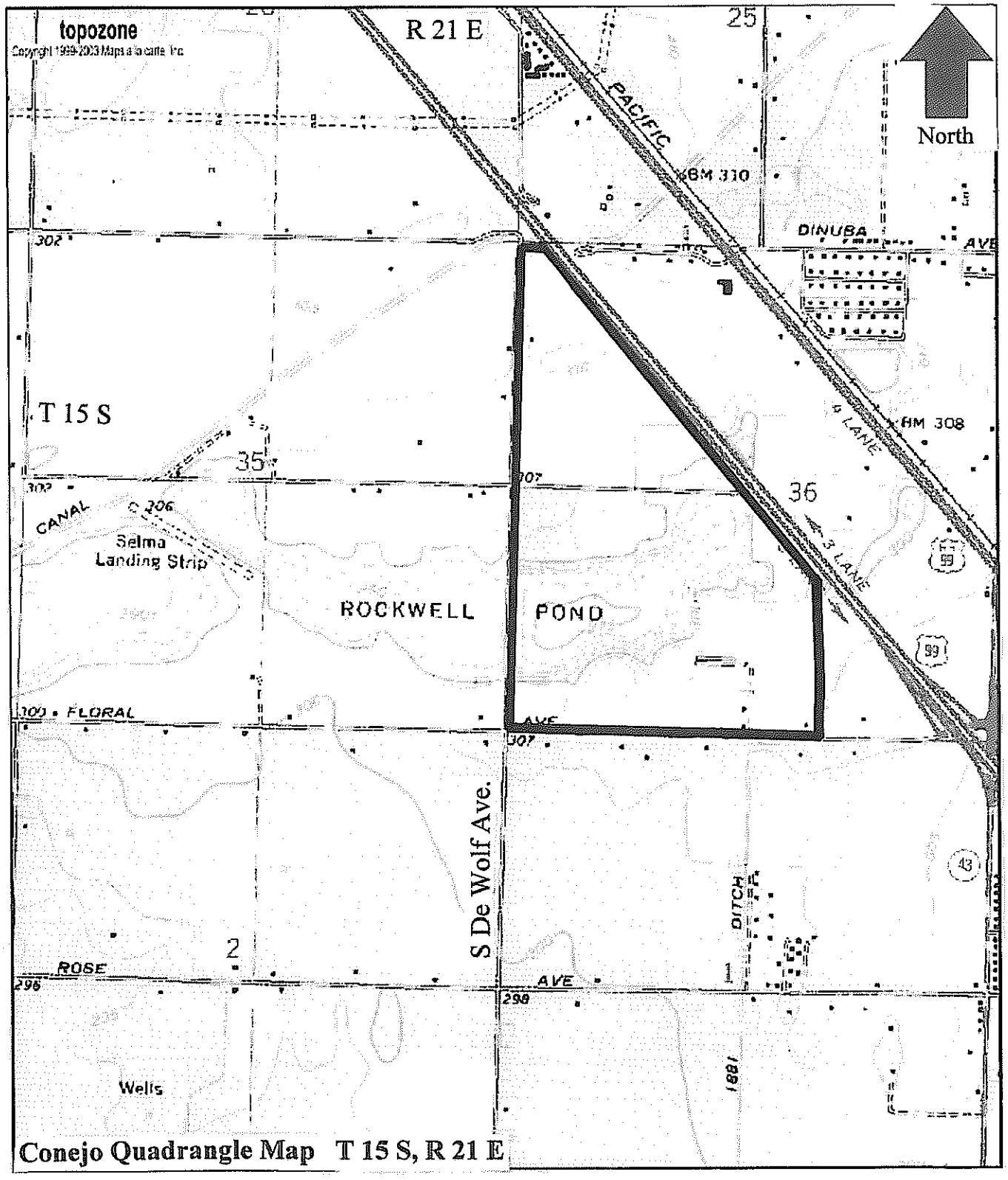
Project Site — ●



Conejo Quadrangle Map T 15 S, R 21 E

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Project Site —

Fresno County, California

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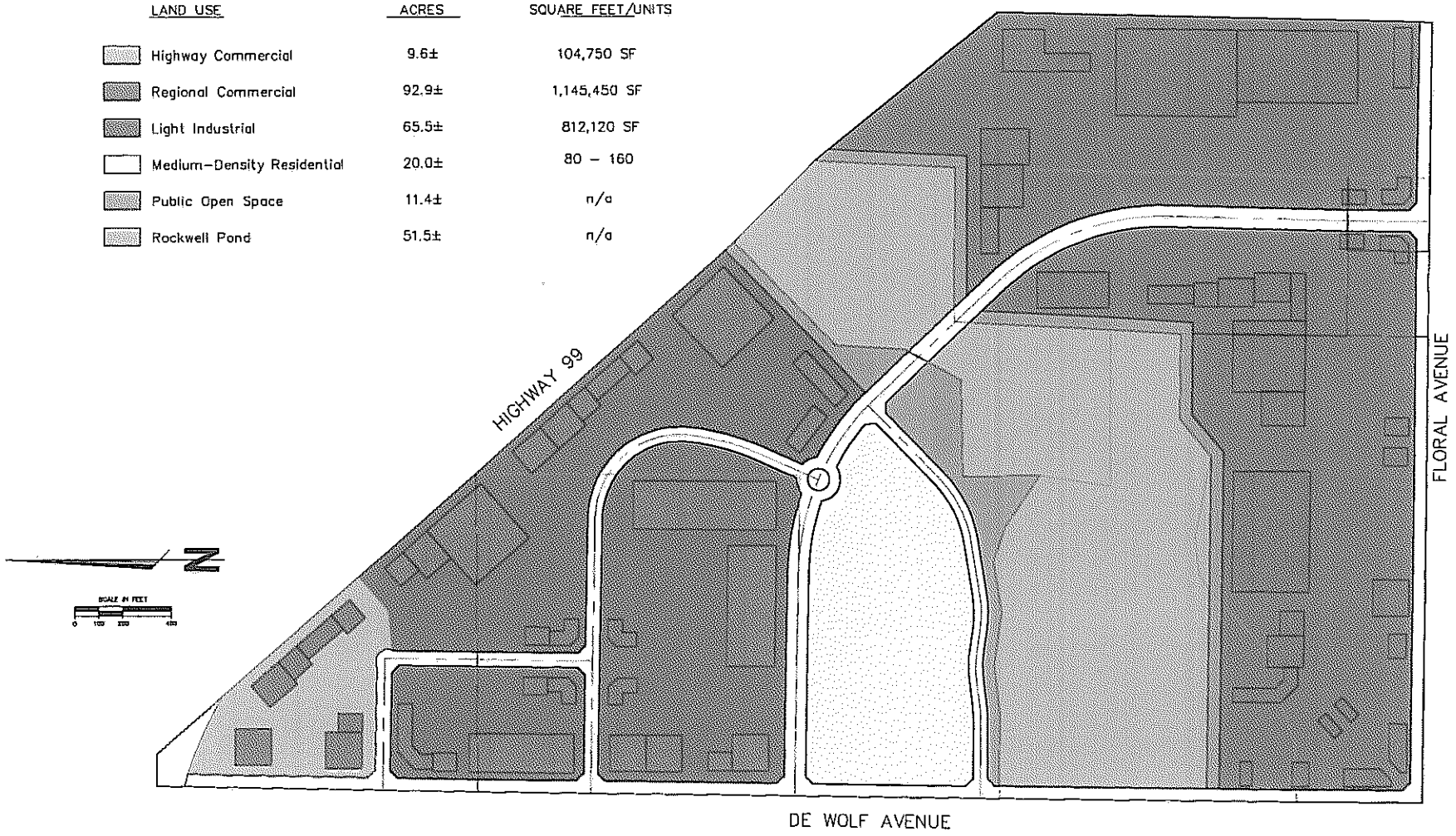
Project Site

ROCKWELL POND SPECIFIC PLAN AREA

SELMA, CA

LAND USE	ACRES	SQUARE FEET/UNITS
Highway Commercial	9.6±	104,750 SF
Regional Commercial	92.9±	1,145,450 SF
Light Industrial	65.5±	812,120 SF
Medium-Density Residential	20.0±	80 – 160
Public Open Space	11.4±	n/a
Rockwell Pond	51.5±	n/a



CLIFF TUTELIAN
CITY OF SELMA
FRESNO COUNTY, CALIFORNIA

ROCKWELL POND PLAN AREA

DESIGN ENGINEER:
LICENSE NO:
DRAFTED BY: JNO
CHECKED BY:
SCALE: AS SHOWN
DATE: 5/16/2007
JOB NO: 10970001
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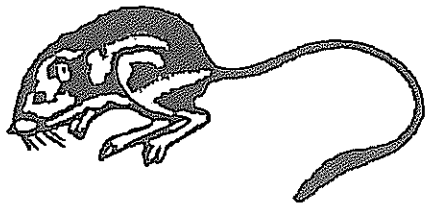
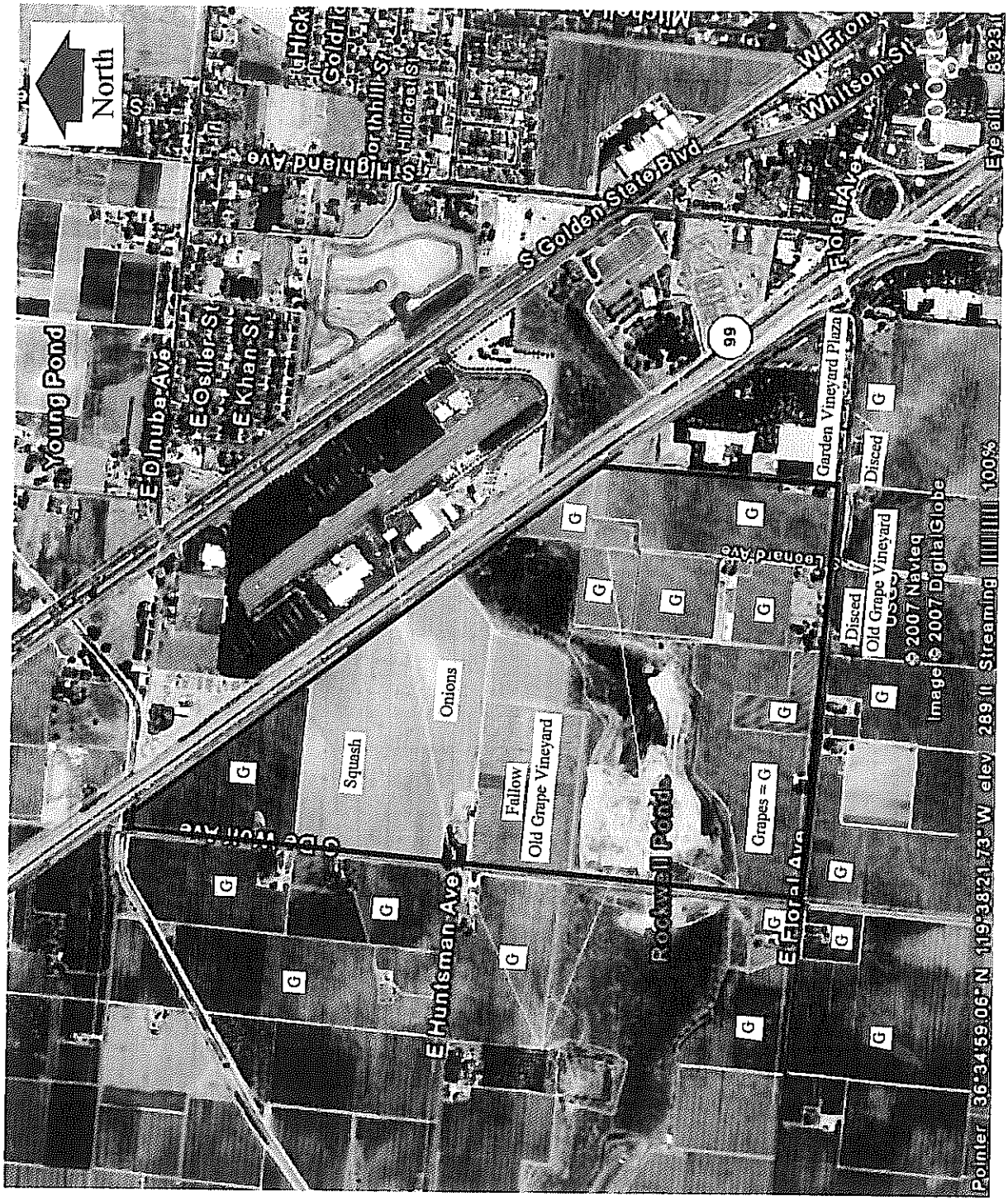
SHEET
1 OF 1

APPENDIX B

General Habitat Map





Fresno County, California

HALSTEAD & ASSOCIATES
Endangered Species / Environmental Consultants
296 Burgan Avenue, Clovis, CA 93611

Habitat Map

APPENDIX C

Photographs of the Project Site

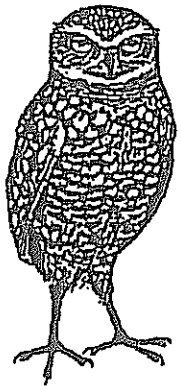


Figure 1. Fallow land on the project site.

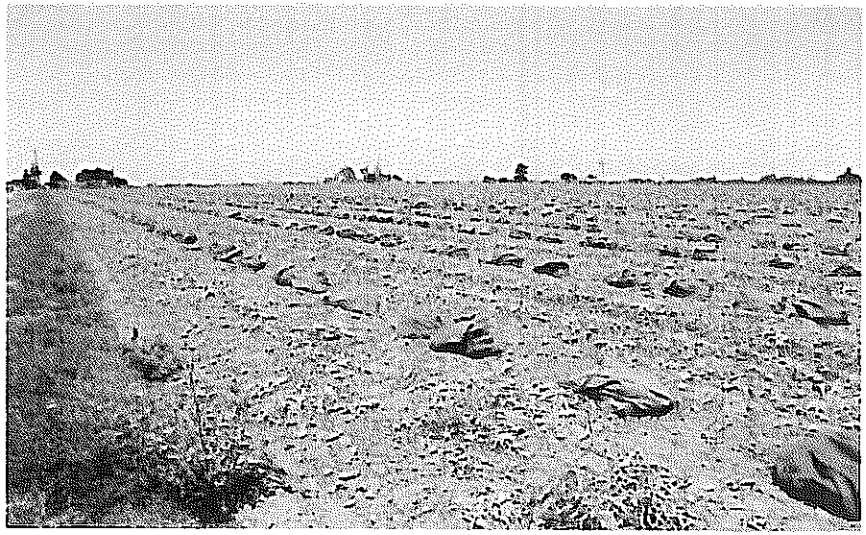


Figure 2. Onion field on the project site.

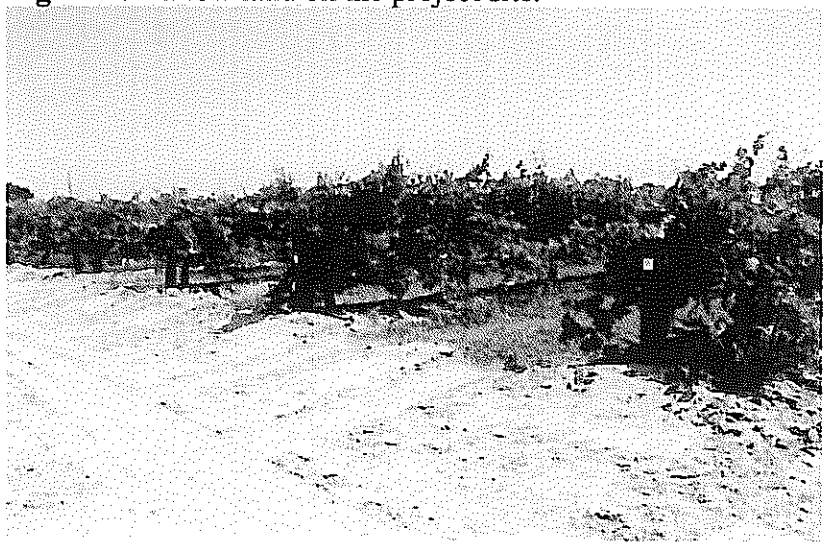


Figure 3. Grape vineyard on the project site.

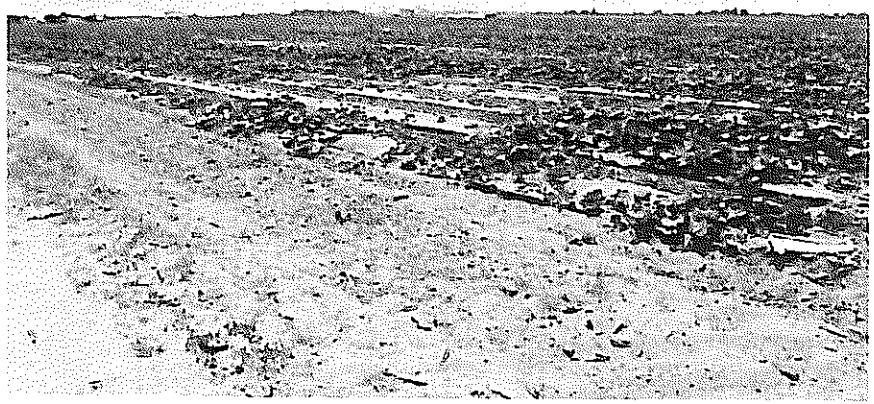


Figure 4. Squash field on the project site.

