CALIFORNIA ENDANGERED SPECIES ACT

MEMORANDUM OF UNDERSTANDING

AND TAKE AUTHORIZATION

By and Between

OCCIDENTAL OF ELK HILLS, INC.

and

THE CALIFORNIA DEPARTMENT OF FISH AND GAME

regarding

NAVAL PETROLEUM RESERVE - 1
(ELK HILLS)

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NAVAL PETROLEUM RESERVE - 1 (ELK HILLS)

This California Endangered Species Act Memorandum of Understanding ("CESA MOU") is made and entered into by and between Occidental of Elk Hills, Inc., a Delaware corporation ("Occidental"), in its individual capacity and its capacity as the Elk Hills Unit Operator, and the California Department of Fish and Game (the "Department"), collectively "the Parties."

Occidental proposes to undertake a project that may cause the take of species of wildlife protected by the California Endangered Species Act, California Fish and Game Code §2050, *et seq.* ("CESA"). The Project is the subject of a federal Biological Opinion issued pursuant to a Federal Endangered Species Act, Section 7 consultation between the United States Fish and Wildlife Service ("USFWS") and the Department of Energy (Exhibit 1). In conjunction with the federal Biological Opinion, this CESA MOU prescribes management measures for the species that are to be incorporated into the Project. The management measures are designed to avoid, minimize, and mitigate adverse impacts to the species and to ensure that the Project will not destroy or adversely modify habitat essential to the species' continued existence. If the management measures are duly implemented, the Project can be completed in compliance with CESA. This CESA MOU will become effective upon execution by the Department and Occidental, and will cover all actions also covered by the Biological Opinion, provided that it shall also be revocable by Occidental in its sole discretion and without any cost or liability in the event that Occidental fails to acquire the United States' interest in the Elk Hills Unit from the Department of Energy and assume unit operator status for the Project.

AGREEMENT

The Parties agree to the following recitals of fact, definitions, terms, conditions, and other provisions:

1.0 DEFINITIONS

The following definitions shall govern interpretation of this CESA MOU:

1.1 *"Wildlife"* means all wild animals, birds, plants, fish, amphibians, and related ecological communities, including the habitat upon which the wildlife depends for its continued viability, as provided in Fish and Game Code §711.2.

1.2 *"Take"* means to hunt, pursue, catch, capture, or kill an individual of a listed species, or to attempt any such act. *"Take"* includes any act that is the proximate cause of the death of an individual of a listed species or any act a natural and probable consequence of which is the death of any individual of a listed species.

1.3 *"Management measure"* means any action deemed necessary by the Department to sustain a species within a natural ecological system. *"Management measures"* include legal, biological and administrative measures.

1.4 *"Elk Hills Unit"* means the real property located near Tupman, Kern County, California previously known as Naval Petroleum Reserve - 1 ("NPR-1"), the sale of the United States' interest in which is defined in Public Law 104-106 and is expected to occur at the Closing.

1.5 *"Elk Hills Unit Operator"* means the entity responsible for the operation and management of petroleum product recovery and related activities at the Elk Hills Unit on its own behalf and on behalf of other Elk Hills Unit participants. Upon its acquisition of the United States' interest in the Elk Hills Unit at the Closing, Occidental will become the Elk Hills Unit Operator.

1.5 *"Closing"* means the date on which the sale of the United States' interest in the Elk Hills Unit to Occidental becomes effective.

1.6 *"Biological Opinion"* means that biological opinion issued by the USFWS entitled "Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County," dated November 8, 1995.

2.0 RECITALS

2.1 The wildlife species identified on Exhibit 2 (the "Covered Species") have been listed pursuant to the CESA as either endangered or threatened, or are species of concern, and are known to exist at or in the vicinity of the Project, which consists of Occidental's acquisition,

operation and management of the Elk Hills Unit and continued oil and gas exploration, extraction, production, development, transport, processing and related activities at the Elk Hills Unit (collectively the "Project"). Life history information concerning the Covered Species is contained in Exhibit 3, which consists of relevant portions of the Draft Recovery Plan for Upland Species of the San Joaquin Valley, California, published in 1997 by Region 1 of the United States Fish and Wildlife Service. Occidental proposes to avoid, minimize and mitigate adverse impacts to the Covered Species that may result from the Project and has requested Take Authorization for the Covered Species from the Department, pursuant to Fish and Game Code §2081.

2.2 The Department is trustee for the fish and wildlife resources of the State of California and has jurisdiction over the conservation, protection, and management of fish, wildlife and native plants, and the habitat necessary for biologically sustainable populations thereof, pursuant to Fish and Game Code §1802. Under the objectives and policies of CESA, it is the Department's goal to conserve, protect, restore, and enhance the Covered Species and the Covered Species' habitat.

2.3 The Parties acknowledge that Occidental will not acquire the United States' interest in the Elk Hills Unit until the Closing, which is anticipated by the Parties to occur approximately February 2, 1998, but that Occidental has received a grant of option from the United States to acquire such interest sufficient to warrant issuance of this CESA MOU. The Parties are entering into this CESA MOU in anticipation of the Closing.

2.4 This CESA MOU is the result of a cooperative effort by the Parties to ensure that the Project may proceed as proposed to the extent it is consistent with CESA.

3.0 PROJECT DESCRIPTION

The description of the Project contained in the federal Biological Opinion (also described in Section 2.1 above) is hereby incorporated into this CESA MOU. Pursuant to the terms of the Biological Opinion (pages 19-20), the Project includes the temporary and permanent surface habitat disturbance of the Elk Hills Unit for continued oil and gas exploration, extraction, production, development, transport, processing and related activities, consisting of the following approximate totals: 3,240 acres of historic, pre-1976 permanent disturbance, 547 acres of disturbance unrelated to petroleum recovery operations, 482 acres of actual and future post-1976 temporary disturbance, 3,623 acres of actual and future post-1976 permanent disturbance, 691 acres of post-1976 pipeline disturbance, and 3,390 acres of minor post-1976 seismic survey disturbances. The parties estimate that approximately 50 acres of temporary and 828 acres of permanent disturbance remain under those totals. This estimate of remaining future surface habitat disturbance will be verified by existing surface area disturbance calculations to be completed within ninety (90) days after the Closing.

4.0 IMPACTS TO COVERED SPECIES

4.1 The Project will result in the temporary and permanent loss of potential habitat for the Covered Species as described in the federal Biological Opinion. Individuals of the

Covered Species that are displaced by the Project may escape direct injury, but will have to compete for food and living space in adjacent areas. Relocated individuals will be more vulnerable to disease, predation, and accidental death. Disturbance of the existing habitat will temporarily reduce the prey base and/or foraging area for individuals residing in the Project vicinity.

4.2 The Project's impacts on certain of the Covered Species are described in the federal Biological Opinion and are hereby incorporated into this CESA MOU.

4.3 Impacts to the San Joaquin Antelope Squirrel, western burrowing owl, and oil neststraw are not addressed specifically as such in the federal Biological Opinion. However, project impacts to these species are included in the federal Biological Opinion by implication, in that the habitat occupied or potentially occupied by them within the project area are generally contained within the habitat occupied by the other Covered Species, and the impacts of the project on them are consistent with the impacts to the other Covered Species.

5.0 TAKE AUTHORIZATION

Subject to the terms and conditions of the federal Biological Opinion and of this CESA MOU, specifically including this provision of the CESA MOU and pursuant to Section 2081 of the Fish and Game Code, the Department authorizes any take of Covered Species that is incidental to the Project as described in Section 3.0. Non-incidental take of the Covered Species by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents that is deliberate or that otherwise results from an act by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents outside the scope of the Project as defined in Section 3.0 is not authorized. The State Fully Protected blunt-nosed leopard lizard is known to occur on the Elk Hills Unit. Direct take of this species is not authorized by the Department at this time, despite its inclusion as a Covered Species. Implementation of take avoidance measures required by the federal Biological Opinion will avoid direct take of blunt-nosed leopard lizard and is authorized.

5.1 Department Notification and Approval.

Wherever the federal Biological Opinion requires that Elk Hills Unit Operator inform, notify, or obtain the approval of the USFWS, Elk Hills Unit Operator shall also inform, notify, or obtain the approval of the Department, if the information, notification, or approval concerns the Covered Species. Where the Department's approval is required, the Department shall abide by the schedule or time constraint, if any, imposed on the USFWS for providing its approval.

5.2 Project Representative.

At least thirty (30) days before the Closing, Elk Hills Unit Operator shall designate a representative responsible for communications with the Department, and for overseeing compliance with this CESA MOU and the attached federal Biological Opinion. The

Department shall be informed, in writing, of the representative's name, business address and telephone number, and shall be notified in writing if a substitute representative is designated.