Examples of crops lands on the project site. Photos by H&A in May 2007.

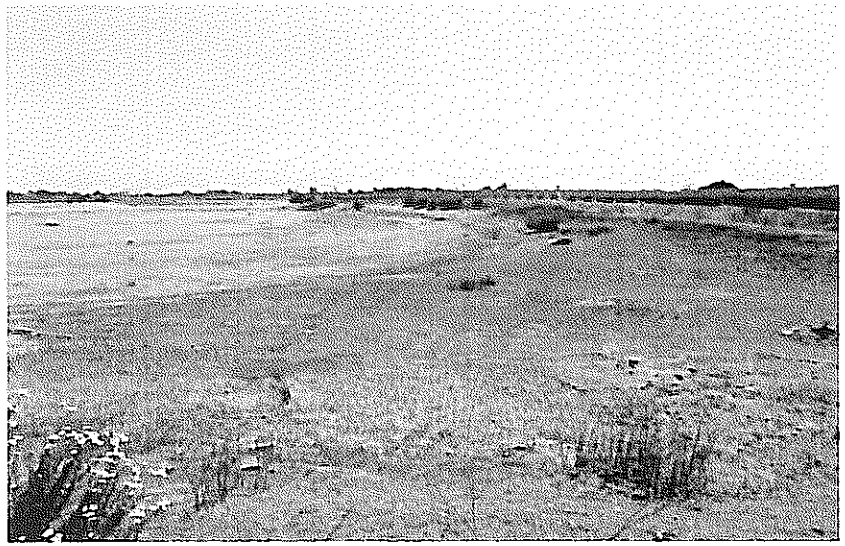


Figure 1. View of Rockwell pond looking South.

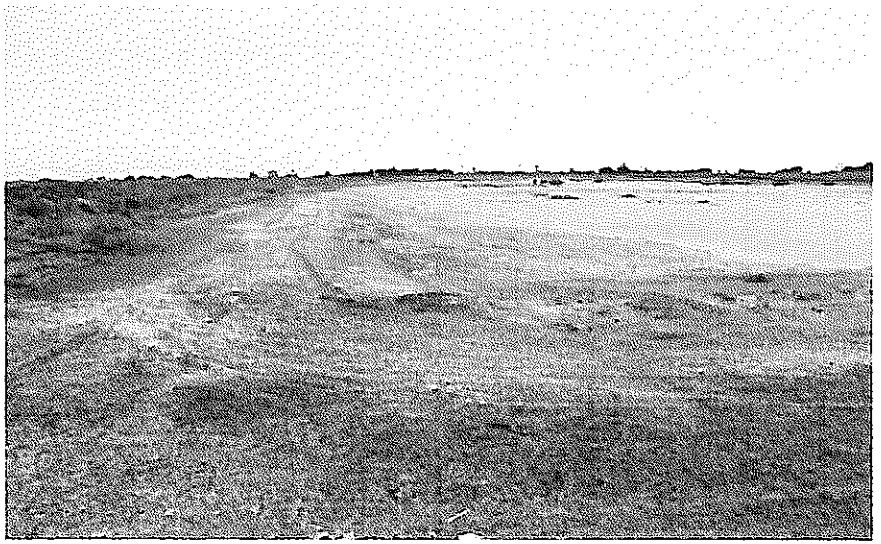


Figure 2. View of Rockwell pond looking East.

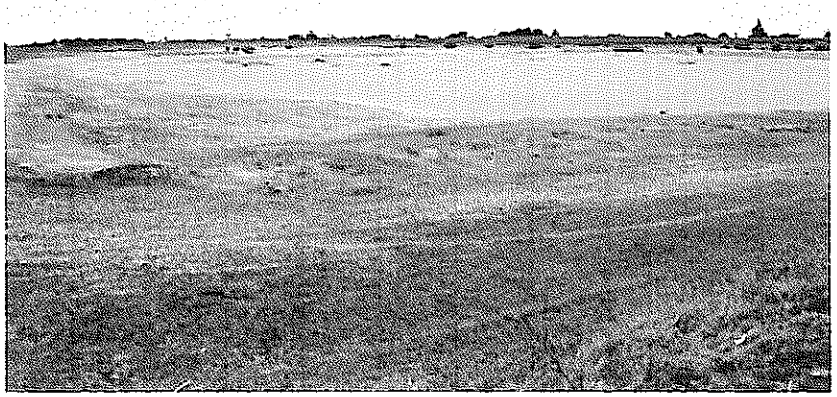


Figure 3. Rockwell Pond looking Southwest.

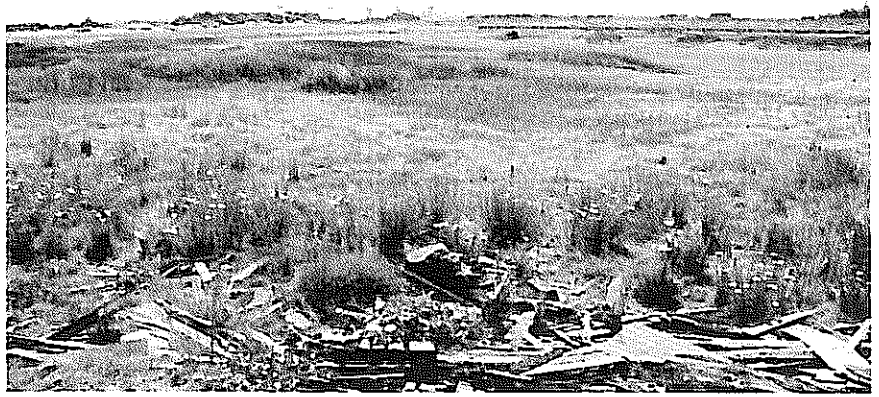


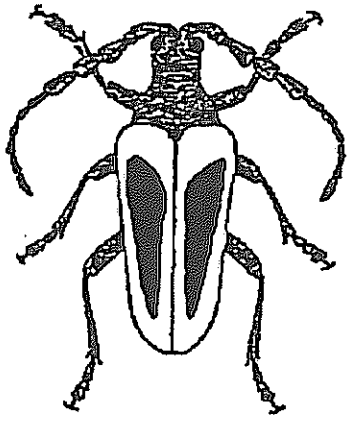
Figure 4. Fallow land adjacent to Rockwell Pond.

Landscape views of Rockwell Pond. Photos by H&A in May 2007.

APPENDIX D

Life Information on the San Joaquin Kit Fox

(CDFG 1990)



M148 Kit Fox *Vulpes macrotis*

Family: Canidae **Order:** Carnivora **Class:** Mammalia
Management Status: *V. m. mutica*, Federal Endangered, California Threatened.
Date: February 4, 1982

DISTRIBUTION, ABUNDANCE, AND SEASONALITY

Uncommon to rare, permanent resident of arid regions of the southern half of the state (Grinnell *et al.* 1937). May still occur in eastern Lassen Co. Lives in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. The San Joaquin kit fox *(V. m. mutica)* is Federal Endangered and California Threatened.

SPECIFIC HABITAT REQUIREMENTS

Feeding: Kit foxes primarily are carnivorous. The principal foods are black-tailed hares and desert cottontails, rodents (especially kangaroo rats and ground squirrels), insects, reptiles, and some birds, bird eggs, and vegetation (Egoscue 1962, Laughrin 1970, Morrell 1971, 1972, Orloff *et al.* 1986). They hunt by searching, meandering, circling clumps of brush, and wandering back and forth between clumps of vegetation. They stealthily approach larger prey, or prey in the open, then make sudden, swift rushes. They pounce on smaller prey.

Cover: Cover provided by dens they dig in open, level areas with loose-textured, sandy and loamy soils (Laughrin 1970, Morrell 1972).

Reproduction: Pups born in dens excavated in open, level areas with loose-textured soils.

Water: May not require a source of drinking water.

Pattern: Open, level areas with loose-textured soils supporting scattered, shrubby vegetation with little human disturbance represent suitable habitats for kit foxes. Some agricultural areas may support these foxes.

SPECIES LIFE HISTORY

Activity Patterns: Active yearlong; mostly nocturnal, but often active in daytime in cool weather (Ingles 1965).

Seasonal Movements/Migration: Non-migratory.

Home Range: Little data available. In California, Morrell (1972) reported home ranges of 2.6-5.2 km² (1.0-2.0 mi²) for the San Joaquin kit fox. Considerable overlap between individual home ranges appears to occur (Morrell 1972). In Utah, Egoscue (1962) reported 0.19 kit foxes/km² (0.5/mi²) before birth of pups, and 0.48 per km² (1.25/mi²) after pups were born.

Territory: No data found.

Reproduction: Kit foxes usually are monogamous, but polygamy apparently also is common (McGrew 1979). Most pups born February through April, following a gestation period of 49 to 55 days (Egoscue 1962). One litter/yr of about 4 pups, range 1-7 (McGrew 1979). Pups weaned at about 4-5 mo. Males and females sexually mature in second yr. In Utah, Egoscue (1975) found a known-age individual of 7 yr at last capture.

Niche: Kit foxes use dens throughout the year. Nocturnal activity and regular use of dens are important adaptations for thermal regulation and water conservation (Golightly 1981). Potential predators are coyotes, large hawks and owls, eagles, and bobcats. Cultivation has eliminated much habitat. Kit foxes are vulnerable to many human activities, such as hunting, use of rodenticides and other poisons, off-road vehicles, and trapping.

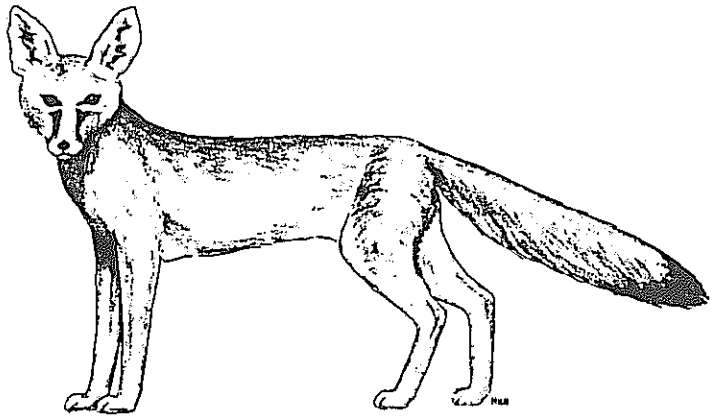
REFERENCES

Grinnell *et al.* 1937, Egoscue 1956, 1962, 1975, Ingles 1965, Laughrin 1970, Morrell 1971, 1972, Laughlin and Cooper 1973, Snow 1973, McGrew 1979, O'Farrell and Gilbertson 1979, California Dept. Fish and Game 1980a, Golightly 1981, Orloff *et al.* 1986.

KIT FOX

AUTHORSHIP

Species Note Prepared By: G. Ahlborn
Species Note Edited By: M. White, G. Ahlborn
Species Note Reviewed By: M. White



CALIFORNIA'S WILDLIFE

VOLUME III

MAMMALS

Editors

David C. Zeiner
William F. Laudenslayer, Jr.
Kenneth E. Mayer
Marshall White

California Statewide Wildlife Habitat Relationships System

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME
Sacramento, California

April 1990

APPENDIX E

Life Information on the San Joaquin Kit Fox

(USFWS 1998)

the blunt-nosed leopard lizard should focus on information needed to make informed decisions about land acquisition and habitat management and restoration, and measure progress toward recovery. Habitat protection is important, and in some portions of the geographic range of blunt-nosed leopard lizards, it has a high priority. Yet, while habitat protection goals may require many years to achieve, and some may never be reached, other actions must be implemented. Needed actions are:

1. Determine appropriate habitat management and compatible land uses for blunt-nosed leopard lizards.

2. Conduct range-wide surveys of known and potential habitat for presence and abundance of blunt-nosed leopard lizards.

3. Protect additional habitat for them in key portions of their range; areas of highest priority to target for protection are:

   a. Natural lands in western Madera County;

   b. Natural lands in the Panoche Valley area of Silver Creek Ranch, San Benito County;

   c. Agricultural and natural land between the north end of the Kettleman Hills and the Guijarral Hills and the Guijarral Hills and Anticline Ridge (western rim of Pleasant Valley, Fresno County) to restore and protect a corridor of continuous habitat for blunt-nosed leopard lizards and other species without the ability to move through irrigated farmland;

   d. Natural lands west of Highway 33 and east of the coastal ranges between the Pleasant Valley, Fresno County, on the north and McKittrick Valley, Kern County, on the south;

   e. Natural lands of the linear, piedmont remnants of their habitat west of Interstate Highway 5 between Pleasant Valley and Panoche Creek, Fresno County;

   f. Natural lands in upper Cuyama Valley.

4. Gather additional data on population responses to environmental variation at representative sites in its extant geographic range.

5. Design and implement a range-wide population monitoring program.

6. Protect additional habitat for blunt-nosed leopard lizards in the following areas (all are of equal priority):

   a. Natural and retired agricultural lands around Pixley National Wildlife Refuge, Tulare County, with an objective of expanding and connecting the Refuge units with each other and with the Allensworth Ecological Reserve;

   b. Natural land in and around the Elk Hills Naval Petroleum Reserves in California and Lokern Natural Area with the objective of expanding and connecting existing lands with conservation programs;

   c. Natural and retired agricultural lands in the Semitropic Ridge Natural Area, Kern County, with the objective of expanding and connecting existing reserves and refuges.

L. San Joaquin Kit Fox
(Vulpes macrotis mutica)

1. Description and Taxonomy

Taxonomy.—The kit fox, *Vulpes macrotis,* was described by C. Hart Merriam (1888). The area of the type locality, near Riverside in Southern California, is now highly urbanized. Eight subspecies were recognized historically (e.g., Hall 1981). *V. m. mutica,* the San Joaquin kit fox, was first described by Merriam (1902). Today, only *V. m. macrotis* and *V. m. mutica* are recognized (Mercure et al. 1993). The type locality is near Tracy, San Joaquin County, California.

Several different taxonomies for the species and subspecies of small, North American foxes have been proposed over the last 110 years (historical literature summarized by Hall 1946, Hall and Kelson 1959, Rohwer and Kilgore 1973, Waithman and Roest 1977, Hall 1981). Two recent studies examined the

evolutionary and taxonomic relationships among small, North American foxes (Dragoo et al. 1990, Mercure et al. 1993). Dragoo et al. (1990) concluded that all North American arid-land foxes belonged to the species *V. velox* (swift fox). The subspecific statuses of the taxa historically regarded as subspecies of *V. macrotis* also were challenged by Dragoo et al. (1990), who recommended that all be synonymized under *V. velox macrotis*. Genetic work by Mercure et al. (1993) led them to conclude that, though there was evidence of hybridization between kit and swift foxes over a limited geographic area, they should be considered separate species. Further, Mercure et al. concluded that of the traditional subspecies of the kit fox, the San Joaquin Valley population is the most distinct and should be considered a subspecies (1993, p. 1323). Their data recognize the swift fox as a separate monotypic species, and two subspecies of kit foxes: *V. macrotis macrotis*, found throughout the remaining habitat within the historical range of the species, except the San Joaquin kit fox range; and *V. macrotis mutica*, the San Joaquin kit fox.

Description.—The kit fox is the smallest canid species in North America and the San Joaquin kit fox is the largest subspecies in skeletal measurements, body size, and weight. Grinnell et al. (1937) found a difference in body size between males and females: males averaged 80.5 centimeters (31.7 inches) in total length, and 29.5 centimeters (11.6 inches) in tail length; females averaged 76.9 centimeters (30.3 inches) in total length, and 28.4 centimeters (11.2 inches) in tail length. Kit foxes have long slender legs and are about 30 centimeters (12 inches) high at the shoulder. The average weight of adult males is 2.3 kilograms (5 pounds), and of adult females is 2.1 kilograms (4.6 pounds) (Morrell 1972).

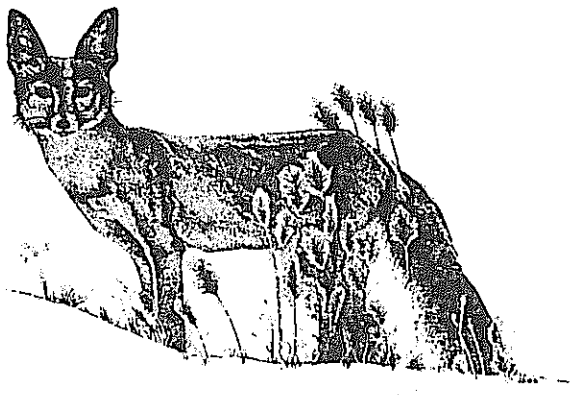


Figure 50. Illustration of a kit fox by Jodi Sears (© D.F. Williams)

General physical characteristics of kit foxes include a small, slim body, relatively large ears set close together, narrow nose, and a long, bushy tail tapering slightly toward the tip (Figure 50). The tail is typically carried low and straight.

Color and texture of the fur coat of kit foxes varies geographically and seasonally. The most commonly described colorations are buff, tan, grizzled, or yellowish-gray dorsal coats (McGrew 1979). The guard hairs on the back are black tipped, which accounts for the grizzled appearance (Bell 1994). Two distinctive coats develop each year: a tan summer coat and a silver-gray winter coat (Morrell 1972). The undersides vary from light buff to white (Grinnell et al. 1937), with the shoulders, lower sides, flanks and chest varying from buff to a rust color. The ear pinna (external ear flap) is dark on the back side, with a thick border of white hairs on the forward-inner edge and inner base. The tail is distinctly black-tipped.

Identification.—The foot pads of kit foxes are small by comparison with other canids. A sample of 21 tracks from throughout the San Joaquin Valley had an average length of 3.1 centimeters (1.2 inches) and an average width of 2.6 centimeters (1 inch) (Orloff et al. 1993). Other characteristics such as the degree to which the feet are furred and the size, shape, and configuration of the pads distinguish kit fox tracks from those of co-occurring canids and domestic cats (Orloff et al. 1993).

Because all three fox species that occur in the San Joaquin Valley are primarily nocturnal, identification of free-living, and often fast-moving, animals can be a challenge. The black-tipped tail and coat color differences usually distinguish kit foxes from red foxes *(V. vulpes)*. At 4 to 5 kilograms (8 to 11 pounds), the red fox also is much heavier than the kit fox. Gray foxes *(Urocyon cinereoargenteus)* however are sometimes misidentified as kit foxes, especially in winter when the kit fox coat is thicker and has more gray. Both species have a black tail tip but gray foxes also have a distinctive black stripe running along the top of the tail. Gray foxes are more robust than kit foxes; they are heavier with an average body weight of about 3.6 kilograms (8 pounds) (Grinnell et al. 1937). However, San Joaquin kit foxes have longer ears, averaging 8.6 centimeters (3.4 inches) compared with 7.8 centimeters (3 inches) for gray foxes (Grinnell et al. 1937).

2. Historical and Current Distribution

Historical Distribution.—The historical range was first defined by Grinnell et al. (1937). Prior to 1930, kit foxes inhabited most of the San Joaquin Valley from southern Kern County north to Tracy, San Joaquin County, on the west side, and near La Grange, Stanislaus County, on the east side. These authors believed that by 1930 the kit fox range had been reduced by more than half, with the largest portion of the range remaining in the southern and western parts of the Valley (Figure 51), though they provided no indication for why they believed foxes had been eliminated from most of the east side and Valley floor.

Current Distribution.—Although the San Joaquin kit fox has been listed as endangered for over 30 years, there has never been a comprehensive survey of its entire historical range. And, despite the loss of habitat and apparent decline in numbers since the early 1970s, there has been no new survey of habitat that was then thought to be occupied (Morrell 1975).

Despite the lack of a comprehensive survey, local surveys, research projects and incidental sightings indicate that kit foxes currently inhabit some areas of suitable habitat on the San Joaquin Valley floor and in the surrounding foothills of the coastal ranges, Sierra Nevada, and Tehachapi Mountains, from southern Kern County north to Contra Costa, Alameda, and San Joaquin Counties on the west, and near La Grange, Stanislaus County on the east side of the Valley (Williams in litt. 1990), and some of the larger scattered islands of natural land on the Valley floor in Kern, Tulare, Kings, Fresno, Madera, and Merced Counties (Figure 51). Kit foxes also occur westward into the interior coastal ranges in Monterey, San Benito, and Santa Clara Counties (Pajaro River watershed), in the Salinas River watershed, Monterey and San Luis Obispo Counties, and in the upper Cuyama River watershed in northern Ventura and Santa Barbara Counties and southeastern San Luis Obispo County. Kit foxes are also known to live within the city limits of the city of Bakersfield in Kern County (Laughrin 1970, Jensen 1972, Morrell 1975, USFWS 1983, Swick 1973, Waithman 1974*a*, Endangered Species Recovery Program unpubl. data).

Some researchers have suggested that as San Joaquin Valley natural lands were cultivated or otherwise developed, displaced kit foxes colonized nearby valleys and foothills (Laughrin 1970, Jensen 1972); however, there is no concrete evidence to support this assertion. As early as 1925, Grinnell et al. reported kit fox specimens from the Panoche Creek area in the foothills of western Fresno County, and east of Rose Station (Fort Tejon) in southern Kern County at an elevation of 363 meters (1,200 feet) (Grinnell et al. 1937, USFWS 1983). Therefore, it is more probable that kit foxes have always occurred in these areas, possibly at low density.

The largest extant populations of kit foxes are in western Kern County on and around the Elk Hills and Buena Vista Valley, Kern County, and in the Carrizo Plain Natural Area, San Luis Obispo County. The kit fox populations of Elk Hills and the City of Bakersfield, Kern County (B.L. Cypher pers. comm.), Carrizo Plain Natural Area, San Luis Obispo County (White and Ralls 1993, Ralls and White 1995), Ciervo-Panoche Natural Area, Fresno and San Benito Counties (Endangered Species Recovery Program), Fort Hunter Liggett, Monterey County (V. Getz pers. comm.), and Camp Roberts, Monterey and San Luis Obispo Counties (W. Berry pers. comm.) have been recently, or are currently, the focus of various research projects. Though monitoring has not been continuous in the central and northern portions of the range, populations were recorded in the late 1980s at San Luis Reservoir, Merced County (Briden et al. 1987), North Grasslands and Kesterson National Wildlife Refuge area on the Valley floor, Merced County (Paveglio and Clifton 1988), and in the Los Vaqueros watershed, Contra Costa County in the early 1990s (V. Getz pers. comm.). Smaller populations and isolated sightings of kit foxes are also known from other parts of the San Joaquin Valley floor, including Madera County and eastern Stanislaus County (Williams 1990).

3. Life History and Habitat

Food and Foraging.—Diet of kit foxes varies geographically, seasonally, and annually, based on variation in abundance of potential prey. In the southern portion of their range, kangaroo rats, pocket mice, white-footed mice *(Peromyscus* spp.), and other nocturnal rodents comprise about one-third or more of their diets. Kit foxes there also prey on California ground squirrels, black-tailed hares, San Joaquin antelope squirrels, desert cottontails, ground-nesting birds, and insects (Scrivner et al. 1987*a*). Vegetation and insects occur frequently in feces. Grass is the most commonly ingested plant material (Morrell 1971, C.A. Vanderbilt-White pers. comm.). In the central portion of their geographic range,

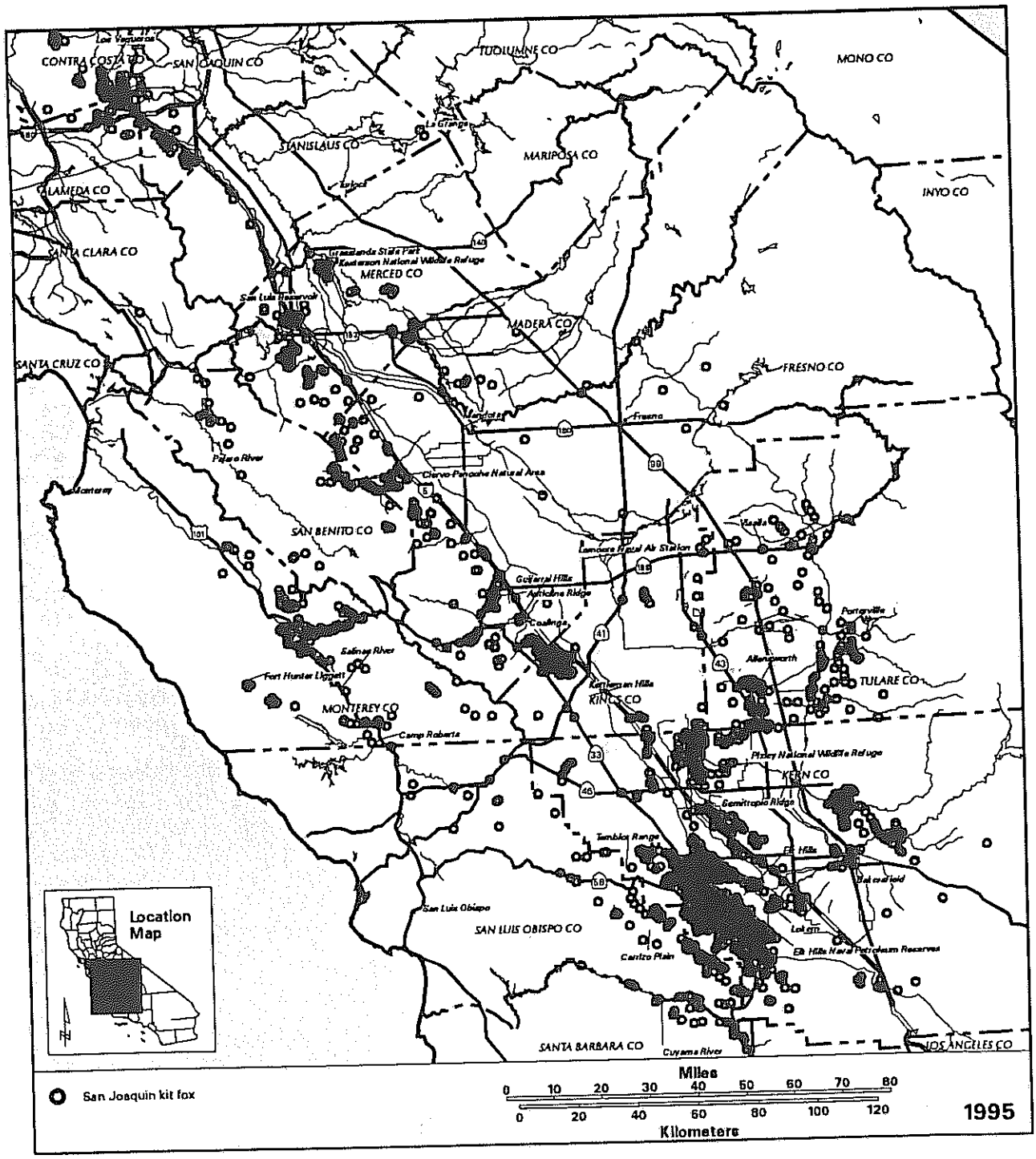


Figure 51. Map of distributional records for the San Joaquin kit fox *(Vulpes macrotis mutica).*

defined here as Kings, Tulare, Fresno, Madera, San Benito, Merced, Stanislaus, and Monterey Counties, known prey species include white-footed mice, insects, California ground squirrels, kangaroo rats, San Joaquin antelope squirrels, black-tailed hares, and chukar *(Alectoris chukar)* (Jensen 1972, Archon 1992), listed in approximate proportion of occurrence in fecal samples. In the northern part of their range, defined here as San Joaquin, Alameda and Contra Costa Counties, kit foxes most frequently consume California ground squirrels (Orloff et al. 1986). Cottontails, black-tailed hares, pocket mice, and kangaroo rats also are eaten (Hall 1983, D.F. Williams unpubl. data). Though ground squirrels are diurnal and kit foxes are predominantly nocturnal, kit foxes are commonly seen during the day during late spring and early summer (Orloff et al. 1986).

Reproduction and Demography.—Kit foxes can breed when 1 year old, but may not breed their first year of adulthood (Morrell 1972). Adult pairs remain together all year, sharing the home range but not necessarily the same den (K. Ralls pers. comm.). During September and October, adult females begin to clean and enlarge natal or pupping dens (they select dens with multiple openings; Morrell 1972). Mating and conception take place between late December and March (Egoscue 1956, Morrell 1972, Zoellick et al. 1987*a*, Spiegel et al. in press). The median gestation period is estimated to range from 48 to 52 days (Spiegel et al. in press). Litters of from two to six pups are born sometime between February and late March (Egoscue 1962, Morrell 1972, Zoellick et al. 1987*a*, Spiegel et al. in press).

The female is rarely seen hunting during the time she is lactating. During this period the male provides most of the food for her and the pups. The pups emerge above ground at slightly more than 1 month of age. After 4 to 5 months, usually in August or September, the family bonds begin to dissolve and the young begin dispersing. Occasionally a juvenile female will remain with the adult female for several more months (O'Neal et al. 1992, Spiegel et al. in press). Offspring of both sexes sometimes remain with their parents through the following year and help raise a subsequent litter (White and Ralls 1993, Spiegel et al. in press, B.L. Cypher pers. comm.).

Reproductive success of kit foxes is correlated with abundance of their prey (Egoscue 1975). Success decreases when the density of prey species drops because of drought, too much rainfall, or other circumstances (White and Ralls 1993, Spiegel et al. in press, B.L. Cypher pers. comm., White and Garrott 1998).

During a 6-year study at the Elk Hills Naval Petroleum Reserves in California, pups dispersed an average of 8 ± 1.4 kilometers (5.0 ± 0.9 mile; Scrivner et al. 1987*b*). Maximum reported distances can vary considerably (Hall 1983). One individual traveled a minimum of 40 kilometers (25 miles) from its whelping den (V. Getz pers. comm.), and a prime adult male dispersed from Camp Roberts to the Carrizo Plain in 1989 (P.J. White pers. comm.). Adult and juvenile kit foxes radio-collared at the Elk Hills Naval Petroleum Reserves in California dispersed through disturbed habitats, including agricultural fields, oil fields, rangelands, and across highways and aqueducts. One pup crossed the Temblor Range into the Carrizo Plain (Scrivner et al. 1987*b*).

The average age of kit foxes in a Utah population was about 2 years (Egoscue 1975). One fox in another Utah study was estimated to be at least 7 years old (Egoscue 1962). Kit foxes at Camp Roberts are reported to be over 8 years old (P.J. White pers. comm.). Kit foxes on Naval Petroleum Reserve-1 in California are known to live as long as 8 years but such longevity is rare; animals less than 1 year old outnumber older foxes by 2.8:1 (Berry et al. 1987*a*). Annual survival rates of juvenile foxes have ranged from 0.26 on Naval Petroleum Reserve-1 in California (Berry et al. 1987*a*) to 0.21 to 0.41 on the Carrizo Plain (Ralls and White 1995). In captivity, kit foxes have lived up to 10 years (McGrew 1979, M. Johnson pers. comm.).

An annual adult mortality rate of approximately 50 percent has been reported (Morrell 1972, Egoscue 1975, Berry et al. 1987*a*, Ralls and White 1995, Standley et al. 1992). The annual mortality rate for juvenile kit foxes may be closer to 70 percent (Berry et al. 1987*a*). Predation by larger carnivores (e.g., coyotes) accounts for the majority of San Joaquin kit fox mortality. The effects of disease, parasites and accidental death are largely unknown, but were thought to account for only a small portion of mortality (Berry et al. 1987*a*). Drought plays a role in low reproductive success (i.e., pups are born but do not survive to weaning). Adults can maintain weight and body condition and females can give birth, but pairs apparently cannot catch enough prey to support pups (White and Ralls 1993, Spiegel et al. in press).

San Joaquin kit fox densities on the west side of the

San Joaquin Valley were estimated to be 0.4 per square kilometer (1.04 per square mile) prior to 1925, based on fur trapping efforts (Grinnell et al. 1937). In 1969, Laughrin (1970) estimated that range-wide kit fox densities were 0.2 to 0.4 per square kilometer (0.52 to 1.04 per square mile). Morrell (1975) estimated densities of 1.2 per square kilometer (3.11 per square mile) in optimal habitats in "good" years. In the 1983 recovery plan (USFWS 1983), Morrell's data was corrected for habitat loss and an estimate of 0.5 per square kilometer (1.30 per square mile) was obtained. The estimated mean density of trappable adult kit foxes was from 0.8 to 1.1 per square kilometer (2 to 2.8 per square mile) between 1980 and 1982 on the Naval Petroleum Reserves in California (O'Farrell 1984). More recently, kit fox densities at the Naval Petroleum Reserves were determined from annual live-trapping efforts (Enterprise Advisory Services, Inc., unpubl. data). On Naval Petroleum Reserve-1 in California, the mean density from 1981 to 1993 was 0.12 per square kilometer (0.31 per square mile) in winter, but varied from 0.72 per square kilometer (1.86 per square mile) in 1981 to 0.01 per square kilometer (0.03 per square mile) in 1991. On Naval Petroleum Reserve-2 in California, mean density from 1983 to 1993 was 0.38 per square kilometer (0.98 per square mile), and varied from 0.72 per square kilometer (1.86 per square mile) in summer 1983 to 0.1 per square kilometer (0.30 per square mile) in winter 1991. On the nearby Carrizo Plain Natural Area, kit fox densities were estimated to be 0.15 to 0.24 per square kilometer (0.39 to 0.62 per square mile) (White and Ralls 1993).