5.3 Employee Orientation.

Elk Hills Unit Operator shall conduct an orientation program for all persons who will work on-site during construction. The program shall consist of a brief presentation from a person knowledgeable about the biology of the Covered Species and the terms of this CESA MOU and the federal Biological Opinion. The education program shall include a discussion of the biology of the Covered Species, the habitat needs of these species, their status under CESA, and the Management Measures in the federal Biological Opinion and this CESA MOU. A fact sheet containing this information shall also be prepared and distributed. Upon completion of the orientation, employees shall sign a form stating that they attended the program and understand all Management Measures. These forms shall be filed at Elk Hills Unit Operator's offices and shall be made available to the Department on request.

5.4 Notification Regarding Dead, Injured or Entrapped Animals.

If Elk Hills Unit Operator or any of its employees, contractors or designated agents kills or injures an individual of a Covered Species at the Elk Hills Unit, or finds any such animal dead, injured, or entrapped at the Elk Hills Unit, Elk Hills Unit Operator shall as soon as practicable (but in no event later than the first business day 24 hours after the Representative has knowledge of such death or injury) notify the Department by telephone. All reasonable efforts shall be made to allow any entrapped animals to escape. Any dead or injured animal discovered by Elk Hills Unit Operator or its contractors or designated agents at the Elk Hills Unit shall be turned over to the Department in a manner reasonably requested by the Department (or to USFWS consistent with the Biological Opinion), and a written report detailing the date, time, location and general description of the circumstances under which it was found must be submitted to the Department no later than three (3) business days after the Representative has knowledge of such death or injury.

5.5 Access to Project Site/Compliance Reports.

Elk Hills Unit Operator shall allow Department representatives access to the Project site, accompanied by the Representative, to monitor compliance with the terms and conditions of this CESA MOU, subject to any reasonable access restrictions requested by Elk Hills Unit Operator. A copy of the annual compliance report as required by the federal Biological Opinion will be provided to the Department, and will be augmented to include information regarding the San Joaquin Antelope Squirrel consistent with the information required for the other Covered Species.

5.6 Implementation of On-Going Wildlife Management Plan Components

Elk Hills Unit Operator shall continue to implement the on-going program components of the Wildlife Management Plan as described in the federal Biological Opinion.

Elk Hills Unit Operator will provide a description of the on-going program components for Department approval within thirty (30) days following the Closing.

5.7 Inventory of Disturbances

Elk Hills Unit Operator shall provide a baseline inventory of surface disturbances to the Department within ninety (90) days following the Closing, shall confer with the Department and the USFWS regarding the accuracy and adequacy of this inventory, and shall provide revisions as necessary.

5.8 Summary of On-Going Surface Disturbance

Elk Hills Unit Operator shall provide an annual summary of surface disturbances and reclamation to the Department within the first quarters of 1999 and 2000, unless this requirement is superseded by the requirements of the proposed long-term wildlife habitat and management plan cited in paragraph 6 below

5.9 Preparation of Permanent Wildlife Habitat and Management Plan

Elk Hills Unit Operator shall prepare a wildlife habitat and management plan for the Elk Hills Unit in consultation with the Department and USFWS and subject to Department approval. A draft plan shall be submitted to the Department for review no later than the end of the second quarter of 1998, and a final plan including supporting plans, agreements, and other elements, shall be prepared for Department approval by November 9, 1998.

5.10 Habitat Reserve

Consistent with the federal Biological Opinion, Elk Hills Unit Operator shall place into protected status at least 7,075 acres of Habitat Management lands on or adjacent to the Elk Hills Unit, at locations approved by the Department, and shall provide a suitable management plan and adequate funding for long-term management of those lands, subject to Department requirements. The Department may extend or revise this requirement to facilitate the transition from this interim CESA MOU to a proposed long-term wildlife habitat and management plan, and/or potential federal section 10(a) permit.

5.11 Additional Management Measures

Occidental shall comply with those Conservation Measures identified in Exhibit 4, if any, for the species that are not specifically provided for in the federal Biological Opinion.

5.12 Security for Faithful Performance

Within thirty (30) days following the Closing, Occidental shall provide to the Department a Conditional Standby Letter of Credit in the face amount of Seven Hundred Fifty

Thousand Dollars ($750,000.00), as security for Occidental's faithful performance of its obligations under Section 5.10 above.

6.0 DEPARTMENT FINDINGS

The Department finds that: (a) neither the Project nor this CESA MOU will result in jeopardy to the continued existence of the Covered Species if the terms and conditions of the federal Biological Opinion and this CESA MOU are fully implemented and adhered to, (b) through the identification and protection of conservation areas as specified in the federal Biological Opinion, the Covered Species may be afforded protection from further degradation, (c) the take authorized by this CESA MOU is incidental to an otherwise lawful activity, (d) the impacts of the authorized take pursuant to the federal Biological Opinion and this CESA MOU will be minimized and fully mitigated through adherence to the terms and conditions of the Biological Opinion and this CESA MOU, and (e) the Biological Opinion is consistent with CESA.

7.0 DEFAULT

In the event Elk Hills Unit Operator defaults on any of its material obligations under the federal Biological Opinion and this CESA MOU, the Department shall have all rights and all remedies available at law or in equity, including specific performance and injunction.

8.0 NOTICE

All notices and other communications required or permitted by this CESA MOU shall be in writing. Such writing shall be delivered personally, by courier, by telecopy, or by first-class or certified mail, return receipt requested. All default notices shall be sent certified mail, return receipt requested. Notices or transmittals shall be deemed delivered upon the earlier of actual receipt or three days after posting by certified mail, if delivered to the following addresses:

Elk Hills Unit Operator	Occidental of Elk Hills, Inc. 1200 Discovery Drive Box 12021 Bakersfield, CA 93389-2021 ATTN: Dennis L. Newman Environmental Manager
and to	Occidental of Elk Hills, Inc. 1200 Discovery Drive Box 12021 Bakersfield, CA 93389-2021 ATTN: General Counsel

DEPARTMENT	GENERAL COUNSEL Legal Affairs Division California Department of Fish and Game 1416 Ninth Street, Twelfth Floor Sacramento, California 95814
REGION	Regional Manager California Department of Fish and Game 1234 East Shaw Avenue Fresno, CA 93720 Attn: Dr. Jeffrey R. Single.

9.0 ASSIGNMENT

Any sale or assignment of this CESA MOU or any of the rights or obligations hereunder is void absent the written consent of the Department, which shall not be withheld or delayed without good reason; provided, however, that no consent shall be required for assignment or pledge made by Elk Hills Unit Operator (a) to any company that shall succeed by purchase, merger or consolidation to the stock, assets or properties of Elk Hills Unit Operator; or (b) as security for a debt under the provision of any mortgage, deed of trust, indenture, bank credit agreement, or similar instrument or pursuant to an exercise of remedies under any such security; and provided, further, that no consent shall be required for a transfer of an undivided interest in all or a part of Elk Hills Unit Operator's interest in this CESA MOU in conjunction with transfer of a corresponding interest in the Elk Hills Unit, so long as Elk Hills Unit Operator remains the operator of the Elk Hills Unit and is liable for performance of the duties and responsibilites of the Elk Hills Unit Operator pursuant to the CESA MOU.

10.0 ENTIRE AGREEMENT

This CESA MOU comprises the entire agreement and understanding between the Parties concerning the Project. This CESA MOU supersedes all prior and contemporaneous agreements, representation or understandings whether oral or written.

11.0 GOVERNING LAW

This CESA MOU shall be governed by the laws of the State of California. The Parties agree to attempt in good faith to resolve any dispute pursuant to this CESA MOU or the terms and conditions hereof through non-binding mediation prior to instituting litigation, except in exigent circumstances. If the dispute has not been resolved by mediation within fourteen (14) days of the Parties first meeting with the mediator, then either Party may seek to resolve the dispute by filing an action in the state or federal courts of California. Actual or threatened breach of this CESA MOU may be prohibited or restrained by a court of competent jurisdiction, subject to generally applicable requirements for injunctive relief.

12.0 BENEFIT OF CESA MOU

This CESA MOU is solely for the benefit of the Parties and the People of the State of California by and through the Department.

13.0 FURTHER ACTIONS

From time to time, the Parties shall by mutual agreement execute such instruments and other documents, and take such other actions, as may be reasonably necessary to carry out the terms of this CESA MOU. This CESA MOU cannot be amended or modified in any way except by a written instrument executed by the Parties. Any proposal for amendment or modification must be duly delivered for review and approval by the Director of the Department and by Elk Hills Unit Operator.

14.0 TERMINATION

This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 1999, unless otherwise extended in writing executed by all Parties.

15.0 DISCLAIMER

This CESA MOU contains the Department's requirements for the Project pursuant to CESA; barring material unforeseen circumstances, the Department shall not request additional mitigation or avoidance measures for the Project under authority of CESA. Elk Hills Unit Operator understands and recognizes that this CESA MOU does not constitute or imply compliance with applicable state or federal laws and regulations, other than CESA, and does not create an entitlement under other applicable laws and regulations to proceed with the Project.

16.0 EFFECTIVE DATE

This CESA MOU shall be immediately effective upon the later to occur of execution by the Parties or the Closing.

17.0 COUNTERPARTS

This CESA MOU may be executed in counterparts, in which case each executed counterpart shall be deemed an original.

18.0 EXHIBITS

This CESA MOU includes and incorporates the following:

EXHIBIT 1: FEDERAL BIOLOGICAL OPINION

EXHIBIT 2: COVERED SPECIES

EXHIBIT 3: LIFE HISTORIES

EXHIBIT 4: ADDITIONAL CONSERVATION MEASURES

IN WITNESS WHEREOF, THE PARTIES HERETO HAVE EXECUTED THIS MOU TO BE IN EFFECT AS OF THE DATE LAST WRITTEN BELOW.

OCCIDENTAL OF ELK HILLS, INC., a Delaware corporation

By: Don Romine Date: Dec 22, 1997
Don Romine, General Manager

CALIFORNIA DEPARTMENT OF FISH AND GAME

By:_____ Date:_____
C.F. RAYSBROOK, Interim Director

APPROVED AS TO FORM:

By:_____ Date:_____
CRAIG MANSON, General Counsel

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OCCIDENTAL OF ELK HILLS, INC., a Delaware corporation

By:_____ Date: _____
Don Romine, General Manager

CALIFORNIA DEPARTMENT OF FISH AND GAME

By: Jacqueline E. Schafer Date: 12-29-97
JACQUELINE E. SCHAFER, Director

APPROVED AS TO FORM:

By: Craig Manson Date: 12-24-97
CRAIG MANSON, General Counsel

EXHIBIT 1

FEDERAL BIOLOGICAL OPINION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-95-F-102

November 8, 1995

Mr. Danny A. Hogan, Director
U.S. Department of Energy
Naval Petroleum Reserves in California
P.O. Box 11
Tupman, California 93276

Subject: Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County, California

Dear Mr. Hogan:

This responds to your October 9, 1991, request for reinitiation of formal consultation pursuant to section 7(a) of the Endangered Species Act of 1973, as amended (Act), on a proposal by the U.S. Department of Energy (DOE or the Department) to continue oil production activities at Maximum Efficient Rate (MER) on Elk Hills Naval Petroleum Reserve (NPR-1 or the Reserve), Kern County, California. At issue are effects of proposed MER production on the federally endangered San Joaquin kit fox *(Vulpes macrotis* mutica), blunt-nosed leopard lizard *(Gambelia silus)*, giant kangaroo rat *(Dipodomys ingens)*, Tipton kangaroo rat *(Dipodomys nitratoides nitratoides)*, Kern mallow *(Eremalche kernensis)*, and San Joaquin wooly-threads *(Lembertia congdonii)*, and the federally threatened Hoover's woolly-star *(Eriastrum* hooveri). Your request for formal consultation was received by this office on October 15, 1991. The U.S. Fish and Wildlife Service (Service) provided a draft biological opinion to DOE on May 28, 1993. Formal comments from DOE on the draft opinion were received on December 8, 1994. Subsequent meetings between representatives from the Service, DOE and Chevron U.S.A. (Chevron) were held on February 8, March 3, April 20, and May 18, 1995, to discuss the content of the biological opinion.

The Service addressed effects on federally listed species of MER production activities on NPR-1 in two prior biological opinions dated February 1, 1980 (Case No. 1-1-80-F-2) and December 16, 1987 (Case No. 1-1-80-F-2R). The 1980 biological opinion concluded that MER oil production on NPR-1 may jeopardize the continued existence of the San Joaquin kit fox and blunt-nosed leopard lizard, but included six reasonable and prudent alternatives that, if implemented, would allow MER production to continue. The Department agreed to implement these alternatives and to complete a future consultation to evaluate their success in minimizing adverse effects of MER production on federally listed species.

The subsequent 1987 biological opinion concluded that MER production on NPR-1 would not jeopardize the continued existence of the San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat and giant kangaroo rat--which was listed as federally endangered in 1988. This conclusion was based, in part, on development and implementation by DOE of a comprehensive mitigation program designed to minimize adverse effects of MER production on federally listed species. In addition to this program, the 1987 opinion required the Department to implement several reasonable and prudent measures, including replacement of endangered species habitat lost as a result of project related actions.

The 1987 biological opinion also cited the Department's intent to develop a Supplemental Environmental Impact Statement (SEIS) concerning future oil production activities on NPR-1. The intent to develop such an update resulted from planning activities conducted concurrently with the 1987 consultation that determined that future oil development activities on NPR-1 could exceed some environmental impacts projected in the Department's original EIS completed in 1979 (DOE 1979). Accordingly, the Department published a Notice of Intent to prepare a supplemental ETS on NPR-1 activities in the Federal Register on April 4, 1988, completed a draft supplemental ETS (DSEIS) in May, 1992 (DOE 1992), and a final supplemental EIS (FSEIS) in July, 1993 (DOE 1993).

It is this supplemental EIS, together with Federal listing of several plant species--the Hoover's woolly-star, San Joaquin wooly-threads, and Kern mallow on July 19, 1990--that necessitates reinitiation of formal consultation and preparation of this revised biological opinion.

This biological opinion is based on the DSEIS (DOE 1992); the FSEIS (DOE 1993); a biological assessment prepared for currently proposed activities on NPR-1 (DOE 1991); several other reports (see Literature Cited section); meetings and discussions between the Service, Department, Chevron, and Energy Advisory Services, Inc. (EASI), the Department's biological contractor (formerly EG&C Energy Measurements); and information in our files.

BIOLOGICAL OPINION

Description of the Proposed Action

Elk Hills Naval Petroleum Reserve (or Naval Petroleum Reserve No. 1) was established in 1912 for national defense purposes, but was largely maintained in reserve shut-in status until 1976. Because of oil shortages in the early 1970's, Congress passed the Naval Petroleum Reserve Production Act in 1976, which provided for oil production on NPR-1 at the "Maximum Efficient Rate." Maximum Efficient Rate under this statute was defined as the maximum rate that optimizes both economic return and hydrocarbon recovery. The proposed action addressed in this biological opinion is continuing MER production on NPR-1 in compliance with the Naval Petroleum Production Act and as described in the DSEIS (DOE 1992)

NPR-1 consists of approximately 47,409 acres about 25 miles southwest of Bakersfield, California. Of this, 37,049 acres (78 percent) are administered by the Department of Energy; the balance of 10,360 acres (22 percent) is owned by Chevron (DOE 1992). To the south of and partially contiguous with NPR-1 lies Buena Vista Hills Oil Field which encompasses Naval Petroleum Reserve (NPR-2). Of approximately 30,000 acres comprising NPR-2, DOE administers about 10,000 acres and the balance is owned by private oil companies. The government's share of NPR-2 has been developed under lease by private oil companies since the 1920's. Together, NPR-1 and NPR-2 constitute what is known as the Naval Petroleum Reserves in California (NPRC).

Topographically, Elk Hills consists of a ridge about 16 miles long by six miles wide that runs east to west in the southern San Joaquin Valley. NPR-1 is surrounded on three sides by oil and gas fields and agricultural lands. On the north side, NPR-1 is immediately contiguous with a large area (approximately 30,000 acres) of relatively undisturbed endangered species habitat known as the Lokern Road area. Vegetation on NPR-1 consists primarily of saltbush scrub and grassland habitats.

Elk Hills is the seventh largest oil field in the United States (DOE 1991). It is a highly profitable field, cumulative net government revenues exclusive of Chevron's share from 1976 to 1990 totalling $11.6 billion (DOE 1992).

Hydrocarbon products recovered or produced on NPR-1 include crude oil, natural gas, and natural gas liquids including propane, butane, and natural gasoline. Of estimated original recoverable oil reserves on NPR-1, 860 million barrels have been produced--630 as the result of MER production since 1976 (DOE 1992). Oil production on NPR-1 peaked in 1981 at approximately 180,000 barrels per day and averaged approximately 74,000 barrels per day in Fiscal Year 1991 (DOE 1992). The Department estimates that oil production on NPR-1 could continue to be profitable until 2010 to 2025, perhaps longer (DOE 1992).