In the 1983 recovery plan (USFWS 1983) it was estimated that the population range-wide of adult kit foxes prior to 1930 may have been between 8,667 and 12,134 assuming an occupied range of 22,447 square kilometers (8,667 square miles) and densities of 0.4 to 0.6 per square kilometer (1.04 to 1.55 per square mile). The kit fox population in San Luis Obispo, Santa Barbara, Kings, Tulare and Kern Counties was estimated to be about 11,000 animals in the early 1970s based on limited aerial surveys of pupping dens and amount of historic habitat, but without correction for cultivated and urbanized lands (Waithman 1974*b*). Laughrin (1970) reported an estimated total population size of 1,000 to 3,000 foxes in 1969. Morrell (1975) conducted a more thorough investigation of kit fox abundance in 14 counties in which kit foxes were known to occur and estimated the total population at 14,832. In the 1983 recovery plan (USFWS 1983), Morrell's data was adjusted and a corrected estimate of 6,961 foxes in 1975 was obtained. When compared to the pre-1930 estimate, this represents a possible population decline of 20 to 43 percent. Approximately 85 percent of the fox population in 1975 was found in only six counties (Kern, Tulare, Kings, San Luis Obispo, Fresno, and Monterey), and over half the population occurred in two of those counties: Kern (41 percent) and San Luis Obispo (10 percent) (Morrell 1975).

Behavior and Species Interactions.—San Joaquin kit foxes use dens for temperature regulation, shelter from adverse environmental conditions, reproduction, and escape from predators. Though kit foxes are reputed to be poor diggers (Jensen 1972, Morrell 1972), the complexity and depth of their dens do not support this assessment (USFWS 1983). Kit foxes also modify and use dens constructed by other animals, such as ground squirrels, badgers, and coyotes (Jensen 1972, Morrell 1972, Hall 1983, Berry et al. 1987*b*), and human-made structures (culverts, abandoned pipelines, and banks in sumps or roadbeds) (Spiegel et al. in press, B.L. Cypher pers. comm.).

Den characteristics vary across the San Joaquin kit fox's geographic range. In the southernmost portion, dens with two entrances are most frequently found. Natal and pupping dens, in which pups are born and raised, tend to be larger with more entrances (2 to 18) (Morrell 1972, O'Farrell and Gilbertson 1979, O'Farrell et al. 1980, O'Farrell and McCue 1981, Berry et al. 1987*b*). Entrances are usually from 20 to 25 centimeters (8 to 10 inches) in diameter and normally are higher than wide. Ramp-shaped mounds of dirt from 1 to 2 meters (3 to 6 feet) long are deposited at some den entrances (Morrell 1972). Most hillsides where kit fox dens are found (95 percent) have a slope of less than 40 degrees (Reese et al. 1992). Natal and pupping dens are found on flatter ground with slopes of about 6 degrees (O'Farrell and McCue 1981, O'Farrell et al. 1980). The entrances of pupping dens show more evidence of use, such as fox scat, prey remains, and matted vegetation. In the central portion of their geographic range, dens also have several openings; however, instead of a mound of dirt in front of the opening, the dirt is more often scattered into a long tailing ramp, generally with a runway down the middle. In areas of tall grass, matted grass in front of the entrance is obvious. In western Merced County, most dens are found on slopes of less than 10 degrees, but a few are found on slopes of up to 55 degrees (Archon 1992). In the northern portion of the kit fox range, dens appeared to

be placed higher than most surrounding ground compared to areas farther south, perhaps reflecting the topography of the area. Dens most often are located on the lower section of the slope (Orloff et al. 1986), yet foxes are sometimes seen entering dens on the upper part of a slope (Bell 1992). Most dens lack the ramp or runway characteristic of dens in the southern and central portions of the Valley. No evidence has been found to indicate that kit foxes in this area construct their own dens (Hall 1983). Kit foxes probably enlarge California ground squirrel burrows (Orloff et al. 1986), but they also may construct their own dens.

Kit foxes often change dens and numerous dens may be used throughout the year. However, evidence that a den is in use may be absent (V. Getz pers. comm.). Reese et al (1992) found that 64 percent of the dens used by radio-collared kit foxes at Camp Roberts during 1988-1991 exhibited no sign of kit foxes. Foxes change dens four or five times during the summer months, and change natal dens one or two times per month (Morrell 1972). One family of 7 kit foxes used 43 dens; the maximum number used by 1 individual was 70 (Hall 1983). Foxes on the Carrizo Plain Natural Area changed dens much more frequently than indicated by Morrell's study (White and Ralls 1993). Radiotelemetry studies indicate that foxes use individual dens for a median of 2 days (mean of 3.5 days) before moving to a different den. One fox was tracked to 70 different dens during a two year study (K. Ralls pers. comm.). Den changes have been attributed to depletion of prey in the vicinity of the den or to increases in external parasites such as fleas (Egoscue 1956). Avoidance of coyotes is a more probable reason for frequently changing dens because kit foxes can easily search their home range in one night for prey, and parasites are unlikely to build to intolerable levels in 2 or 3 days (K. Ralls pers. comm.)

Nightly movements on the Elk Hills Naval Petroleum Reserves in California averaged 15.4 kilometers (9.6 miles) during the breeding season and were significantly longer than the average nightly movements of 10.2 kilometers (6.3 miles) during the pup-rearing season. Movements during the breeding season also were significantly longer than those made during the pup-dispersal season (10.4 kilometers, 6.5 miles) (Zoellick et al. 1987*b*).

Home ranges of from less than 2.6 square kilometers (1 square mile) up to approximately 31 square kilometers (12 square miles) have been reported by several researchers (Morrell 1972, Knapp 1978, Zoellick et al. 1987*b*, Spiegel and Bradbury 1992, White and Ralls 1993, Paveglio and Clifton 1988). The maintenance of large and relatively non-overlapping home ranges, as noted on the Carrizo Plain, may be an adaptation to drought-induced periods of prey scarcity that are episodic and temporary on the Carrizo Plain (White and Ralls 1993). Differences in home range size among study sites tend to be related to prey abundance (White and Ralls 1993, White and Garrott 1998).

Kit foxes are subject to predation or competitive exclusion by other species, such as the coyote, nonnative red foxes, domestic dog *(Canis familiaris)*, bobcat *(Felis rufus)*, and large raptors (Hall 1983, Berry et al. 1987*a*, O'Farrell et al. 1987*b*, White et al. 1994, Ralls and White 1995, CDFG 1987). Coyotes are known to kill kit foxes, though an experimental coyote-control program at the Elk Hills Naval Petroleum Reserves in California did not result in an increase in survival rate for kit foxes, nor did coyote-induced mortality decrease (Cypher and Scrivner 1992, Scrivner and Harris 1986, Scrivner 1987). The extent to which gray and kit foxes compete for resources is unknown. The need for similar den sites and prey species probably place nonnative red foxes in direct competition with the much smaller kit fox. Nonnative red foxes are expanding their geographic range in central California (Orloff et al. 1986, Lewis et al. 1993), and competition with or predation on kit foxes may be a factor in the apparent decline of kit foxes in the Santa Clara Valley (T. Rado pers. comm.), and perhaps elsewhere in the northwestern segment of their range. Coyotes aggressively dominate encounters with red foxes and will pursue and kill both red and gray foxes (Sargeant and Allen 1989), as well as kit foxes. Coyotes may reduce the negative impacts of red foxes on kit foxes by limiting red fox abundance and distribution, but details of interactions between the two species and the extent to which coyotes might slow or prevent the invasion of red foxes into kit fox habitats are unknown (White et al. 1994, Ralls and White 1995).

Activity Cycle.—San Joaquin kit foxes are primarily active at night (i.e., nocturnal), and active throughout the year (Grinnell et al. 1937, Morrell 1972). Adults and pups sometimes rest and play near the den entrance in the afternoons, but most above-ground activities begin near sunset and continue sporadically throughout the night. Morrell (1972) reported that hunting occurred only at night. Yet predation on ground squirrels, which are active during the day (i.e., diurnal), by some populations

indicates that kit foxes are not strictly nocturnal, adapting to the activities of available prey (Balestreri 1981, Hall 1983, Orloff et al. 1986, O'Farrell et al. 1987*b*, Hansen in litt. 1988).

Habitat and Community Associations.—Kit foxes prefer loose-textured soils (Grinnell et al. 1937, Hall 1946, Egoscue 1962, Morrell 1972), but are found on virtually every soil type. Dens appear to be scarce in areas with shallow soils because of the proximity to bedrock (O'Farrell and Gilbertson 1979, O'Farrell et al. 1980), high water tables (McCue et al. 1981), or impenetrable hardpan layers (Morrell 1972). However, kit foxes will occupy soils with a high clay content, such as in the Altamont Pass area in Alameda County, where they modify burrows dug by other animals (Orloff et al. 1986).

Historically, San Joaquin kit foxes occurred in several native plant communities of the San Joaquin Valley. Because of extensive land conversions and intensive land use, some of these communities only are represented by small, degraded remnants today. Other habitats in which kit foxes are currently found have been extensively modified by humans. These include grasslands and scrublands with active oil fields, wind turbines, and an agricultural matrix of row crops, irrigated pasture, orchards, vineyards, and grazed annual grasslands (nonirrigated pasture). Other plant communities in the San Joaquin Valley providing kit fox habitat include Northern Hardpan Vernal Pool, Northern Claypan Vernal Pool, Alkali Meadow, and Alkali Playa. These are found as relatively small patches in scattered locations. In general, they do not provide good denning habitat for kit foxes because all have moist or waterlogged clay or clay-like soils. However, where they are interspersed with more suitable kit fox habitats they provide food and cover.

In the southernmost portion of the range, the kit fox is commonly associated with Valley Sink Scrub, Valley Saltbush Scrub, Upper Sonoran Subshrub Scrub, and Annual Grassland. Kit foxes also inhabit grazed grasslands, petroleum fields (Morrell 1971, O'Farrell 1980), urban areas (B. Cypher pers. comm.), and survive adjacent to tilled or fallow fields (Jensen 1972, Ralls and White 1991). In the central portion of the range, the kit fox is associated with Valley Sink Scrub, Interior Coast Range Saltbush Scrub, Upper Sonoran Subshrub Scrub, Annual Grassland and the remaining native grasslands. Agriculture dominates this region where kit foxes mostly inhabit grazed, nonirrigated grasslands, but also live next to and forage in tilled or fallow fields, irrigated row crops, orchards, and vineyards. In the northern portion of their range, kit foxes commonly are associated with annual grassland (Hall 1983) and Valley Oak Woodland (Bell 1994). Kit foxes inhabit grazed grasslands, grasslands with wind turbines, and also live adjacent to and forage in tilled and fallow fields, and irrigated row crops (Bell 1994).

Kit foxes use some types of agricultural land where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Jensen 1972, Knapp 1978, Hansen 1988). Kit foxes also den on small parcels of native habitat surrounded by intensively maintained agricultural lands (Knapp 1978), and adjacent to dryland farms (Jensen 1972, Kato 1986, Orloff et al. 1986).

4. Reasons for Decline and Threats to Survival

Reasons for Decline.—Numerous causes of kit fox mortality have been identified, though these have probably varied considerably in relative importance over time. Researchers since the early 1970s have implicated predation, starvation, flooding, disease, and drought as natural mortality factors. Shooting, trapping, poisoning, electrocution, road kills, and suffocation have been recognized as human-induced mortality factors (Grinnell et al. 1937, Morrell 1972, Egoscue 1975, Berry et al. 1987*a*, Ralls and White 1991, Ralls and White 1995, Standley et al. 1992).

By the 1950s the principal factors in the decline of the San Joaquin kit fox were loss, degradation, and fragmentation of habitats associated with agricultural, industrial, and urban developments in the San Joaquin Valley (Laughrin 1970, Jensen 1972, Morrell 1975, Knapp 1978). Extensive land conversions in the San Joaquin Valley began as early as the mid-1800s with the Arkansas Reclamation Act, and by 1958 an estimated 50 percent of the Valley's original natural communities had been lost (USFWS 1980*a*). In recent decades this rate of loss has accelerated rapidly with completion of the Central Valley Project and the State Water Project, which diverted and imported new water supplies for irrigated agriculture (USFWS in litt. 1995*a*). From 1959 to 1969 alone, an estimated 34 percent of natural lands were lost within the then-known kit fox range (Laughrin 1970). By 1979, only about 6.7 percent of the San Joaquin Valley floor's original wildlands south of Stanislaus County remained untilled and undeveloped (USFWS 1980*a*).

Such land conversions contribute to kit fox declines through displacement, direct and indirect mortalities, and reduction of prey populations.

Threats to Survival.—Loss and degradation of habitat by agricultural and industrial developments and urbanization continue, decreasing carrying capacity of remaining habitat and threatening kit foxes. Livestock grazing is not thought to be detrimental to kit foxes (Morrell 1975, Orloff et al. 1986), but may alter the numbers of different prey species, depending on the intensity of the grazing. Livestock grazing may benefit kit foxes in some areas (Laughrin 1970, Balestreri 1981), but grazing that destroys shrub cover and reduces prey abundance may be detrimental (O'Farrell et al. 1980, O'Farrell and McCue 1981, USFWS 1983, Kato 1986).

Petroleum field development in the southern half of the San Joaquin Valley affects kit foxes by habitat loss due to grading and construction for roads, well pads, tank settings, pipelines, and settling ponds. Habitat degradation derives from increased noise, ground vibrations, venting of toxic and noxious gases, and release of petroleum products and waste waters. Traffic-related mortality is also a factor for kit foxes living in oil fields. The cumulative and long-term effects of these activities on kit fox populations are not fully known, but recent studies indicate that areas of moderate oil development may provide good habitat for kit foxes, as long as suitable mitigation policies are observed (O'Farrell et al. 1980, Spiegel et al. in press). The impacts of oil activities at the Elk Hills Naval Petroleum Reserves in California on kit fox population density, reproduction, dispersal, and mortality appeared to be similar in developed and undeveloped areas of the Reserve (Berry et al. 1987*a*). The most significant impact on kit fox abundance in developed oil fields appears to be mediated through habitat loss. However, the relationship between habitat loss and population size in western Kern County is unclear: the Midway-Sunset oil field is highly developed with about 70 percent ground disturbance yet fox abundance is about 50 percent that of the undeveloped Lokern area (Spiegel et al. in press).

Other developments within the kit fox's range include cities and towns, aqueducts, irrigation canals, surface mining, road networks, non-petroleum industrial projects, power lines, and wind farms. These developments negatively impact kit fox habitat, but kit foxes may survive within or adjacent to them given adequate prey base and den sites. Kit foxes have been documented denning along canals and in levees (Jones and Stokes 1981, Hansen 1988), adjacent to highways (ESA Planning and Environmental Services 1986*b*, Hansen 1988), near wind farms (Hall 1983, Orloff et al. 1986), along power line corridors (Swick 1973), and at sanitary land fills (R. Faubion pers. comm.). Kit foxes also are known to live in and adjacent to towns such as Tulare (G. Presley pers comm.), Visalia (Zikratch pers. comm.), Porterville (Hansen 1988), Maricopa, Taft, and McKittrick (J.M. Sheppard pers. comm.) and the City of Bakersfield (Jones and Stokes 1981, B.L. Cypher pers. comm.). Bakersfield foxes (living in the Kern River Parkway) are reported to behave differently from animals in more remote populations: they often scavenge food from parking lots and dumpsters, have small foraging ranges, often are diurnal, and are relatively tame. This may be an expression of their ecological plasticity (e.g., Grinnell et al. 1937, p. 411, T. Murphy pers. comm., B.L. Cypher pers. comm.).

All these influences combine to compress and constrict the kit fox into fragmented areas, varying in size and habitat quality. The fragmentation of these areas coupled with the suspected high mortality during dispersal may limit movement to and habitat of these lands. As the human population of California continues to grow, the amount and quality of habitat suitable for kit foxes will inevitably decrease. Continued habitat fragmentation is a serious threat to the survival of kit fox populations.

The use of pesticides and rodenticides also pose threats to kit foxes. Pest control practices have impacted kit foxes in the past, either directly, secondarily, or indirectly by reducing prey. In 1925, near Buena Vista Lake, Kern County, seven kit foxes were found dead within a distance of 1 mile, having been killed by strychnine-poisoned baits put out for coyotes. It was suspected that hundreds of kit foxes were similarly destroyed in a single season (Grinnell et al. 1937). In 1975 in Contra Costa County (where the main prey item of kit foxes is the California ground squirrel), the ground squirrel was thought to have been eliminated county wide after extensive rodent eradication programs (Bell et al. 1994). In 1992, two kit foxes at Camp Roberts died as a result of secondary poisoning from rodenticides (Berry et al. 1992, Standley et al. 1992). The Federal government began controlling the use of rodenticides in 1972 with a ban of Compound 1080 on Federal lands pursuant to Executive Order. Above-ground application of strychnine within the geographic ranges of listed species

was prohibited in 1988. Efforts have been underway to greatly reduce the risk of rodenticides to kit foxes (USFWS in litt. 1993).