Existing Facilities

Existing operational facilities on NPR-1 include the following (DOE 1991): (1) 1,253 active wells (production, water source, gas injection, waterflood injection, wastewater disposal injection, and steam injection); (2) 1,055 existing wells that are shut-in (idle) or abandoned; (3) approximately 2,500 miles of pipelines and 1,000 miles of roads; (4) one crude oil tank farm; (5) 121 tank settings; (6) five LACT (lease automatic custody transfer) facilities used to separate oil from water and transfer oil to Chevron and Department purchasers; (7) 45 product storage tanks; (8) four gas-processing plants used to separate natural gas liquid products from natural gas; (9) five wastewater disposal facilities; (10) two gas injection plants; (11) 11 gas compression plants; (12) one steam injection facility used for thermally enhanced oil recovery; (13) several emergency wastewater sumps and two landfill facilities; (14) three building complexes for offices, maintenance, and storage; and (15) a variety of other supporting systems and infrastructure.

The majority of waste materials generated on NPR-1 are non-hazardous and include produced water, spent drilling fluids, and solid wastes such as paper, construction debris, and garbage (DOE 1991). Hazardous materials utilized or generated on NPR-1 include used oil, lubricants, and batteries; herbicides and pesticides; and solvent wastes (DOE 1991). Host produced water is re-injected on-site into subsurface formations; drilling fluids are placed into on-site land areas located in Sections 10G and 27R (the land area in Section 10G is temporarily idle). A hazardous waste facility in Section 27R was formally closed in 1992. Hazardous wastes are removed to off-site disposal facilities or are recycled (DOE 1991).

Despite careful handling, spills of oil or other chemicals occasionally occur on NPR-1. Since 1989, these have been handled in accordance with a Spill Prevention Control and Countermeasure Plan (BPOI 1989), which provides for an emergency response team, cleanup procedures, and documentation. Nonetheless, an unquantified number of acres on NPR-1 has been affected by such spills since 1976 and the Department currently is cleaning up approximately 64 sites known to have been contaminated by chromium, arsenic, and other materials (all 64 of these sites already have been remediated) (DOE 1991).

Activities necessary to achieve and maintain MER production on NPR-1 were first described in the original project EIS (DOE 1979). These activities have resulted in the construction of numerous oil production, processing, and storage facilities, associated infrastructure, and administrative facilities on NPR-1 since 1976 (see Environmental Baseline section). Because of evolving conditions, however, including better technical understanding of oil and gas reservoirs beneath NPR-1, the Department now proposes several new facilities believed to be necessary to maintain MER production through the 1990's and into the next century. These are described in the ESEIS (DOE 1993) and are summarized below. The Service completed a biological opinion in 1987 (File No. 1-1-80F-2R) that covers all of the on-going activities at NPR-1.

To maintain hydrocarbon production on NPR-1 at Maximum Efficient Rate, the Department proposes to conduct the following ongoing activities (DOE 1992) (those not pertaining to biological issues are omitted).

(1) Production at MER, estimated in the Long Range Plan to be approximately 99,000 bbl/day of oil in FY 1990, declining to approximately 72,000 bbl/day in FY 1995; 365 million ft/day of gas in FY 1990, increasing to 417 million ft/day in FY 1995; and 654,000 gal/day of natural gas liquid products in FY 1990, increasing to 768,000 gal/day in FY 1995;

(2) Drilling, redrilling or deepening approximately 382 existing wells (including 148 for the steamflood operation described below), performance of approximately 2,663 remedial jobs on existing wells, and abandonment of approximately 1,080 existing wells.

(3) Investigating, remediating, or otherwise managing numerous old and inactive waste sites.

(4) Activities to permit third parties to construct, operate, and maintain pipeline projects, geophysical surveys, and other projects on NPR-1 lands. Approximately 3-4 third-party projects are anticipated per year.

(5) A program to initiate revegetation on approximately 1,045 acres of previously disturbed lands no longer needed for production operations.

(6) Continued maintenance of the NPR-1 perimeter firebreak. This activity was addressed in prior biological opinions dated June 3, 1987 (Case No. 1-1-87-F-40), August 20, 1991 (Case No. 1-1-91-F-18), June 16, 1992 [Case No. 1-1-91-F-18(R)], and April 27, 1993 [Case No. 1-1-91-F-18(R2)].

In addition, the Department proposes to initiate the following new activities to maintain MER production on NPR-1 (DOE 1992).

(1) Construction and operation of a phased multi-year steamflood operation consisting of 148 wells on an approximately 500-acre area (referred to as the SOZ Steam Flood Project). This project represents an expansion of a 59-acre pilot steamflood project initiated in 1987 and addressed under a prior biological opinion (Case No. 1-1-85-F-22).

(2) Construction and operation of an additional waste water treatment facility.

(3) Construction and operation of a 5-acre butane isomerization facility.

(4) Construction and operation of a fourth gas compression and processing facility.

(5) Construction and operation of facilities to increase gas compression capacity for gas-lift and gas injection projects, and to increase waterflooding capacity.

To mitigate for adverse effects on federally listed species of ongoing and new MER production activities on NPR-1, DOE proposes to implement the following mitigation commitments as part of the proposed action. This program consists of the following components.

Mitigation Commitments

Conservation Area

Within three years of the date of this opinion, the Department shall place into protected status 7,075 acres of undisturbed endangered species habitat within, or adjacent to, NPR-1, and if appropriate NPR-2, preferably along the north side of NPR-1 adjacent to the Lokern Road area. This will be subject to agreement between the Service and the Department on a management agreement which would identify precise acreage amount, location, and management details

related to the conservation area. If this cannot be accomplished within 3 years, the Department agrees to reinitiate consultation if the Service is not satisfied with the progress that is being made. Such habitat shall be protected against major development activities in perpetuity through a management agreement or other appropriate document executed by and between the Director, NPRC and State Supervisor, FWS. The Department shall enter into written, legally binding agreement with the Service and other affected parties concerning the manner in which compensation lands shall be managed. This conservation area would satisfy any present or future requirements for compensating for the impacts described in the proposed action.

Prior to finalization of any land protection mechanism as required under this mitigation commitment, the Department shall submit for the Service's review the following information: (I) a description of lands selected for protection; (ii) the manner in which they would be protected; (iii) Department commitments with respect to how such lands would be managed, if necessary; and (iv) other information as deemed appropriate by the Department or Service. Finalization of the protection program shall not occur until written approval is obtained from the Service that the protection program is acceptable in all pertinent respects. The Service is available to assist the Department in selecting suitable NPR-1 lands for protection and for other assistance as necessary.

Wildlife Management Plan

This Plan was developed in 1987 to mitigate the effects of routine NPR-1 operation on endangered species and other wildlife; it requires or encourages the following: (I) conducting pre-activity surveys prior to surface disturbing activities; (ii) revegetation of disturbed areas; (iii) monitoring endangered species populations; (iv) controlling coyote populations as appropriate; (v) implementing operating guidelines; (vi) studying conservation and habitat restoration techniques; (vii) developing information and education programs for NPR-1 employees and contractors; and (viii) participating in endangered species recovery programs (O'Farrell and Scrivner 1987). Some activities conducted under the Wildlife Management Plan are discussed further below.

Endangered Species Research and Monitorina Program

In 1979 DOE initiated an endangered species monitoring program on NPR-1 and hired EG&G Energy Measurements, Inc. (EG&G) as its sole biological consultant. In part, EG&C was tasked with implementing reasonable and prudent alternative no. 1 in the Service's 1980 biological opinion--which required an evaluation of effects of oil field development on NPR-1, "basic research" on endangered species including collection of "baseline population and distributional" data, and development of methods to "increase carrying capacity" and "promote the conservation" of endangered species on NPR-1.

Since 1979 EASI has conducted extensive endangered species activities on behalf of the Department and has become an integral component of DOE's overall program on NPR-1 and NPR-2. From approximately 1979 to 1980, EAST conducted site-wide surveys on the Reserves to inventory endangered species populations (Thom Kato, EG&G, pers. comm.). From approximately 1980 to 1987, EASI gathered extensive data concerning kit fox distribution, abundance, mortality factors, and reproductive success within "developed" and "undeveloped" habitats on the Reserves (see Project Effects section). These data were reported in numerous topical reports prepared in 1986 and 1987 and in a biological assessment prepared in support of the 1987 formal consultation and biological opinion.

Operationally, EASI's role on the Reserves is currently divided into seven program "elements" (Thom Kato, EG&G, pers. comm.). These are (1) endangered

species monitoring, including monitoring of kit foxes, lagomorphs, small mammals, coyotes, and other federally listed species; (2) pre-activity surveys on NPR-1; (3) habitat reclamation and management (discussed below); (4) research and development (discussed below); (5) general program assistance, including section 7 consultation support; (6) assistance with third party projects on NPR-1 and NPR-2; and (7) endangered species support activities on NPR-2. An eighth program element previously included through approximately 1990--investigation of relationships between oil field materials and practices and wildlife--was placed as a task in the research and development element in Fiscal Year 1992, evidently because most tasks associated with this element either have been completed or deferred.

Under Element 4--research and development--EASI has conducted or proposed to conduct a variety of projects that are either independent of or indirectly related to other program tasks. Justification for these "research" studies derives in large part from language in the Service's prior biological opinions requiring or recommending, for example, development of methods to "increase carrying capacity" on NPR-1 (1980 opinion) and to conduct artificial kit fox den studies (1987 opinion). Projects conducted or ongoing under this element include, but are not limited to, a kit fox supplemental feeding study, a kit fox relocation project, a giant kangaroo rat habitat reclamation study, and a burn area re-seeding study. Projects proposed but not conducted to date include a kit fox artificial den study and a study of Bakersfield kit foxes associated with the relocation project (William Lehman, USFWS, pers. comm.).

NPRC has proposed an adjustment in the overall scope of its endangered species program from one that has been dedicated to gaining understanding (data collection, monitoring, research and studies) to one that for the most part is limited to reasonable avoidance, habitat reclamation, and habitat conservation, including the establishment of the on-site conservation area.

Monitoring would continue to be conducted in accordance with current scopes based on the following frequencies: Kit foxes would continue to be monitored annually through fiscal year 1996 (NPR-1, NPR-2, abundance, capture and tagging, prey and predators, i.e., lagomorphs, small mammals, coyotes and bobcats, diseases, sources and rates of mortality, and reproductive success). Absent a convincing scientific basis, after that kit fox abundance only would be monitored every 5 years. The abundance of all other protected species would be monitored annually through fiscal year 1999, and every 5 years thereafter.

NPRC proposes that no new data collection, research, or study activities would be initiated. Such activities currently in progress, however, would be completed, including a comprehensive effort that is in progress to integrate and document all data collected and all research/study information, analyses, and conclusions. The Service recognizes NPRC has conducted a great deal of valuable research of the sensitive species of Elk Hills. However, studies (particularly on the conservation area) should continue to gather information on endangered species management and range-wide recovery. Efforts can include habitat manipulations that will sustain and enhance the habitat quality on NPR-1; monitoring populations of listed and candidate species; beet leafhopper control and it's effect on blunt-nosed leopard lizards; etc. Ultimately, these studies should be designed to facilitate on-site endangered species conservation with an emphasis of range-wide recovery needs. The Department and the Service have agreed to address the issue of research/studies as part of the conservation area management agreement.

In late 1988, the DOE established an interagency committee to assist DOE and Chevron by providing additional perspectives on its endangered species programs on NPR-1 and NPR-2. Known informally as the Elk Hills Endangered Species Advisory Committee, this group is composed of representatives from DOE, Bechtel Petroleum Operations, Inc. (DOE's Unit Operator), EASI, Chevron,

the Service, California Department of Fish and Came, the California Energy Commission, the Bureau of Land Management, Enterprise Advisory Services, Inc., and the San Joaquin Valley Endangered Species Recovery Planning Program. The committee meets four times per year.

Habitat Reclamation and Compensation

Both prior biological opinions concerning MER production on NPR-1 discussed in detail the issue of habitat losses, resulting from MER production, and compensation for such losses. A reasonable and prudent measure in the 1980 opinion required DOE to "prepare a Master Plan for the restoration of disturbed habitat on NPR-1." The terms and conditions within the 1987 opinion required the Department to (1) complete an inventory of previously disturbed parcels at NPR-1 that could be rehabilitated to offset habitat loss associated with project activities, and (2) to develop a 10-year program to restore on-site disturbed acreage equivalent to that lost as a result of project activities.

Pursuant to these requirements, the Department in 1988 completed detailed disturbance mapping of NPR-1 based on current aerial photography, and in 1985 initiated a habitat reclamation program on NPR-1 and NPR-2. Through FY 1993, 899 acres of previously disturbed acres on NPR-1 had been replanted (EG&G 1995). While this represents all lands available for reclamation (i.e., lands that are abandoned and meet all reclamation criteria), the Department has estimated an additional 363 acres on NPR-1 will be available for abandonment and reclamation, through 1998 (DOE 1994). This would yield a total of 1,262 acres revegetated as a result of the Department's reclamation program through 1998. In addition, approximately 920 acres of disturbed lands on NPR-1 have revegetated naturally (DOE 1991).

The issue of how the Department's habitat reclamation program relates to its overall obligation to compensate for habitat losses on NPR-1 resulted in considerable discussion during the current consultation. Based on the requirement within the 1987 opinion to restore "equivalent on-site acreage" DOE questioned whether its habitat reclamation program alone was not sufficient to compensate for MER related disturbances, provided equivalent acreage was revegetated. However, for the following reasons the Service did not consider habitat reclamation alone to be adequate. First, the 1987 biological opinion states that equivalent on-site acreage should be restored "at a minimum". Second, both prior opinions also mention other compensation methods, including zoning for no development, purchase of off-site habitats and contribution of funds. Third, "equivalent" reclamation (at a 1:1 ratio) would not be consistent with San Joaquin Valley compensation policy as developed by the Service and California Department of Fish and Game through numerous prior projects--which typically requires a 3:1 compensation ratio for permanent habitat impacts and a 1.1:1 ratio for temporary impacts in saltbush scrub habitats. Finally, in previous projects, revegetation of disturbances resulting from a project typically is not credited to the compensation obligation for that project but is considered a separate mitigation measure.

On the other hand, the Service recognizes that DOE has in good faith expended considerable effort and expense on its habitat reclamation program based in part on the Service's recommendations and requirements. Because of this, the Service has worked with the DOE to develop a compensation program for NPR-1 that would utilize standard compensation policies, recognize the Department's reclamation efforts, and encourage continuation of such efforts.

Studies near completion demonstrate that in some cases reclamation projects are no more effective than natural revegetation for habitat restoration. In situations where natural revegetation is effective, NPRC would limit reclamation to only those activities needed to stabilize soils while natural revegetation is occurring. Procedures for reclamation would be developed in

collaboration with the Service and other professionals as appropriate. Otherwise, habitat reclamation and success monitoring would continue in a manner similar to current procedures. Existing disturbances would be reclaimed as they are identified as no longer being needed for oil field operations.

The resulting program is based on the following assumptions: (1) because MER development has primarily been considered a single integrated project under this and prior biological opinions, and not as a series of separate projects, the habitat compensation obligation for MER development should apply retro-actively to 1976 for the unfulfilled portion of habitat reclamation obligations stemming from the 1987 biological opinion; (2) that habitat disturbances resulting from MER development should be compensated at the same rate as other San Joaquin Valley habitat losses; (3) that habitat disturbances on NPR-1 that have recovered naturally should not count as credits toward DOE's compensation obligation, since they are fortuitous and not the result of its reclamation program; and (4) that all acres revegetated or planned for revegetation under the DOE's reclamation program should be credited toward its compensation obligation, even though many reclaimed areas were disturbed after MER development began. The latter assumption is also based on the fact that the Department's reclamation program is a relatively large-scale, systematic effort being applied to a wide variety of disturbances on NPR-1. We therefore regard it as a programmatic effort rather than merely a project effort.

Finally, to satisfy DOE's compensation obligation, the Service and Department have discussed conceptually the possibility of placing portions of NPR-1 into protected status for the primary purpose of endangered species management. The Service considers this a suitable strategy because significant areas of NPR-1 are relatively undisturbed (especially along its periphery); and because NPR-1 and undisturbed portions of NPR-2 are contiguous with other important native habitats, including the Buena Vista Valley and the Lokern Road area.

Based on the above discussion, the Department has agreed in principle to compensate for habitat losses associated with MER development on NPR-1 by placing into protected status a total of 7,075 acres of undisturbed lands on NPR-1 and NPR-2. This figure is based on estimated temporary disturbance of 318 acres and estimated permanent disturbance of 2,525 acres resulting from MER development, utilizing agreed-upon compensation ratios and minus all acres revegetated or planned for revegetation under DOE's reclamation program established pursuant to the 1987 biological opinion: i.e., 318 temporary acres X 1.1 = 350 acres; 2,525 permanent acres X 2 or 3 = 5,965 acres; 350 + 5,965 = 6,315 total compensation acres + 691 acres of temporary disturbance for third party projects (691 x 1.1 – 760); 6,315 + 760 – 7,075 (DOE 1995). The derivation of temporary versus permanent disturbances is explained in the Project Effects section below.

Plant Mitigation Commitments

To protect federally listed plants and plant species of concern on NPR-1, the Department also has agreed to the following measures.