Invasion and occupation of historical and potential kit fox habitats by nonnative red foxes may limit opportunities for kit foxes. Exclusion of kit foxes by competing red foxes, direct mortality, and potential for disease and parasite transmission all are issues that have not yet been researched. Therefore, we know neither the historical impacts to the kit fox, nor to what extent the continuing expansion of the range of nonnative red foxes will have on kit foxes.

Accidents and disease, though not well documented, are thought to play a minor role in kit fox mortality (USFWS 1983), however, at Camp Roberts rabies accounted for 6.3 percent of deaths of radio-collared kit foxes (Standley et al. 1992) and there is concern that rabies may be a contributing factor in the recent decline of kit foxes at Camp Roberts (P.J. White pers. comm.). Random catastrophic events such as drought or flooding present a significant threat. Drought, with a corresponding decline in prey availability, results in a decrease in kit fox reproductive success (White and Ralls 1993, Spiegel et al. in press). How extended periods of drought may affect kit fox populations is unclear, but local extinctions are likely in some isolated areas. Recently, small mammal populations have declined rapidly and severely, apparently due to the above average rainfall in the 1994-1995 precipitation year. In the Elk Hills region, relatively few pupping dens were found in 1995, and only a small proportion of kit fox pairs apparently raised pups (B.L. Cypher pers. comm., L.K. Spiegel pers. comm.).

5. Conservation Efforts

The San Joaquin kit fox was listed as endangered by the U.S. Department of the Interior in 1967 (USFWS 1967) and by the State of California in 1971 (Table 1). A recovery plan approved in 1983 proposed interim objectives of halting the decline of the San Joaquin kit fox and increasing population sizes above 1981 levels (USFWS 1983).

Conservation efforts subsequent to the 1983 recovery plan have included habitat acquisition by USBLM, CDFG, California Energy Commission, Bureau of Reclamation, USFWS, and The Nature Conservancy. Purchases most significant to conservation efforts were the acquisitions in the Carrizo Plain, Ciervo-Panoche Natural Area, and the Lokern Natural Area. A multi-agency acquisition is underway which would secure 60,000 acres straddling western Merced, Stanislaus, and eastern Santa Clara Counties. Other lands have been acquired as mitigation for land conversions, both temporary and permanent (Table 2). Mitigation in the form of management and research was granted to the California Energy Commission, U.S. Department of Energy (Naval Petroleum Reserves in California), Army National Guard (Camp Roberts), and Department of Defense (Fort Hunter Liggett). Most of the current research literature arises from these sources and The Smithsonian/Nature Conservancy-sponsored research on the Carrizo Plain Natural Area (White and Ralls 1993, White et al. 1994, Ralls and White 1995, White et al. 1996).

For over 15 years EG&G Energy Measurements has conducted research into the ecology of the kit fox population on the Naval Petroleum Reserves in California, Kern County. Reports have covered such topics as dispersal (Scrivner et al. 1987*b*), mortality (Berry et al. 1987*a*), and movements and home range (Zoellick et al. 1987*b*). Additionally, they have evaluated habitat enhancement, kit fox relocation, supplemental feeding (EG&G Energy Measurements 1992), and coyote control (Cypher and Scrivner 1992) as means of enhancing recovery. Other life history information has come from studies sponsored in whole or in part by CDFG, California Department of Water Resources, USFWS, Smithsonian Institution, Department of the Army and Air Force, California Energy Commission, and The Nature Conservancy (Hall 1983, Archon 1992, Spiegel and Bradbury 1992, White and Ralls 1993, White et al. 1994, 1996). Following the 1983 recovery plan, only three surveys for distribution have been conducted, two in the northern range of the fox (Orloff et al. 1986, Bell et al. 1994), and one in western Madera County (Williams 1990).

Large-scale habitat surveys have been conducted on the Carrizo Plain (Kato 1986, Kakiba-Russell et al. 1991) and the southern San Joaquin Valley (Anderson et al. 1991). A preliminary aerial survey for potential habitat was conducted along the east side of the Valley (Bell et al. 1994). There also have been numerous smaller-scale preproject surveys as part of the section 7 and 10(a) permit process of the Endangered Species Act, National Environmental Protection Act, and California Environmental Quality Act laws and regulations.

A population viability analysis was prepared for USFWS using RAMAS/a, a Monte Carlo simulation of the dynamics of age-structured populations (Buechner 1989). Since this analysis, deficiencies in the database have been identified and a metapopulation analysis has been completed (Kelly et al. 1995). This analysis, however, is preliminary and will be updated as new information is collected.

The U.S. Environmental Protection Agency County Bulletins governing use of rodenticides have greatly reduced the risk of direct mortality to San Joaquin kit fox populations by State and county rodent-control activities. The California Environmental Protection Agency, California Department of Food and Agriculture, county agricultural departments, CDFG, and U.S. Environmental Protection Agency collaborated with the USFWS in the development of County Bulletins that are both efficacious and acceptable to land owners (R.A. Marovich pers. comm.).

6. Recovery Strategy

Though the kit fox has been listed for over 30 years, its status throughout much of its current range is poorly known. This is partly because so much of its historical range in the San Joaquin Valley is in private ownership. Similar gaps in information are common to many of the other listed and candidate species being addressed in this recovery plan. However, recovery actions for the kit fox are also considered critical to the recovery of many of these other species in the San Joaquin Valley. The kit fox's occurrence in the same natural communities as most other species featured in this plan and its requirement for relatively large areas of habitat mean its conservation will provide an umbrella of protection for many of those other species that require less habitat. Therefore, a conservative recovery strategy is appropriate for this species and the following regional (or ecosystem level) recovery actions should be given high priority.

Given the importance and urgency of the situation, the recovery strategy for the kit fox needs to operate on two distinct but equally important levels: the continuation and expansion of recovery actions initiated subsequent to the original recovery plan using existing information; and, the development of new information in concert with expansion of existing information, which is currently inadequate for some aspects of recovery management.

Level A Strategy.—The goal of this strategy is to work toward the establishment of a viable complex of kit fox populations (i.e., a viable metapopulation) on private and public lands throughout its geographic range. Although the exact dimensions of a viable kit fox metapopulation cannot be predicted in advance, there are general principles from conservation biology that can and must be applied for recovery of the San Joaquin kit fox (with due consideration to the current, inadequate knowledge about the animal's life history, distribution, and status). Because kit foxes require large areas of habitat and have dramatic, short-term population fluctuations, one cannot rely on a single population to achieve recovery. Preliminary population viability analyses suggest that the Carrizo Plain population, the largest remaining, is not viable by itself nor is it viable in combination with populations in western Kern County and the Salinas Valley.

Conserving a number of populations, some much more significant than others because of their large sizes or strategic locations, therefore, will be a necessary foundation for recovery. The areas these populations inhabit need to encompass as much of the environmental variability of the historical range as possible. This will ensure that maximal genetic diversity is conserved in the kit fox metapopulation to respond to varying environmental conditions, and that one environmental event does not negatively impact to the same extent all existing populations. Also, connections need to be established, maintained, and promoted between populations to counteract negative consequences of inbreeding, random catastrophic events (e.g., droughts) and demographic factors.

A sound, conservative strategy hinges on the enhanced protection and management of three geographically-distinct core populations, which will anchor the spine of the metapopulation. A number of smaller satellite populations (number and location yet to be determined, probably 9 to 12 or more) will be fostered in remaining fragmented landscapes through habitat management on public land and conservation agreements with private land owners.

The three core populations are:

1. Carrizo Plain Natural Area in San Luis Obispo County;

2. Natural lands of western Kern County (i.e., Elk Hills, Buena Vista Hill, and the Buena Vista Valley, Lokern Natural Area and adjacent

natural land) inhabited by kit foxes; and

3. The Ciervo-Panoche Natural Area of western Fresno and eastern San Benito Counties.

These three core populations each are distinct. The western Kern County and Carrizo Plain populations, although geographically close, are separated by the Temblor Range. Although both locations have high fox densities from time to time, they also have different environmental conditions, which are reflected in the fact that their population dynamics are not always synchronous (B.L. Cypher pers. comm., Endangered Species Recovery Program unpubl. observ.). These differences amongst the core populations are important considerations in conservation planning. Also, preliminary population viability analyses indicate that extinction probabilities increase dramatically if either the Carrizo Plain or western Kern County population is eliminated. Finally, both of these locations have large amounts of land in public ownership, lowering the burden on private land owners to assist in recovery of the kit fox. The Carrizo Plain and western Kern County populations are important for kit fox recovery.

The Ciervo-Panoche Natural Area population is located more than 160 kilometers (100 miles) northwest of the other two core populations. As with the other core populations, it has significant numbers of foxes, at least it had historically and it still may from time to time, and large expanses of land are in public ownership. It also experiences a different environmental regime from the other two. Finally, preliminary metapopulation viability analyses indicate that recovery probabilities increase if a population is established or maintained in this area, apparently because of its different environmental regime.

In addition to basing the choice of these three core populations on the above criteria, this particular metapopulation configuration has an additional important advantage over combinations of other fox populations. These three populations are more or less connected to each other by grazing lands, although they are steep and rugged in many places. Kit foxes occur at varying densities in the areas between the core populations (e.g., Kettleman Hills), providing linkages between core populations, and also probably with smaller, more isolated populations in adjacent valleys.

Important kit fox populations in the Salinas-Pajaro Region (herein defined as the area of the Salinas River and Pajaro River watersheds with habitat for kit foxes; Figs. 1 and 51) are located at Camp Roberts and Fort Hunter Liggett in the Salinas River Watershed. Though there are natural connections between the Salinas-Pajaro Region, the Carrizo Plain Natural Area, and the San Joaquin Valley, the amount of movement of kit foxes between the Salinas-Pajaro Region and these areas is unknown, though one fox is known to have moved from Camp Roberts to the Carrizo Plain (K. Ralls pers. comm.).

Other lands in the San Joaquin Valley that have kit foxes, or the potential to have them, include refuges and other lands managed by the CDFG, California Department of Water Resources, Center for Natural Lands Management, Lemoore Naval Air Station, Bureau of Reclamation, and USFWS, as well as those on private lands in western Madera County, central, western, and eastern Merced County, eastern Stanislaus County, northern Kings County, around Pixley National Wildlife Refuge and Allensworth Ecological Reserve in Tulare County, Semitropic Ridge Natural Area and around the Bakersfield metropolitan area of Kern County (Figure 51).

Many of these more isolated natural lands exhibit symptoms of ecosystem fragmentation such as degradation of natural communities and loss of biodiversity. Nevertheless, some fragments have resident kit foxes by virtue of their proximity to other populations, and others serve as important corridors between kit fox populations. For example, the California Department of Water Resources's Kern Fan Element provides an important linkage between kit foxes along the Kern River Parkway in Bakersfield and the western Kern County core population.

Yet, many of these areas, despite having suitable habitat, have become so degraded over time, reduced in size, and isolated from extant kit fox populations that they rarely have kit foxes today. When they do, these small, isolated populations are very susceptible to local extinction. It is likely that the degree of isolation from larger, more stable kit fox populations is the primary reason for absence or very low densities of kit foxes on some of the larger parcels of natural land remaining on the Valley floor (e.g., central Merced County, western Madera County, and the Mendota area, Fresno County; Williams 1990).

Connecting larger blocks of isolated natural land to

core and other populations, thus, is an important element of recovery of kit foxes. Connecting large blocks will help reduce the harmful effects of habitat loss and fragmentation. To enhance these connections, conservation lands on the Valley floor could be increased in size through acquisition of title or conservation easements, or a combination of both.

Another complementary approach is to reduce the level of isolation by promoting conservation of kit foxes on agricultural lands through "safe harbor" and other initiatives. New procedures and regulations must ensure that farmers are not penalized and farming not disrupted by enhancing use of farmland by kit foxes. The goal should be specific incentive programs to encourage farmers to maintain, enhance, or create habitat conditions for kit foxes. The ideal situation would be to establish a small number of breeding kit foxes in farm lands. A proposal to address habitat fragmentation in this way has already been developed by the American Farmland Trust (Scott-Graham 1994). Those lands could then serve as bridges between the more isolated refuges and reserves and the larger populations along the spine of the metapopulation, on the west side of the San Joaquin Valley.

Concurrently, strategic retirement of agricultural lands that have serious drainage problems will help reduce the effects of widespread habitat fragmentation of populations. Land retirement for reducing or eliminating drainage problems has been authorized by both State and Federal governments. In particular, the Central Valley Project Improvement Act of 1992 has provisions and funding for such land retirement. If land retirement proves not to pose a contaminant issue, the program can greatly boost recovery of kit foxes and other listed species and species of concern in the San Joaquin Valley. If large blocks (ideally, no less than 2,023 to 2,428 hectares [5,000 to 6,000 acres]) of drainage-problem lands are retired from irrigated agriculture, the retired farmland can be converted to habitat for kit foxes, kangaroo rats, blunt-nosed leopard lizards, and other listed and sensitive species. Those land blocks can provide more than just habitat. They can also reduce isolation and its detrimental effects. If strategically located, they can provide "stepping stones" for movement of kit foxes between Valley floor and west side populations. Strategic irrigated land retirement and subsequent establishment as habitat conservation areas is the most cost effective and rapid route to recovery of kit foxes.

Level B Strategy.—While land retirement and habitat restoration and management get under way, other urgent recovery needs, which are primarily research-related or informational in nature, must be addressed. The acquisition of new and better information will permit refinement of the viability models and land-use optimization models that are under development for the kit fox. In turn these models will assist in management of kit fox populations.

Needed is information on distribution and status throughout most of its current and historical range. Much better information on the distribution, status and movements of kit foxes is needed, particularly in the Salinas-Pajaro Region and the northern and eastern San Joaquin Valley.

Good data also are needed on the use of agricultural lands by kit foxes. Better demographic information is needed for kit foxes living in natural, agricultural, residential, and industrial lands throughout their range. Most of the existing data are for the southern part of the Valley where the environmental regime is more arid, and destruction of former fox habitat has been much more recent. Better data on the relationship between prey populations and kit fox population dynamics also are needed. A better understanding is needed of how kit foxes interact with red foxes, the indirect impacts of rodenticide use, and the influence of predator control activities.