(1) The Department will complete one comprehensive floristic survey of NPR-1 for all State and Federal endangered, threatened, candidate, and special concern species in the areas of NPR-1 where this kind of a survey has not already been completed. The Department agrees to complete the survey by the end of the fourth growing season, subject to adequate precipitation following permit issuance. Within 60 days of permit issuance, NPRC will provide a written scope of work for the survey to the Service for review comment, and approval. The scope of the surveys will be developed informally in collaboration with Service personnel from the outset. The scope will address such things as priorities, precipitation criteria, reporting requirements, and schedules. Service comments and approval on

the scope are to be provided to NPRC within 60 days. Within 6 months following the completion of each year's survey, the Department will complete a topical report covering the results and findings for that year's survey, including mapping. Within 6 months following the completion of the last year's survey, the Department will complete a topical report covering the results and findings for the four year survey.

(2) With the exception of Hoover's woolly-star, the Department will initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants.

(3) To minimize adverse effects of oil and gas production on Hoover's woolly-star, the Department will implement the following protective measures:

a. The Department will conduct preactivity surveys for Hoover's woolly-star for all projects and to make every reasonable effort to conduct them during the Hoover's woolly-star's growing season.

b. If Hoover's woolly-star is known or thought to be in a project area, every reasonable effort will be made to avoid them by relocating and/or reconfiguring the project.

c. If it becomes necessary to locate a project in an area where Hoover's woolly -star is known or thought to be present, every reasonable effort will be made to wait until after seed set before beginning ground disturbances. When disturbances occur after seed set, 2 to 4 inches of topsoil will be conserved and respread within one year, if possible, within appropriate Hoover's woolly-star habitat at a site that is being revegetated outside the conservation area. If it is not possible to meet the 1-year time frame, the topsoil shall be stockpiled and respread within appropriate habitat outside the conservation area as soon as possible.

d. It will not be necessary to protect Hoover's woolly-star that has become reestablished in previously disturbed areas.

(4) The Department will include Hoover's woolly-star habitat in the conservation area.

(5) The Department will use locally obtained native seed for revegetation to the extent commercially available at competitive prices.

(6) The Department will ensure that the habitat of the four oil neststraw *(Stylocline citroleum)* populations known to exist in Sections 10R, 12R, and 17S, is not developed.

Species Account/Environmental Baseline

San Joaquin Kit Fox. The endangered San Joaquin kit fox historically was distributed within an 8,700-square mile in central California from the vicinity of Tracy in the upper San Joaquin Valley south to the general vicinity of Bakersfield. Intensive agriculture, urbanization, and other land-modifying actions have eliminated extensive portions of habitat and are the most significant causes of this species' endangerment. The coyote and the introduced red fox compete for food resources with the smaller kit fox, and are suspected of preying upon kit foxes as well. Predation, competition, poisoning, and road kills contribute substantially to the vulnerability of this species. Kit foxes currently are limited to remaining grassland, saltbush, open woodland, and alkali sink valley floor habitats, and similar habitats located along bordering foothills and adjacent valleys and plains.

Although in the southern San Joaquin Valley, they appear to make extensive use of habitat fragments in an urbanizing environment.

Giant Kangaroo Rat. The giant kangaroo rat was distributed historically from southern Merced County, south through the San Joaquin Valley, to southwestern Kern County and northern Santa Barbara County. Preferred habitat is native annual grasslands with sparse vegetation, good drainage, fine loamy soils, and slope of less than 10 percent. Significant populations survive only in a few areas of remaining habitat, including the Pahoche Hills, Cuyama Valley, Carrizo and Elkhorn Plains and the Lokern area.

Kangaroo rats typically inhabit areas of open ground which tends to facilitate their mode of locomotion. Such areas include rangeland, wildlands, and farmlands that have not been recently cultivated or disced. Kangaroo rats can repopulate formerly cultivated areas from adjoining occupied habitat.

Blunt-Nosed Leonard Lizard. The blunt-nosed leopard lizard was distributed historically throughout the San Joaquin Valley and adjacent interior foothills and plains, extending from central Stanislaus County south to extreme northeastern Santa Barbara County. The blunt-nosed leopard lizard prefers open, sparsely vegetated areas of low relief and inhabits valley sink scrub, valley saltbush scrub, valley/plain grasslands, and foothills grasslands vegetational communities.

Adult lizards often seek safety in burrows, while immature lizards use rock piles, trash piles, and brush. The lizards use burrows constructed by mammals, such as kangaroo rats, for overwintering and aestivation. The habitat of the lizard has been significantly reduced, degraded, and fragmented by agricultural development, petroleum and mineral extraction, livestock grazing, pesticide application, and off-road vehicle use. Today its distribution is limited to scattered parcels of undeveloped land, with the greatest concentrations occurring on the west side of the valley floor and in the foothills of the Coast Range. The 1985 revised recovery plan (FWS 1985) identified habitat essential for the survival and recovery of the species, priority habitat areas, and areas that could be restored to habitat.

Tipton Kangaroo Rat. The Tipton kangaroo rat inhabits saltbush scrub and alkali sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley. They currently inhabit approximately 4 percent of their historic range. Tipton kangaroo rats commonly dig burrows on elevated ground which is not subject to flooding. However, areas which are flooded in winter and spring are occasionally colonized during the dry season. The preferred location for Tipton kangaroo rat burrows typically involves alluvial fans and floodplains and includes fine, highly alkaline sands and, to a lesser degree, alkaline sandy loams. In addition, they generally burrow around the bases of woody shrubs. One of the smallest kangaroo rats, the subspecies is often found in areas also occupied by the larger Heermann's kangaroo rat.

Hoover's woolly-star. Surveys have shown that Hoover's woolly-star populations range from the upper Cuyama Valley near Ventucopa, Santa Barbara County, northward to the Panoche Hills in San Benito County, a distance of approximately 140 miles. Hoover's woolly-star occurs in 42 USGS 7 ½ minute quadrangles within Kings, Kern, San Luis Obispo, Santa Barbara, San Benito, and Fresno counties. Hoover's woolly-star occurrences primarily are located within four areas. The four areas from largest to smallest are: (1) the Kettleman Hills area, (2) the Carrizo Plain-Elkhorn Plain-Temblor Range-Caliente Mountains-Cuyama Valley-Sierra Madre Mountains area, (3) the Lokern-Elk Hills-Buena Vista Hills-Coles Levee-Maricopa-Taft area, and (4) the Antelope Plain-Lost Hills-Semitropic area. Additional, more isolated populations occur throughout the region. An intra-agency draft recovery plan has been developed for Hoover's woolly-star.

Kern Mallow. Kern mallow was first described as *Eremalche kernesis* (Wolf 1938). The most recent treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* (Greene) Greene ssp. *parryi*. Bates' treatment of Kern mallow, which includes both white- and purple-flowered gynodioecious plants, has not widely been accepted by the scientific community. Due to the debate within the scientific community over the newest treatment, the Service intends to undertake a status review to solicit available scientific information on which to base a determination of the appropriate taxonomic circumscription of Kern mallow. In the interim, the Service shall continue to consider the listed entity to be *E. kernensis* C.B. Wolf, which was the circumscription used when Kern mallow was listed in 1990. The endangered Kern mallow is a small annual herb of the mallow family 2 to 4-inches in height primarily with white flowers (USFWS 1989). Kern mallow is restricted to the eastern base of the Temblor Range, occurring from the vicinity of McKittrick to near Buttonwillow within valley saltbush scrub in Kern County (Taylor and Davilla 1986). The species is threatened by oil and gas development, transmission line maintenance or expansion, agricultural conversion, overgrazing by livestock, exotic plant competition, and off-road vehicle use. An intra-agency draft recovery plan has been developed for Kern mallow.

San Joaquin wooly-threads. The endangered San Joaquin wooly-threads is a small annual herb of the sunflower family and is endemic to the San Joaquin Valley of California. Its white-wooly stems, only three inches long, often trail along the ground. Flowers are about. 1/4-inch in diameter, lack ray flowers, and have a yellow center. San Joaquin wooly-threads once ranged throughout the floor of the San Joaquin Valley from western Fresno County and eastern Tulare County south to the foothills of the Tehachapi Mountains, reaching into San Benito County on the northwestern part of its range following the rain shadow of the South Coast Ranges (Taylor, 1989). Little is known of the habitat preferences of San Joaquin wooly-threads. It appears to favor non-alkaline soils of sandy or silty sand texture and an arid climatic regime (Taylor, 1989). Much of the habitat for San Joaquin wooly-threads has been eliminated by conversion of annual grassland sites to agriculture. An intra-agency draft recovery plan has been developed for San Joaquin wooly-threads.

Endangered Species Surveys/Status

In 1979, when the Department began its endangered species program on NPR-1, kit foxes were numerous and widely distributed within the Reserve. In 1984, kit fox dens were observed on all but two sections (DOE 1991). However, since 1979 the kit fox population on the NPR-1 "study area" has declined from a high of 144 animals in the winter of 1981-1982 to a low of just 12 animals in the winter of 1991-1992. In addition, kit foxes have disappeared from the central upland portions of NPR-1--where most oil development has occurred--and now appear to be confined to the flatter peripheries of NPR-1. This decline and the status of kit foxes on NPR-1 is discussed in detail in the Project Effects section. However, Elk Hills continues to be very important for the long-term survival and recovery of the San Joaquin kit fox.

Distribution of other federally listed species on NPR-1 typically is more restricted than that of kit foxes. From 1979 to 1987, a total of only 136 blunt-nosed leopard lizards were observed in only 28 of NPR-1's 74 sections (DOE 1991). Leopard lizards typically are found in washes and areas of low relief around the periphery of the Reserve, especially in the Buena Vista Valley along the NPR-1/NPR-2 border; however, leopard lizards also have been observed in six sections in the NPR-1 central uplands. Recorded leopard lizard densities on NPR-1 vary from 0.16 to 0.24 individuals per acre (DOE 1991).

Giant kangaroo rat burrow systems have been observed in 30 sections of NPR-1 (DOE 1991). Like the leopard lizard, the majority of these burrow systems

occur in the Buena Vista Valley, though a few burrows also have been observed in the central uplands. In recent surveys, however, many of these burrow systems have been found to be inactive, possibly because of drought conditions from 1987 to 1991. Giant kangaroo rat burrows on NPR-1 were observed at elevations ranging from 316 to 1,510 feet.

The California Aqueduct is cited in Williams (1985) as the approximate line between the ranges of the Tipton kangaroo rat and the short-nosed kangaroo rat *(Dipodomys nitratoides brevinasus)*. Consequently, Tipton kangaroo rat distribution on NPR-1 is confined to those small portions of the Reserve east of the aqueduct. During a three-night trapping census conducted in 1988, six to 12 Tipton kangaroo rats were captured per night in this area (DOE 1991).

Initial field surveys for the Hoover's wooly-star and other federally listed plants were conducted on NPR-1 in spring 1988 (EG&G 1988, DOE 1991). A total of 28 Hoover's wooly-star populations were observed, primarily restricted to alluvial fans along the lower flanks of the Reserve in Sections 4B, 10B, 12G, 7R, 8R, 10R, 12R, 13R, 32R, 17S, 18S, 20S, 21S, 22S, 23S, and 26S (DOE 1991). Further surveys were conducted in 1991 and additional wooly-star populations were observed in Sections 3B, 12B, 13B, 1G, 10G, 25S, 27S, 30S, 31S, and 14Z (EG&G unpublished data). Hoover's wooly-star populations on NPR-1 tend to occur in areas where other vegetation is sparse such as washes and formerly disturbed sites (e.g., the NPR-1 firebreak and abandoned roadways). Four populations were found at or above 1,000 feet in elevation (EG&G 1993).

The Kern mallow, San Joaquin wooly-threads, and California jewelflower *(Caulanthus californicus)* were not observed during these surveys. However, apparently suitable habitat for Kern mallow was observed in the northwestern portion of NPR-1 (Sections 12Z, 13Z, and 14Z), and the species likely exists here in low numbers or may become established within the foreseeable future (DOE 1991). Potential habitat for San Joaquin wooly-threads also was observed along the northern flanks of NPR-1, but these habitats may be suboptimal because of the dense cover of red brome present (DOE 1991). Based on these data the Service concludes that the Kern mallow and San Joaquin wooly-threads may be present within NPR-1 and may be affected by proposed project activities within the remaining life of the NPR-1 oil field. Suitable habitat for the California jewelflower probably does not exist on NPR-1 (DOE 1991).

Effects of the Proposed Action on Listed Species

Adverse effects of continued MER production on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads, and Hoover's woolly-star may result from numerous sources. During construction activities, individual animals may be directly injured or killed by vehicle strikes resulting from construction related traffic, through inadvertent crushing or entombment in collapsed dens or burrows, or through entrapment in construction related holes or trenches. Also during construction, individual mallow, wooly-threads, or woolly-star populations may be crushed or damaged by vehicle traffic or destroyed by grading, pipeline trenching, and related disturbances. Seedbanks of these plants also may be buried or otherwise destroyed. Other forms of death or injury to federally listed species may result from wildfires inadvertently ignited during welding operations, contact with oil spills, sumps, and inundation of animals during release of hydrostatic pipeline test water.

Individual kit foxes, leopard lizards, kangaroo rats, and plant populations also may be subject to harm and mortality during routine day-to-day operations on NPR-1. Factors contributing to such harm and mortality include routine vehicle traffic, routine grading associated with well drilling and access road construction, oil spills, contamination by commonly used oil field chemicals, habitat degradation (discussed below), and other routine operations.

In addition, individual kit foxes, leopard lizards, and kangaroo rats may be subject to harassment during NPR-1 construction and other activities resulting from increased levels of human disturbance, destruction or excavation of dens and burrows, entrapment in open pipes and construction related trenches, and other factors. Some animals may escape direct injury during such activities but become displaced into adjacent areas. These animals may be vulnerable to increased predation, exposure, and stress through disorientation and loss of shelter.

To date, effects discussed above have been substantially minimized by the Department's endangered species mitigation program. A key component of this program is the practice of conducting preactivity surveys prior to all surface disturbing activities. Preactivity surveys are conducted according to "Operational guidelines for conducting endangered species preactivity surveys on Naval Petroleum Reserve #1, Kern County, California" (Kato and O'Farrell, 1987). Based on available data, the Service concludes that DOE has done a good job of implementing its preactivity survey program (EG&G 1992). In 1980, 74 percent of all NPR-1 projects were conducted without preactivity surveys, while in 1984 and 1985 all projects conducted on NPR-1 were preceded by surveys (Kato 1986). Pre-construction surveys continue to be implemented on NPR-1 on a regular basis (Thom Kato, EG&G, pers. comm.). However, some problems exist in ensuring that recommendations resulting from such surveys actually are implemented. For example, in Fiscal Year 1991 recommendations were not implemented in 22 of 175 projects (12.6%) for which preactivity surveys were conducted, and recommendations were not followed in 3 of 90 surveys (3.3%) in Fiscal Year 1992. The instances noted above where the recommendations were not followed did not result in take of endangered species.

Since the December 1987 Biological Opinion, the number of deaths that occurred as a result of DOE/NPRC activities included 2 kit foxes and 2 blunt-nosed leopard lizards. Twenty-four giant kangaroo rat burrows were disked in 1988 during firebreak maintenance but the actual number of individuals killed was not determined. From a historical perspective, a total of 49 San Joaquin kit foxes, 7 blunt-nosed leopard lizards, and 72 giant kangaroo rats have been reported killed or injured as a result of the factors discussed above since 1980. (EG&G unpublished data). Of these, 11 San Joaquin kit foxes, 2 blunt-nosed leopard lizards, and 6 giant kangaroo rats have been killed or injured as a result of the Department's endangered species research program. No Tipton kangaroo rats are known to have been killed or injured during HER activities on NPR-1.

Based on radio-collar data, 291 kit foxes were recovered dead on NPR-1 from 1980 to 1988. Of these, cause of death for 29.9 percent was classified as predation (primarily by coyotes), 24.7 percent as probable predation, 10.0 percent as vehicle strikes, and 3.1 percent as other causes (DOE 1991). Cause of death for 32.3 percent of kit foxes recovered could not be determined. Excluding these foxes, 80.7 percent of foxes for which cause of death could be determined were killed by predation, 14.7 percent by vehicle strikes, and 4.6 percent by other causes (DOE 1991). Mortality sources other than predation and vehicles included disease, shootings drowning, and burying.

Following is a detailed discussion of the effects of past and proposed future MER activities on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, federally listed plants, and their habitats (USFWS 1987).

San Joaquin Kit Fox

DOE/NPRC has studied the San Joaquin kit fox population on NPR-1 intensively since 1980 on a 28,480-acre area encompassing the southern half of the Reserve and 2,880 acres in adjacent Buena Vista Valley known as the NPR-1 study area.