Recovery Actions.—Recognizing that recovery requires a dual track with simultaneous actions, recovery actions are ordered in two lists, each of approximately equal priority to the other: a) habitat protection and population interchange, and, b) population ecology and management. Habitat protection and enhancement requires appropriate land use and management. To do so often requires purchase of title or conservation easement, or another mechanism of controlling land use. However, until needed research is completed, if listed species occur on an acquired parcel, the general rule of thumb should be that no dramatic changes in land use be made until appropriate management prescriptions have been determined. Many elements of management must first be determined by scientific research; thus the concept of adaptive management (monitoring and evaluating outcomes, then readjusting management directions accordingly) is operative here. A high priority therefore is the research required to determine appropriate habitat management and other recovery actions.

a. Habitat Protection and Population Interchange:

i. Protect natural lands in western Kern County.

ii. Protect natural lands in the Ciervo- Panoche Natural Area of western Fresno and eastern San Benito Counties.

iii. Expand and connect existing refuges and reserves in the Pixley-Allensworth and Semitropic Ridge natural areas through acquisition of existing natural land and farmland with drainage problems, and by safe harbor initiatives.

iv. Expand and connect (physically or by "stepping stones") existing natural land in the Mendota area, Fresno County, with the Ciervo-Panoche Natural Area, through restoration of habitat on retired, drainage-problem farmland.

v. Maintain and enhance connecting corridors for movement of kit foxes between the Kettleman Hills and the Valley's edge through the farmed gap between the Kettleman and Guijarral Hills, and between the Guijarral Hills and Anticline Ridge.

vi. Maintain and enhance connecting corridors for movement of kit foxes around the western edge of the Pleasant Valley and Coalinga in Fresno County, and between this area and natural lands on the western edge of the Coastal Range in Kings and Kern Counties.

vii. Maintain and enhance movement of kit foxes through agricultural land between the Lost Hills area and the Semitropic Ridge Natural Area by strategic retirement of drainage-problem farmland, acquisition, and safe harbor initiatives.

viii. Maintain and enhance habitat and movement corridors around the south end of the Valley between the Maricopa area on the west and Poso Creek area on the northeast through easements, zoning agreements, and safe harbor initiatives. One south Valley component is already in place. Kern Fan Element provides valuable conservation lands that serve as an important bridge between the Bakersfield area and the Elk Hills-Lokern core area. This design is being maintained by the new project owners, the Kern Water Bank Authority.

ix. Maintain and enhance movement of kit foxes between the Mendota area, Fresno County, natural lands in western Madera County, and natural lands along Sandy Mush Road and in the wildlife refuges and easement lands of Merced County. Specifically, maintain and enhance the Chowchilla or Eastside Bypass and natural lands along this corridor through acquisition, easement, or safe harbor initiatives.

x. Link natural lands in the Sandy Mush Road area of Merced County with the population of kit foxes on natural lands to the east by a safe harbor initiative on farmland.

xi. Protect natural land on the eastern base of Ortigalita Mountain and maintain and enhance a potential movement corridor through farmland between the base of Ortigalita Mountain, Merced County, and natural land to the north along the edge of the Diablo Range through Santa Nella by zoning and cooperative safe harbor initiatives.

xii. Protect and enhance existing kit fox habitat in the Salinas-Pajaro Region, centered on Camp Roberts and Fort Hunter Liggett.

xiii. Protect and enhance corridors for movement of kit foxes through the Salinas-Pajaro Region and from the Salinas Valley to the Carrizo Plain and San Joaquin Valley.

xiv. Protect existing kit fox habitat in the northern, northeastern, and northwestern segments of their geographic range and existing connections between habitat in those areas and habitat farther south.

b. Population Ecology and Management:

i. Determine habitat restoration and management prescriptions for kit foxes. Such studies should focus on factors that promote populations of prey species, including several

that are included in this recovery plan. Appropriate habitat management for those species is one of the highest priority issues in their recovery, and thus, indirectly in recovery of kit foxes.

ii. Determine current geographic distribution and population status of kit foxes, with special emphasis on potential habitat in eastern Madera, Merced, Stanislaus, and San Joaquin Counties and the Salinas-Pajaro Region.

iii. Establish a scientifically valid population monitoring program range-wide at representative sites, and periodically monitor the status of these populations.

iv. Determine use of farmland by kit foxes. Studies should determine types of crops and cultural practices providing foraging habitat; structures and landscape features providing denning opportunities and promoting movement of kit foxes through agricultural land and between natural and agricultural land; demography of kit foxes in agricultural land; and red fox/kit fox interactions in an agricultural setting (the latter topic is discussed further in a subsequent action).

v. Measure population movements between the three core areas and the Salinas-Pajaro Region through genetic investigations and expansion and coordination of existing population studies. Ongoing studies at Elk Hills (Naval Petroleum Reserve #2 in California - U.S. Department of Energy and its contractors, and Occidental of Elk Hills - Occidental Petroleum), Fort Hunter Liggett (U.S. Army), Camp Roberts (CA Army National Guard), and the Panoche Region (Endangered Species Recovery Program, USFWS, Bureau of Reclamation), should be expanded and their objectives redefined and coordinated. An additional population study should be initiated on the Carrizo Plain Natural Area and coordinated with these other studies. Important common objectives of all studies should be: population estimates applicable to each region and not just the facility (e.g., western Kern County, Salinas-Pajaro Region); dispersal distance and success; fluctuations in vital rates and spatial parameters of populations compared to environmental fluctuations (i.e., population demography, including reproduction, mortality, survivorship, recruitment into the population and dispersal); and interactions of canid species (i.e., kit foxes, red foxes, coyotes, free-ranging dogs).

vi. Determine direct and indirect effects of rodent and rabbit control programs on kit foxes, and the economic costs and benefits of control programs versus kit fox enhancement programs for controlling ground squirrels and rabbits.

vii. Measure genetic features and degree of isolation of agricultural "island" populations and effective population movement between core populations using DNA techniques.

viii. Determine the nature of interactions between kit foxes, red foxes, coyotes, and free-ranging dogs on both farmland and grazing land. One element of this study should be to determine which fox species benefits more from enhancement of farmland habitat for wildlife, and what this means to survival of kit fox populations in farmland. Another element should be to determine if coyote control benefits red foxes to the detriment of kit foxes.

M. State Listed, Federal Candidates and Other Animal Species of Concern

1. Dune Community Insects

Three species of sand-dwelling beetles are not candidates for listing, but are of special interest. Though each has a different pattern of distribution, all occur in similar, rare habitats in the northwestern portion of the San Joaquin Valley. There are several common elements in their recovery, particularly protecting their habitats and learning more about distribution, life history, and population status. First, individual accounts are presented, then a composite conservation strategy is presented for them and their supporting biotic communities.

Recovery Plan
for Upland Species
of the
San Joaquin Valley, California

Region 1
U. S Fish and Wildlife Service
Portland, Oregon

Authors:

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Other Contributors:

Sam Fitton[3] (draft San Joaquin Le Conte's thrasher account, review), Ross L. Goldingay[4] (recovery strategy and criteria, review), Heather M. Bell[2] (draft kit fox account), Lawrence Saslaw[5] (draft San Joaquin Le Conte's thrasher account, review), and Mary Ann T. Showers[6] (draft palmate-bracted bird's-beak account)

1998

Approved: _____ Date: 9/30/98

Michael J. Spear
Manager, California/Nevada Operations Office
Region I, U.S. Fish and Wildlife Service

APPENDIX F

Survey Methodologies for San Joaquin Kit Fox

(CDFG 1990)

CALIFORNIA DEPARTMENT OF FISH AND GAME
REGION 4
APPROVED SURVEY METHODOLOGIES
FOR SENSITIVE SPECIES

SAN JOAQUIN KIT FOX, Vulpes macrotis mutica

Status: CT, FE

Methods: Three methods should be used to survey for San Joaquin kit fox (SJKF): 1) night spotlighting, 2) line transects (to identify known and potential den sites), and 3) scent stations.

1) Night spotlighting should be conducted on a minimum of six nights (within a 14-day period) using 400,000 (minimum) candle power spotlights. Surveys should be conducted using at least two observers with spotlights (one for each side of the road). For adequate visibility the observer's eye level should be a minimum of 60 inches above the road surface. This generally precludes the use of cars and small trucks for spotlight surveys. The survey vehicle should be operated at 10 m.p.h. or less. The entire project area should be surveyed, as well as approximately a two-mile area around the subject property. Vehicles should only be operated on existing roads to avoid adversely impacting endangered species or their habitat. Spotlighting should be conducted for a minimum of 3 hours each night and the routes should be varied so that specific locations are not spotlighted at the same time each survey period. Whenever eyeshine or animal movement is detected, the vehicle should be stopped and the animal identified using binoculars (minimum 7x35) or spotting scopes. Sightings of SJKF, their prey, and competing predators should be recorded for later mapping, and the time, mileage, weather, and moon phase noted. Spotlight surveys should not be conducted when visibility is less than 2 miles.

2) Daytime line transect surveys for dens, tracks, scat, etc., should be conducted by walking the property at 10-30 meter (30 to 100-foot) intervals so that the area is completely covered in a systematic manner. Transect width should be adjusted based on vegetation height, topography, etc., to facilitate the detection of dens and other sign. When a den or burrow is discovered, the observer should determine if it has the potential to be used by SJKF and if it is currently occupied (please refer to the attached USFWS SJKF den definitions). Potential burrow openings are generally round or oval in shape, 10-25 centimeters (4-10 inches) in diameter, and often have multiple openings. SJKF activities at a den site should be determined by noting a variety of factors (fresh digging, presence of prey remains, tracks, or scat near the opening). All known and potential dens should be accurately mapped. Photographs of the dens should be taken along with information on topography, vegetation, land use, den characteristics, and activity.

3) Scent stations should be established at a minimum density of five scent stations per 640 acres. One scent station should be placed at the center of the project site with the other four placed 1/4 mile away (i.e. a domino 5 pattern). A minimum of 5 scent stations is required for all projects unless otherwise agreed to by CDFG and USFWS. If a linear corridor is being surveyed, five scent stations should be established per linear mile. Scent stations should not be set adjacent to heavily traveled roads to reduce the potential for kit fox/vehicle collisions. Scent stations should be operated for a minimum of six nights (within a 14-day period), and checked each morning for visitation, re-baited and tracks cleared when necessary. All tracks observed (i.e. kit fox, dogs, kangaroo rats, etc.) should be recorded on pre-formatted data sheets.

Scent stations should be situated on relatively level ground and cover a circle approximately 1 meter (39-inches) in diameter. All vegetation and debris should be cleared and a thin layer (1-2 cm) of fine-grained tracking material (diatomaceous earth, fire clay, finely sifted soil) sifted over the site. (The tracking substrate must be of a consistency to delineate the lines of a human hand when placed on the tracking medium). Smoked tracking plates are also acceptable. The scent stations should be baited with cat food placed at the center of the scent station (i.e. directly on the tracking substrate) or with "Predator Survey Disks". Because kit fox have been observed to occasionally avoid scent stations baited with predator survey disks and fish-based baits, no more than 50% of the scent stations should use these types of bait. The disks are available from Pocatello Supply Depot, 238 E. Dillon, Pocatello, ID 83201, or (208) 236-6920.

Timing: The optimum survey period is between May 1 and September 30. Surveys conducted outside of the optimum period should include a minimum ten nights of scent station operation. The period of lowest detectability is December, January and February. Survey methods for detecting kit fox during these months should be reviewed with the agencies prior to commencing field work. When presence of SJKF is confirmed, the agencies should be contacted for further instructions.

STATE OF CALIFORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME
REGION 4
1234 East Shaw Avenue
Fresno, CA 93710
(209) 222-3761

May 8, 1990

Dear Sensitive Species Surveyor

Attached are the survey methodologies for San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat and San Joaquin antelope squirrel. These methodologies were developed by Region 4 of the California Department of Fish and Game with input from the United States Fish and Wildlife Service, the Bureau of Land Management and various species experts. Standardized methodologies were developed to provide consultants, local, state and federal agencies with minimum acceptable standards for surveys that are conducted to determine the presence of state-listed species. All project specific surveys conducted after June 15, 1990 should use these methodologies. We want to emphasize that these survey methods were designed to optimize the chance of detecting the presence of a listed species should it occur on a project site. They are not designed to determine the absence of a species. If a listed species presence is detected prior to conducting surveys using these techniques, no additional surveys need to be conducted until the Regional office is contacted.

When the presence of a listed species is detected, we request you notify the Region 4 office at (209) 222-3761 for further instructions on what additional information will be needed to assess the projects's potential impact on listed species. This will assist in expediting the review of the project and help control the project sponsors biological survey costs. We also suggest that the USFWS be contacted for further advice as soon as federally-listed species are detected.

Field surveyors should also be aware that both state and federal permits are required for trapping/handling of listed species. For further information regarding permits for state-listed species, please contact Mr. John Gustafson at (916) 322-1260. For additional information regarding permits for federally-listed species, please contact the USFWS at (916) 978-4866. Please remember that if you are trapping within the known range of a listed species, the possibility exists that you may capture a listed species. Absent a permit from the Department and USFWS for their capture, you could be in violation of the State and/or Federal Endangered Species Acts.

If you have any questions, comments regarding the methodologies or if you want to propose the use of alternative methodologies, please contact Ron Rempel, Associate Wildlife Biologist, at the above address or telephone number.

Sincerely,

for George D. Nokes
Regional Manager

Attachments

REGION 4

SURVEY METHODOLOGIES

for

SAN JOAQUIN KIT FOX

BLUNT NOSED LEOPARD LIZARD

SAN JOAQUIN ANTELOPE SQUIRREL

TIPTON KANGAROO RAT

GIANT KANGAROO RAT

1990

Compiled by:

Ron Rempel
Associate Wildlife Biologist

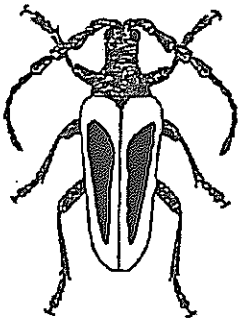
Gail Presley
Wildlife Biologist

APPENDIX G

San Joaquin Kit Fox Survey

Protcol for the Northern Range

(USFWS 1999)



U.S. FISH AND WILDLIFE SERVICE
SAN JOAQUIN KIT FOX SURVEY PROTOCOL
FOR THE NORTHERN RANGE

Prepared by the Sacramento Fish and Wildlife Office
June 1999

"The purposes of the Endangered Species Act of 1973, as amended, are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved . . . and to provide a program for the conservation of such endangered and threatened species." (The Endangered Species Act of 1973, as amended)

The language contained in the Endangered Species Act of 1973, as amended (Act), requires the U.S. Fish and Wildlife Service (Service) to not only protect individual animals, but has the further obligation of providing listed species with functioning ecosystems so protections provided by the Act are no longer necessary. For the Service to achieve this goal and to allow the project applicant to proceed with their project in a timely manner, the Service has developed the U.S. Fish and Wildlife Service San Joaquin Kit Fox Survey Protocol for the Northern Range where foothill grasslands, oak savannah, and adjacent agricultural lands are the primary kit fox habitats.

To avoid unnecessary expenditures and delays for projects located within the northern range of the San Joaquin kit fox, the project applicant, along with a qualified biologist, must conduct an early evaluation with the Service.

EARLY EVALUATION REQUIREMENTS

To enable the Service to evaluate the project's impacts to the San Joaquin kit fox the following information is required:

1. A brief description of the proposed project and a map. The project description needs to include the project name, county where the project is located, the estimated area (acreage) of the project site, and an estimate of acres of potential San Joaquin kit fox habitat (see appendix II). The map must show the precise location of the project site, the location of known kit fox dens and/or sightings on the project site, and delineate kit fox habitat. The map should be either an original or high quality copy of a U.S. Geological Survey topographic map (exact scale, 7.5 minute, 1"=24,000 ft., including township and range).

2. Compile sighting records within a ten-mile radius of the boundaries of the project site. Both the Service and the California Natural Diversity Data Base (CNDDB) shall be contacted for sighting records;

3. Describe vegetation communities found on the project site using CNDDB classification;

4. Describe the continuity of the vegetative communities between the project site and the ten-mile radius;

5. Habitat suitability of the project site to be assessed by completing one set of walking transects (e.g., evaluate prey base and denning potential);

6. An analysis of adverse effects of the project on kit foxes, if any;

7. Provide recommendations for mitigating the adverse effects of the project on kit foxes, where applicable; and

8. An analysis of cumulative effects (appendix II), if any.

Upon receiving all of the above information, the Service will evaluate the information as to whether or not the project site represents kit fox habitat, the quality of the habitat, and the value of that habitat to the recovery of the kit fox (see appendix II). The Service will set forth its reasoning for such determination in writing within 30 days. If it is determined that the project will not result in take (see appendix II), the project applicant may proceed with the project. If the Service determines that take will occur as the project is currently presented, the project applicant should initiate discussions with the Service to determine appropriate project modifications to protect kit fox, including avoidance, minimization, restoration, preservation, or compensation. Project modifications to protect kit fox include efforts to moderate, reduce or alleviate the impacts of a proposed activity, including a) avoiding the impact by not taking a certain action or parts of an action; b) minimizing impacts by limiting the degree or magnitude of the action; c) rectifying the impact by repairing, rehabilitating or restoring the affected environment; d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; e) compensating for the impact by replacing or providing substitute resources or environments. The project applicant must obtain Service concurrence that no take of kit fox will occur, as defined in section 9 of the Act. The Service recognizes that there are cases where early evaluation of the project site may be inconclusive. In that case, the applicant may choose (1) to enter into discussions with the Service on appropriate project modifications or (2) complete the balance of the protocol level survey.

If kit fox or kit fox sign are found using the survey protocol presented here, the project applicant will need to consult with the Service to determine appropriate project modifications and permit requirements to protect kit fox.

If kit fox or kit fox sign are NOT found using this survey protocol, but kit fox sightings or occurrences are documented within a 10-mile radius, the Service will interpret the results, and appropriate project modifications, if necessary, will be discussed with the applicant. Factors the Service will consider in interpreting such cases include the number and dates of kit fox sightings, distance of such sightings from the project site, the continuity of habitat or vegetative types between kit fox sightings and the project site, habitat suitability within the project site (e.g., prey

base and denning potential), available results of surveys in the project vicinity, and the opinions of other kit fox experts. If, based on such information, the Service determines that a project site represents kit fox habitat, it will, if requested by the applicant or the applicant's representative, set forth its reasoning for such determination in writing.

If this survey protocol (and early evaluation process) is implemented as described, and if negative results are obtained and no kit fox sightings are within a 10-mile radius, and the Service concurs in writing, the Service will not require project modifications to reduce effects on kit fox. The protocol level surveys are described below.

SURVEY PROTOCOL

The hilly terrain and tall grasses of the northern range make it extremely difficult to identify small canids using spotlights. In addition, the large home range of kit fox in the northern range decreases the likelihood of detecting a kit fox in a particular area at a particular moment in time. As kit foxes have proven difficult to detect in such areas, this protocol includes more intensive survey efforts than utilized in the southern range of the San Joaquin kit fox. This survey protocol applies to all natural lands and other vegetative communities as follows:

1. native or nonnative grasslands and associated scrub;

2. oak savannah adjacent to grasslands;

3. agricultural lands on the San Joaquin Valley floor within 3 miles of foothill grasslands or extensive valley grasslands;

4. lands that are dryland farmed; and

5. ruderal land that is associated with above-described areas.

The survey protocol should be used within the aforementioned habitats in the San Joaquin kit fox range north of the following boundary: the western intersection of the Merced/Fresno county lines, then along the Merced/Fresno county lines to the intersection of the Merced/Madera county line and State Route 152, then east along State Route 152 to the intersection of State Route 99, and then an imaginary line directly east from that intersection.

The Service can provide a list of quads where San Joaquin kit fox habitat exists. The quad list is not necessarily inclusive and the Service should be contacted for guidance concerning other land use types that may be inhabited by San Joaquin kit foxes.

Once initiated, surveys conducted pursuant to this protocol may be suspended prior to completion if: (a) upon closer inspection or new information the project site represents kit fox habitat, or (b) kit fox are positively identified within the project site or within 2 miles of the boundaries of the project site. If kit fox are identified, the Service must be notified immediately and a California Natural Diversity Data Base form must be completed and mailed.

Below are general requirements of all surveys; details are contained in appendix I. Adjustments to this protocol may only be made with Service concurrence.

1. One walking transect to detect known, natal, and potential kit fox dens (appendix II) must be conducted on all areas within the project site in the previously described vegetative communities. Walking transects must be conducted such that 100% visual coverage of the project areas is achieved. Typically, this requires transect widths of 30

to 100 feet depending on the height of vegetative cover and other visual obstructions. To identify opportunities and "hot spots" for later spotlighting and camera/scent stations, walking transects of at least 50% of the project site must be conducted prior to initiation of spotlighting. The remainder of the walking transects must be completed prior to the placing of camera and scent stations. At least one walking transect survey must be conducted between May 1 and September 30.

2. Spotlighting of the project vicinity must be conducted for a minimum of 10 nights within a 15 day period (weather permitting). "Project vicinity" means the actual project site plus an area encompassing a 2-mile radius around the project site. Prior to accessing private property, the surveyor must obtain permission. However, if permission cannot be obtained, spotlighting of the project site and publicly accessible routes within the 2-mile radius must be conducted. Spotlighting must be conducted so that coverage of the project vicinity is maximized and is consistent with good professional judgment. Areas where canids were observed, but not identified need to have additional camera and scent stations placed in the vicinity within 24 hours.

3. Spotlighting surveys cannot be conducted in the same area where camera and scent stations are in place, except as mentioned above. Camera stations must be established within the project area at a minimum density of eight per 640 acres (1 square mile -- or at a similar density for project sites larger or smaller than 640 acres) and maintained for a minimum of 10 consecutive nights. At least one camera station must be established for project sites smaller than 80 acres. When the number of camera stations on the project acreage does not divide evenly, the required number of stations must be rounded up. Consecutive nights of surveys may be interrupted if weather conditions are inappropriate, provided that 10 nights of effort are completed as promptly as practicable.

4. Concurrently with camera stations, scent stations must be established within the project area at a minimum of eight per 640 acres and maintained for a minimum of 10 consecutive nights (weather conditions permitting). The number of scent stations required for project areas larger or smaller than 640 acres should be rounded up. On project sites larger than 640 acres, camera and scent stations may be rotated as necessary to obtain complete coverage (i.e., where the number of available cameras is not sufficient to simultaneously cover the entire site).

   Camera and scent stations must be established in accordance with methods that maximize the success of attracting and detecting kit foxes, and that is consistent with good professional judgment.

5. Surveys must be conducted between May 1 and November 1 using the methods described above.

6. Results of these surveys together with other pertinent information must be compiled into a survey report or biological assessment and submitted to the Service for review and comment. The report must contain the following mandatory elements:

   a. the early evaluation information and results;

   b. a description of specific methodologies utilized during the project survey and any adjustments from the survey protocol;

   c. survey results and a map showing the location of camera and scent stations;

   d. any other available environmental documents such as draft environmental impact reports or biological assessments; and

   e. an appendix containing the resumes of all biologists who assisted with the project surveys.

REQUIRED QUALIFICATIONS OF BIOLOGISTS

Biologists conducting the early evaluation and field surveys described in this protocol must have demonstrable experience in kit fox biology, identification, and survey techniques. The senior biologist should have a university degree in wildlife biology or a related science, at least 360 hours of field experience in traditional kit fox survey techniques (den surveys, camera and scent stations, and spotlighting) including a minimum of 48 hours of spotlighting experience, and have seen a kit fox during a spotlighting survey within five years of conducting the present survey or can provide comparable experience. The assisting biologist(s) needs to have 30 hours of spotlighting experience, be able to identify coyote, red fox and gray fox in a spotlight, and needs to have seen a kit fox either in the wild, at a zoo or as a museum mount. Other qualifications are not necessarily excluded by this condition, provided the surveyor can demonstrate to the Service good professional judgment and experience.

Resumes submitted to the Service must include specific information concerning kit fox survey experience, experience surveying for other canids, other professional experience, and education. The Service suggests that the biologist contact the Service if there are any questions regarding their qualifications.

ADDITIONAL INFORMATION, LIMITATIONS, AND CAVEATS

With respect to this survey protocol, the following apply:

1. Surveys are to be conducted only after the early evaluation process has been completed. Surveys are only to be conducted with prior approval of the Service, and that the Service, along with the applicant, has determined that surveys are appropriate.

2. Specific circumstances may justify or necessitate modification of this survey protocol on a case-by-case basis. Such modifications are allowable under this protocol if: (a) the applicant or its representative explains to the Service in writing why modifications of the protocol are necessary; and (b) the Service concurs with such adjustments in writing.

3. The Service recognizes that certain types of projects (e.g., linear projects such as pipelines, phased projects, and projects involving small land areas) may raise special issues with respect to the implementation of this protocol. These applicants must consult with the Service prior to initiating surveys.

4. The Service reserves the right to reject kit fox surveys conducted under this protocol as inadequate if:

   a. specific methods described under the Survey Protocol are not implemented and prior written exception to the protocol was not obtained;

   b. surveyor qualifications are demonstrably inadequate or inconsistent with the description under Required Qualifications of Biologists; or

   c. survey methods are conducted in a manner that is demonstrably inconsistent with the Survey Protocol.

5. The applicant should consult the California Department of Fish and Game to determine their responsibilities under the California Endangered Species Act.

6. The applicant shall not be required to conduct additional kit fox surveys for 2.5 years (30 months) from the date of completion of protocol surveys. If by the end of this 2.5 year period, (1) a grading permit has not been issued for any project requiring such a permit, or (2) project construction (i.e., actual ground disturbing activities) has not been initiated, or (3) other specific project activities at issue with respect to this protocol have not been initiated, then the Service must be contacted as all understandings and agreements described above shall have terminated.

7. IF THE APPLICANT CONDUCTS THE PRESCRIBED SURVEYS WITHOUT FINDING ANY KIT FOX, AND KIT FOXES ARE LATER DETERMINED TO OCCUPY THE PROJECT SITE, ALL PROJECT ACTIONS LIKELY TO RESULT IN INCIDENTAL TAKE OF KIT FOXES SHALL CEASE IMMEDIATELY AND THE SERVICE SHALL BE CONTACTED IMMEDIATELY FOR FURTHER GUIDANCE.

APPENDIX I: Mandatory Requirements for Surveys

These requirements have been adapted from the California Department of Fish and Game, Region 4, Approved Survey Methodologies. This appendix details mandatory requirements set forth in the survey protocol.

1. Spotlighting shall be conducted:

   a. for a minimum of two hours within a one sq. mile area, and adjusted appropriately for larger or smaller areas.

   b. The routes should be varied so that specific locations are not spotlighted at the same time each session.

   c. Whenever eye shine or animal movement is detected, the vehicle should be stopped and the animal identified using binoculars (minimum 7x35, light gathering styles preferred) or spotting scopes. If the animal is considered an "unidentified canid," a surveyor's flag or other form of marking shall be placed there to expedite returning to the spot for timely placement of an additional 2 camera and 2 scent stations for 3 consecutive nights.

   d. Any sightings of kit foxes, other predators, and prey species should be noted for mapping.

   e. Spotlighting shall be conducted using at least two observers with spotlights. Spotlights must be 400,000 candlelight or brighter. The Service recommends 800,000 candlelight.

   f. Vehicles must be driven no more than 10 mph and shall be operated on existing roads only.

2. Walking transects shall be conducted as follows:

   a. Survey for dens, sign (tracks, scat, prey remains), and prey availability. It is essential that locations of dens, sign, and prey availability be mapped (e.g., ground squirrel colonies). Scat can now be determined to species. Contact the Service for more information.

   b. Transect width must be adjusted based on vegetation height, topography, etc., to facilitate the detection of dens and other sign.

   c. When a den, appropriate ground squirrel burrow, or badger excavation, etc. is discovered, the biologist should determine its status (appendix II) and map the

location. Most dens which are occupied by kit foxes show no sign. Den status can usually be determined with 3 days of dusting with a tracking medium.

3. Scent stations shall be managed as follows:

   a. Scent stations must measure a minimum of one square yard, and may be either metal, aluminum, or other appropriate surface, covered with appropriate tracking medium. The tracking medium must be kept in a condition which allows the tracks of small canids to be detected. The use of track boxes in areas of heavy dew or fog may prolong the effectiveness of the tracking medium. Track boxes can be used with prior approval by the Service.

   b. Track plates must be secured to the ground by spikes or other means (such as wood backing) to prevent wobbling, being blown away or otherwise disturbed.

   c. Scent stations must be checked each morning and animal visitations recorded. All tracks of small canids and unidentifiable canid tracks should be lifted or photographed and included in the report.

   d. Scent stations shall be re-baited as necessary to encourage nighttime visitation. If a small can is used, such as a cat food can, then it should be nailed into the ground or somehow secured so an animal cannot walk off with it.

   e. Scent stations should be placed in a manner that will foster visitations by carnivores (e.g., adjacent to existing wildlife trails or near dens).

   f. Grass and brush should be cleared from around scent stations to prevent windblown grasses or bushes brushing the track plates and destroying tracks.

   g. If a scent station results in a visitation by an unidentified canid, an additional camera should be set up at the scent station for a minimum of four additional nights and the vacated camera station should be converted to a scent station.

4. Camera stations shall be managed as follows:

   a. Camera stations can be baited trigger cameras and/or infrared beam trip cameras. Cameras must be set to allow triggering or tripping by small canids.

   b. Camera stations should be set so as to foster visitations by small canids, but limit triggering or tripping by domestic livestock.

c. Cameras with motor driven drives must be used to allow multiple photographs to be taken per night. If infrared beams are used, the beam delay should not exceed 30 seconds.

d. Bait and batteries shall be checked on a daily basis.

e. When theft of cameras is a concern, the cameras can be concealed in bee boxes or by other means.

f. Grass and brush should be cleared from around camera stations to prevent windblown grasses or bushes triggering the shutter release.

5. Surveyors must fill out and send to the California Natural Diversity Data Base (CNDDB) all observations of the presence of San Joaquin kit foxes (e.g., sightings, carcasses, scat, tracks). A CNDDB form is available as appendix III.

APPENDIX II: Definitions

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

"Harm" - is defined in the Act to include significant habitat modification or degradation that results in death or injury to a listed species by interfering with essential behavioral patterns such as breeding, foraging, or resting.

"Harass" - is defined in the Act as actions that create the likelihood of injury to listed species to such an extent as to disrupt normal behavior patterns which include, but are not limited to, breeding, foraging, or resting.

"Cumulative Effects" - The cumulative or incremental environmental impact of the effect of the action together with impacts of past, present, and reasonably foreseeable future actions. The action area includes all areas to be affected directly or indirectly by the action, not merely the immediate area involved in the action.

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

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

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

subterranean hole; or (2) any den or burrow of another species (e.g., coyote, badger, red fox, or ground squirrel) that otherwise has appropriate characteristics for kit fox use.

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

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

"Habitat" - Habitat refers to the resources and conditions present in an area that; (1) produces occupancy (including foraging areas and dispersal corridors, etc.); or (2) provides potential for occupancy (e.g., listed species who are so reduced in numbers that they cannot use some areas of habitat, but would do so if their numbers were greater and/or they had the opportunity); or (3) was historically occupied; and (4) are important to the survival, reproduction, and/or recovery of the species.

"Habitat Quality" - The quality of the habitat should be considered a continuous variable, ranging from low to medium to high quality habitats, based on the ability to provide resources for survival, reproduction, and recovery, respectively.

"Habitat Value" - The value of the habitat refers to the importance of the habitat to the recovery of the kit fox. This should be considered a continuum with indefinite boundaries or acreage; low, medium, and high.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340

IN REPLY REFER TO:
1-1-99-TA-1533

June 28, 1999

Memorandum

To: Distribution

From: Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Dissemination of Survey Protocol for the San Joaquin Kit Fox for the Northern Range

The U.S. Fish and Wildlife Service (Service) provides the attached survey protocol for determining habitat suitability and appropriate mitigation for the San Joaquin kit fox (*Vulpes macrotis mutica)* in the northern part of its range. The attached survey protocol is subject to revision by the Service at any time. Successful implementation of the survey protocol will require ongoing contact with the Service before, during, and after early evaluations and field surveys. Questions regarding this guidance may be addressed to Sheila Larsen or Peter Cross of the Sacramento Fish and Wildlife Office at (916) 979-2710. Please note that after July 23, 1999 the Service will be moving to a new address, 2800 Cottage Way, West 2605, Sacramento, California 95826. No new telephone number is available at this time.

Karen J Miller
for Wayne S. White

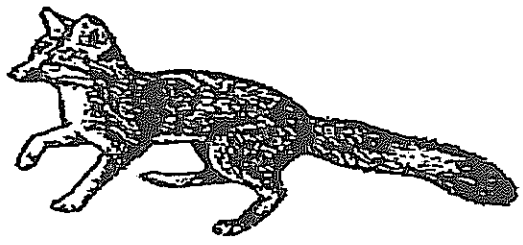
Attachment

APPENDIX H

Standard Recommendations for

Protection of the San Joaquin Kit Fox

(USFWS 1999)



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

Prepared by the Sacramento Fish and Wildlife Office
June 1999

INTRODUCTION

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

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

All surveys, den destructions, and monitoring described in this document must be conducted by a qualified biologist. A qualified biologist (biologist) means any person who has completed at least four years of university training in wildlife biology or a related science and/or has demonstrated field experience in the identification and life history of the San Joaquin kit fox. In addition, biologist(s) must be able to identify coyote, red fox, gray fox, and kit fox tracks, and to have seen a kit fox in the wild, at a zoo, or as a museum mount.

SMALL PROJECTS

Small projects are considered to be those projects with small foot prints such as an individual in-fill oil well, communication tower, or bridge repair. These projects must stand alone and not be part of, or in any way connected to larger projects (i.e., bridge repair or improvement to serve a

future urban development). The Service recommends that on these small projects, the biologist survey the proposed project boundary and a 200-foot area outside of the project footprint to identify habitat features, and make recommendations on situating the project to minimize or avoid impacts. If habitat features cannot be completely avoided, then preconstruction surveys should be conducted.

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

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

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

OTHER PROJECTS

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

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

EXCLUSION ZONES

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

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

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

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

Construction and other project activities should be prohibited or greatly restricted within these exclusion zones. Only essential vehicle operation on existing roads and foot traffic should be permitted. Otherwise, all construction, vehicle operation, material storage, or any other type of surface-disturbing activity should be prohibited within the exclusion zones.

DESTRUCTION OF DENS

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

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

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

Destruction of the den should be accomplished by careful excavation until it is certain that no kit foxes are inside. The den should be fully excavated, filled with dirt and compacted to ensure that kit foxes cannot reenter or use the den during the construction period. If at any point during excavation a kit fox is discovered inside the den, the excavation activity shall cease immediately and monitoring of the den as described above should be resumed. Destruction of the den may be completed when in the judgement of the biologist, the animal has escaped from the partially destroyed den.

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

CONSTRUCTION AND OPERATIONAL REQUIREMENTS

Habitat subject to permanent and temporary construction disturbances and other types of project-related disturbance should be minimized. Project designs should limit or cluster permanent project features to the smallest area possible while still permitting project goals to be achieved. To minimize temporary disturbances, all project-related vehicle traffic should be restricted to established roads, construction areas, and other designated areas. These areas should also be

included in preconstruction surveys and, to the extent possible, should be established in locations disturbed by previous activities to prevent further impacts.

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

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

3. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe becoming trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the Service has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

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

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

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

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

must be conducted, zinc phosphide should be used because of proven lower risk to kit fox.

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

9. An employee education program should be conducted for any project that has expected impacts to kit fox or other endangered species. The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and agency personnel involved in the project. The program should include the following: a description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; an explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the above-mentioned people and anyone else who may enter the project site.

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

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

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

13. The Sacramento Fish and Wildlife Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during

project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The Service contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers given below. The CDFG contact is Mr. Ron Schlorff at 1416 9th Street, Sacramento, California 95814, (916) 654-4262.

Any project-related information required by the Service or questions concerning the above conditions or their implementation may be directed in writing to the U.S. Fish and Wildlife Service, until July 23, 1999 at:

Endangered Species Division
3310 El Camino Avenue, Suite 130
Sacramento, California 95821-6340
(916) 979-2710

After July 23, 1999 please direct mail to:
Endangered Species Division
2800 Cottage Way, West 2605
Sacramento, California 95826
(no telephone number available yet,
please call the old number for a forwarding number)

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

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

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

"Potential Den" - Any subterranean hole within the species' range that has entrances of appropriate dimensions for which available evidence is insufficient to conclude that it is being used or has been used by a kit fox. Potential dens shall include the following: (1) any suitable subterranean hole; or (2) any den or burrow of another species (e.g., coyote, badger, red fox, or ground squirrel) that otherwise has appropriate characteristics for kit fox use.

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

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

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W2605
Sacramento, California 95825-1846

IN REPLY REFER TO:
1-1-99-TA-1534

February 15, 2001

Memorandum

To: Distribution

From: Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Dissemination of Standard Recommendations for the Protection of the San Joaquin Kit Fox Prior to or During Ground Disturbance

The U.S. Fish and Wildlife Service (Service) provides the attached standard recommendations for the protection of the San Joaquin kit fox (*Vulpes macrotis mutica)* prior to or during ground disturbing activities. The attached standard recommendations are subject to revision by the Service at any time. Successful implementation of the standard recommendations will require ongoing contact with the Service before and during the ground disturbance. Questions regarding this guidance may be addressed to Sheila Larsen or Susan Jones of the Sacramento Fish and Wildlife Office at (916) 414-6600.

for Wayne S. White

Attachment

APPENDIX I

Survey Map for Scent Stations

HALSTEAD & ASSOCIATES
Endangered Species / Environmental Consultants
296 Burgan Avenue, Clovis, CA 93611

Den and Track Search Map

APPENDIX J

Survey Map for Den and Track Searches

HALSTEAD & ASSOCIATES
Endangered Species / Environmental Consultants
296 Burgan Avenue, Clovis, CA 93611

Scent Station Map

Scent Station Map - Section 36

- Scent Station Location & Number
(Number corresponds to data in tables)

Township 15 S, Range 21 E, Section 36 Fresno County: Conejo Quadrangle Map

APPENDIX K

Results of San Joaquin Kit Fox Scent Station Survey

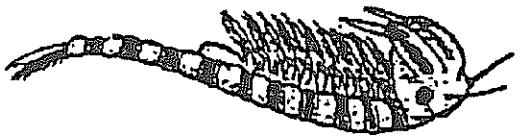


TABLE 1

Results of San Joaquin Kit Fox Scent Station Survey
ROCKWELL POND SPECIFIC PLAN PROJECT
(Township 15S, Range 21E, Section 36, Fresno County, California)

STATION #	SAMPLING DATE (2007)					
	August 28	August 29	August 31	September 1	September 2	September 3
1	Ants	0	0	0	Ants	0
2	Ants	0	Squirrel	0	Ants	0
3	Ants	Domestic Dog	0	0	0	Ants
4	Domestic Cat, Squirrel	0	0	0	Domestic Dog	Domestic Dog
5	0	0	0	0	0	0
6	0	0	0	0	0	Domestic Dog
7	Squirrel	Squirrel	0	Cottontail	Squirrel	Toad
8	Ants	Opossum	Ants	Cottontail	Cottontail	Squirrel, Cottontail
9	Squirrel	Squirrel	Opossum	Squirrel	Squirrel	Squirrel
10	Squirrel, Cottontail	Squirrel, Opossum	Bird	Squirrel	Squirrel	Squirrel
11	Squirrel, Cottontail	Squirrel, Cat	0	Cottontail	Squirrel, Cottontail	Squirrel
12	Squirrel	Domestic Dog	0	Squirrel	0	Toad, Squirrel

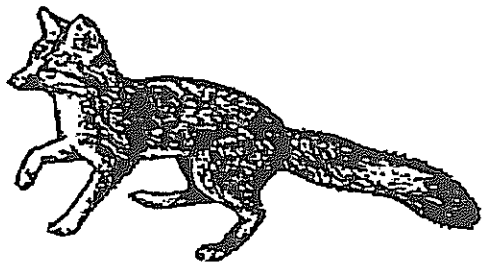
TABLE 2

Summary of San Joaquin Kit Fox Scent Station Results
ROCKWELL POND SPECIFIC PLAN PROJECT
(Township 15S, Range 21E, Section 36, Fresno County, California)

SPECIES	STATION #												TOTAL VISITS
	1	2	3	4	5	6	7	8	9	10	11	12	
Kit Fox	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Cat	0	0	0	1	0	0	0	0	0	0	1	0	2
Domestic Dog	0	0	1	2	0	1	0	0	0	0	0	1	5
Cottontail	0	0	0	0	0	0	1	1	0	1	1	0	4
Ground Squirrel	0	1	0	1	0	0	1	1	1	1	1	1	8
Opossum	0	0	0	0	0	0	0	1	1	1	0	0	3
Bird	0	0	0	0	0	0	0	0	0	1	0	0	1
Western Toad	0	0	0	0	0	0	1	0	0	0	0	1	2
Ants	1	1	1	0	0	0	0	1	0	0	0	0	4
Total Per Station	**1**	**2**	**2**	**4**	**0**	**1**	**3**	**4**	**6**	**8**	**8**	**5**	**29**

APPENDIX L

Results of San Joaquin Kit Fox Spotlighting Survey



Results of San Joaquin Kit Fox Spotlighting Survey
ROCKWELL POND SPECIFIC PLAN PROJECT
(Township 15S, Range 21E, Section 36, Fresno County, California)

SPECIES OBSERVED	SAMPLING DATE (2007)						TOTAL
	August 27	August 28	August 29	August 30	August 31	September 1	
Kit Fox	0	0	0	0	0	0	0
Domestic Cat	3	2	6	2	3	35	51
Domestic Dog	6	6	5	4	9	0	30
Cottontail	26	33	36	35	41	76	247
Opossum	0	0	1	0	0	0	1
Great Blue Heron	0	1	0	1	0	0	2
Barn Owl	4	1	0	4	0	1	10
Killdeer	48	32	35	28	38	0	181
Coyote	1	1	2	0	0	0	4
Black Crowned Night Heron	1	2	0	1	1	0	5
SURVEY EFFORT							
Hours	3.0	3.0	3.0	3.0	2.25	3.0	13.25
Miles	13.2	13.6	12.5	10.9	10.3	11.4	71.90

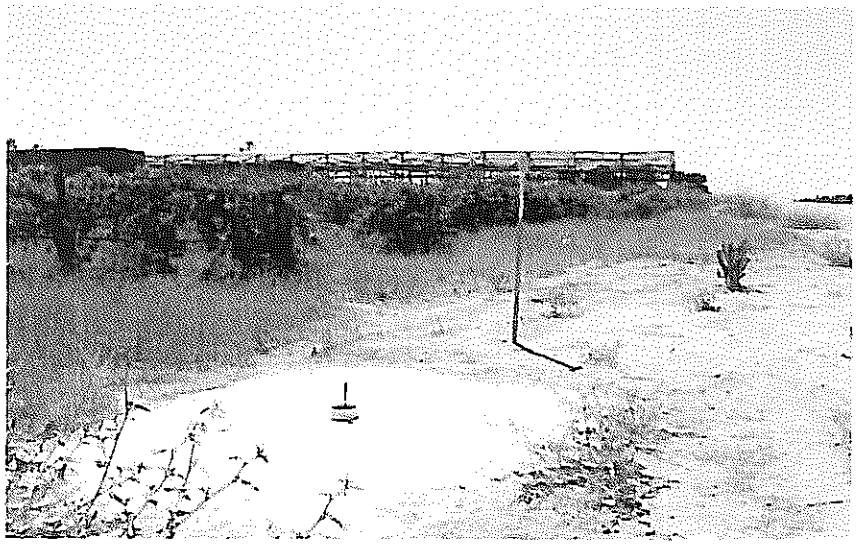


Figure 1. Scent station #10 on the project site.

Figure 2. Scent Station #3 on the project site.

Figure 3. Scent station #12 on the project site.

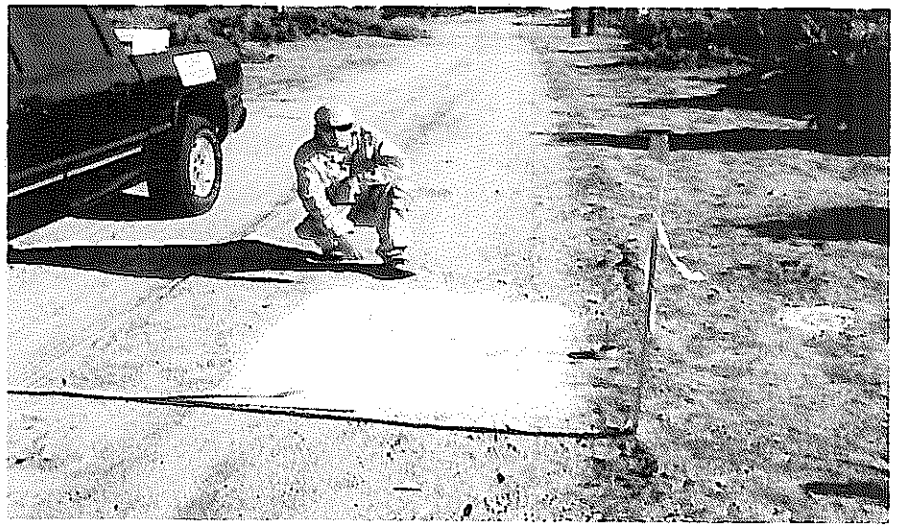


Figure 4. Scent station #9 on the project site.

Examples of San Joaquin Kit Fox scent stations. Photos by H&A in August 2007.
Rockwell Pond Specific Plan Project (Selma, Fresno County, California).

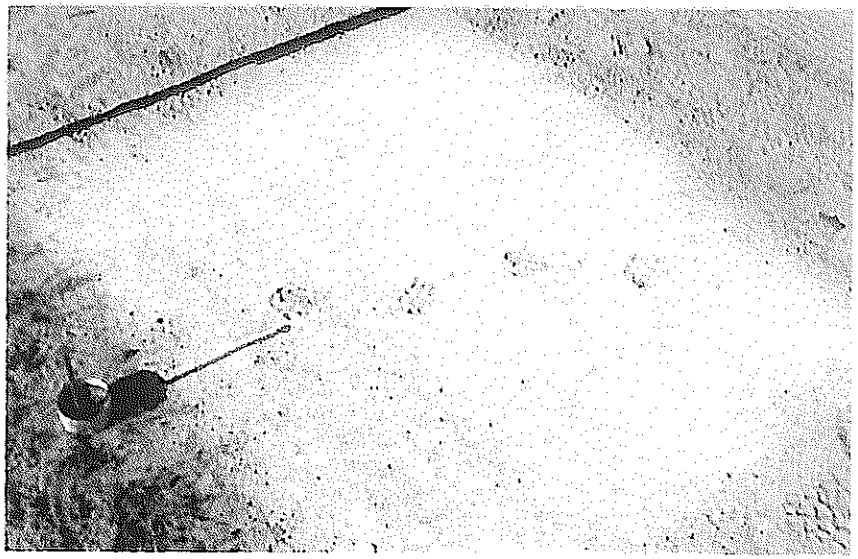


Figure 1. Opossum tracks observed on scent station.

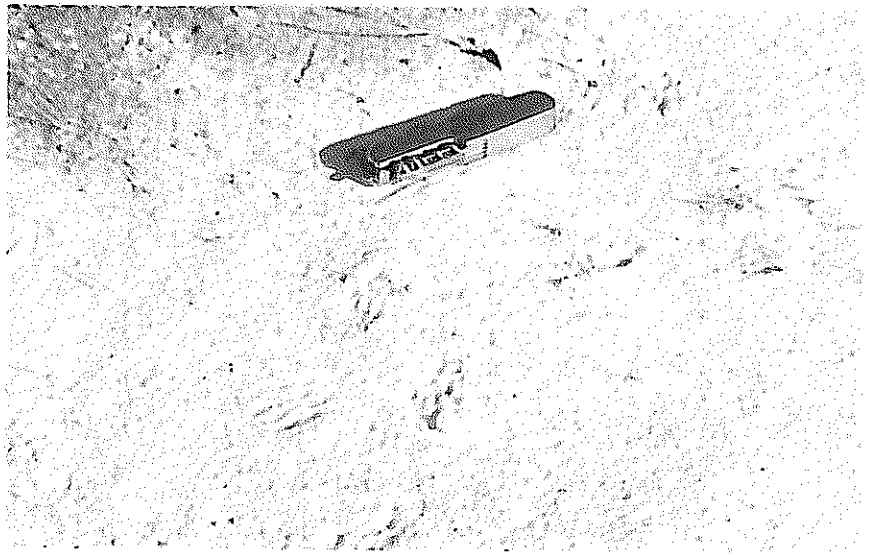


Figure 2. Example of California ground squirrel tracks on station.

Figure 3. California ground squirrel tracks on station.

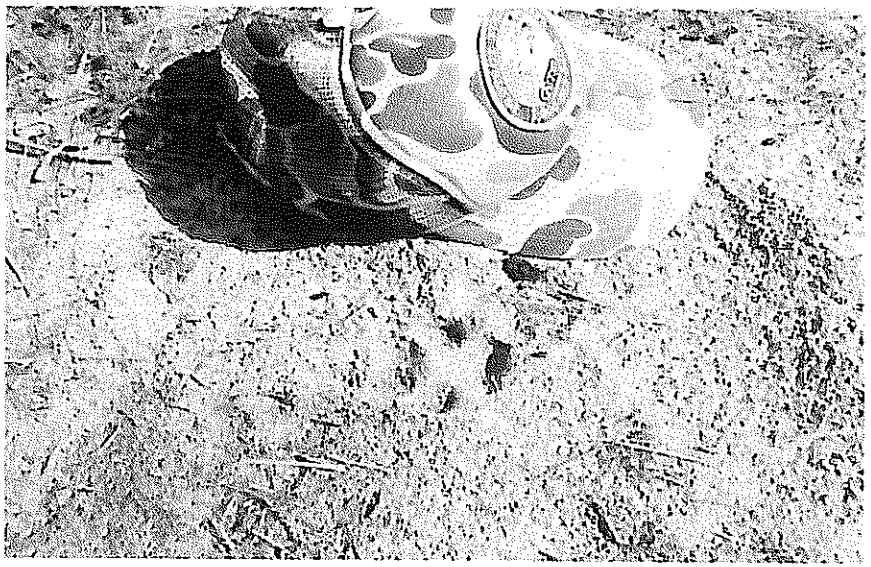


Figure 4. Example of coyote track on the project site.

Examples of San Joaquin Kit Fox scent stations. Photos by H&A in August 2007.
Rockwell Pond Specific Plan Project (Selma, Fresno County, California).

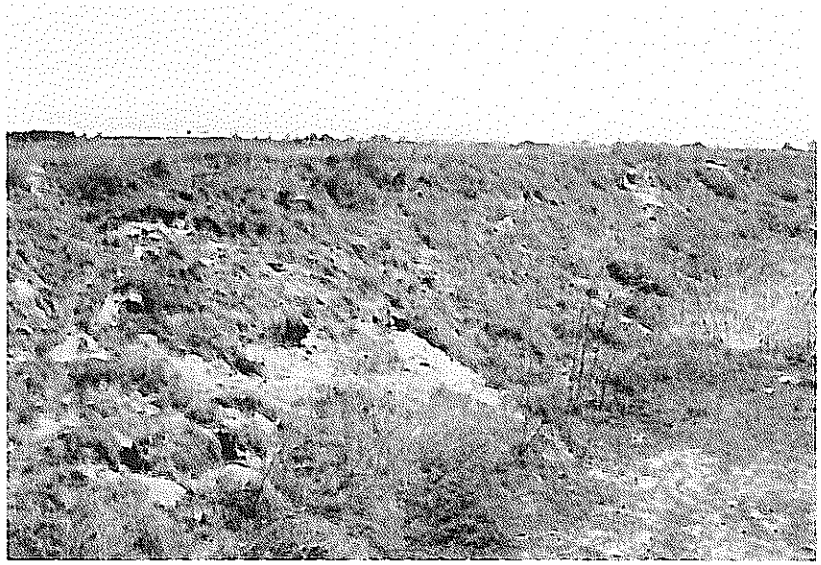


Figure 1. Squirrel burrows on the project site.

Figure 2. Squirrel burrow on the project site.

Figure 3. Potential dens on the project site.

Figure 4. Potential den on the project site.

Examples of potential San Joaquin Kit Fox dens on the project site. Photos by H&A in May 2007.

APPENDIX M

Examples of Scent Stations, Animal

Tracks, and Potential Kit Fox Dens