The NPR-1 study area contains 16,640 acres defined as "developed" habitat and 11,840 acres defined as "undeveloped" habitat; a square mile containing more than 15 percent of developed land (oil wells, roads, etc.) is defined as developed, and a square mile containing 15 percent or less of developed land is defined as undeveloped (DOE 1991). The areas (developed or undeveloped) are largely contiguous; the range of percent developed in the areas considered was 0.5% to 46.3%; and some sections were divided into half-sections when the developed and undeveloped areas were delineated. Studies conducted by EASI on NPR-1 have included monitoring of kit fox population size, reproductive success, diet, mortality factors, movement patterns, and den characteristics. In part, their purpose has been to determine effects of MER related oil development on the resident kit fox population.

Between 1981 and 1991, EASI has estimated the San Joaquin kit fox population on the NPR-1 study area and on NPR-2 (beginning in 1983) twice annually based on intensive trapping sessions and capture-recapture data (once annually since Fiscal Year 1992). In 1988, trapping sessions were extended to include the entire civil boundaries of NPR-1 in an effort to detect differences in kit fox abundance or distribution between the study area and the Reserve as a whole.

During the period since detailed studies began (1980), the minimum known kit fox population within the NPR-1 study area declined from a high of 165 foxes in the winter of 1981-1982 to 44 foxes in the winter of 1985-1986 (DOE 1991). Similarly, the minimum known population size declined from a high of 167 foxes in the summer of 1982 to 55 foxes in summer 1985 (DOE 1991). The population appeared to stabilize at 40 to 50 kit foxes through approximately 1990, but recent evidence suggests the population has again declined. In winter 1991 the minimum population size was as low as 12 in the NPR-1 study area, but has increased to 40 in 1993 (EG&C unpublished data).

This San Joaquin kit fox population decline on NPR-1 was discussed at length in the Service's 1987 biological opinion and remains a subject of concern. It has been discussed in the biological assessment (DOE 1991), DSEIS (DOE 1992), numerous Elk Hills Endangered Species Advisory Committee meetings, as well as other documents and forums. However, the exact cause of the decline has proven difficult to determine.

Several factors have been considered in attempting to explain this decline, including: (1) the effects of MER development; (2) the endangered species research program; (3) effects of an extended drought in California; and (4) other natural or human-caused factors. In addition, this decline may reflect a general decline in the species due to range-wide habitat degradation.

MER Development. As required under the Service's 1980 biological opinion, the Department attempted to determine the effects of MER development on kit foxes through studies conducted by EASI from 1980 through 1986. Based on these studies, EASI and DOE concluded that the NPR-1 kit fox decline has occurred at similar rates in developed and undeveloped habitats (DOE 1991). This conclusion in turn suggests that MER development has not affected the NPR-1 kit fox population in a significant manner.

However, several factors suggest that these conclusions may not be accurate. First, the kit fox population on NPR-2--where little oil development occurred compared to NPR-1 during the same time period--has declined significantly less than on NPR-1. The NPR-2 kit fox population numbered 177 animals in the summer of 1983 and 113 in the summer of 1989 (EG&C unpublished data). Based on winter data, the NPR-2 kit fox population appears even more stable compared to NPR-1 (119 foxes in the winter of 1983-1984 and 131 in the winter of 1988-1989) (DOE unpublished data). Recent kit fox trapping data presented in the draft FY93 annual progress report shows that kit fox abundance differed between NPR-1 and NPR-2, but that they exhibited similar trends. In addition,

the 1993 minimum population size has increased on NPR-2 to 108 foxes, just as on NPR-1.

Second, circumstantial evidence suggests that the kit fox decline on NPR-1 has been greater in the central upland portions of the Reserve, where most oil development has occurred, than in the flatter lands along its periphery, which are relatively undeveloped. This change in distribution is demonstrated by the fact that few foxes have been captured in the central uplands in recent years, where they were relatively numerous in the early 1980's. By far most kit foxes currently are captured in the flatter undeveloped periphery of the Reserve (Thom Kato, EG&G, pers. comm.). The Department has concluded that kit foxes are presently found on their preferred habitat on NPR-1.

Several factors with respect to MER development can probably be eliminated as causing the kit fox decline on NPR-1. First, it is unlikely that den loss has contributed significantly to the decline. Between 1980 and 1986, only 5 known kit fox dens were destroyed inadvertently as a result of the MER production and another 20 were intentionally excavated to avoid burial of resident foxes (DOE 1991). However, these losses appear to be relatively insignificant since during the same period approximately 946 dens were known to be utilized by kit foxes (Berry et al. 1987).

Contamination of kit foxes by heavy metals commonly associated with oil fields also appears to be minimal. Kit fox hair samples collected from kit foxes on NPR-1 developed lands, NPR-1 undeveloped lands, NPR-2, Camp Roberts, and the Elkhorn Plain were analyzed by Oak Ridge National Laboratory in Oak Ridge, Tennessee (Suter et. al. 1992). Results indicated that kit foxes on NPR-1 exhibited little evidence of contamination by the elements studied, including arsenic, barium, vanadium, chromate, or uranium. Although a few foxes showed high tissue concentrations of some elements, most levels were associated with background soil concentrations or were highest in undeveloped reference sites. Heavy metal concentrations evidently were not great enough to account for the kit fox decline on NPR-1.

The Endangered Species Research Program. The intensive kit fox research and monitoring program conducted on NPR-1 by EASI has occasionally been cited as a possible contributor to the NPR-1 kit fox decline (e.g. O'Neil and Greer 1988). Throughout the life of the program, approximately two thousand kit foxes have been captured and 486 foxes have been radio collared (Thom Kato, EG&G, pers. comm.). All foxes captured, whether collared or not, have been equipped with individually numbered ear tags. Research factors possibly contributing to the kit fox decline include lowering of kit fox survivorship as a result of wearing radio collars, spread of disease through trapping and handling, and loss of kit foxes to research accidents.

At the Service's request, DOE/NPRC considerably expanded their studies of the effects of EASI's radio-collar program on kit foxes in 1992. Utilizing EAST data from 1980 to 1992, DOE/NPRC evaluated effects of radio collars on numerous parameters, including collar to body weight ratio, collar design (heavy or light), survival period, and recapture interval, again comparing radio collared kit foxes to kit foxes with ear tags only. With one exception, no differences in survivorship were observed between radio-collared and ear-tagged foxes. Based on these results, and with reference to the large data set and thoroughness of EASI's study, the Service concludes that EASI's kit fox radio collar program has not significantly contributed to the kit fox decline on NPR-1.

However, DOE/NPRC found that kit fox pups radio collared prior to the month of July tended to survive for shorter periods than pups collared after July (EG&C unpublished data). This result probably has not significantly affected kit fox status on NPR-1 but may have important implications in how kit fox radio collar programs are managed on NPR-1 and elsewhere.

Effects of the Drought. By the early 1990's, endangered species populations throughout the San Joaquin Valley were exhibiting declines likely associated with California's five-year drought that lasted from 1987 to 1992. For example, surveys conducted on NPR-1 in 1991 found that most previously active giant kangaroo rat precincts were no longer occupied (EG&G, unpublished data). Similar giant kangaroo rat declines were observed in the Carrizo Plain (Dan Williams pers. comm.), and leopard lizards reportedly did not reproduce in the Carrizo Plain and elsewhere in 1991 (Dave Germano pers. comm.). Similarly, little kit fox reproduction was observed on NPR-1 in 1991 (EG&G, unpublished data). This harsh five-year drought has often been cited as a primary or contributing factor in the kit fox decline on NPR-1. The principal result of the drought thought to affect kit foxes was reduction in availability of prey species (typically, small mammals and lagomorphs).

Since 1983, EASI has conducted a bi-annual census of lagomorphs on NPR-1 and NPR-2, and, like the kit fox, lagomorphs have declined significantly on both Reserves (DOE 1991). On NPR-1, lagomarphs also were censused during road counts from 1980 to 1983 and declined annually over this period. Similarly, the California Department of Fish and Game (CDFG) has conducted two annual spotlighting routes near NPR-1 (the "Taft" and "McKittrick" routes) in which both kit foxes and lagomorphs have been censused since approximately 1970 (CDFG unpublished data). Results of CDFG data also indicate significantly declining lagomorph numbers along these routes, together with a decline in kit fox numbers that appears to strongly "mimic" the pattern of lagomorph decline. These data suggest that a decline in prey availability caused by the drought may be a primary contributor to the kit fox decline on NPR-1.

However, based on other available data this conclusion cannot be considered certain. For example, the lagomorph and kit fox decline on NPR-1 began prior to 1987, when the five-year drought began; while on NPR-2, where the kit fox decline has been less pronounced, lagomorph densities did not begin to decline until 1987, when the drought began (DOE 1991). Furthermore, in an analysis of EG&G data (kit fox numbers versus lagomorph numbers) on NPR-1 and NPR-2 conducted in 1991, the General Accounting Office (GAO) found that between 1984 and 1989 the estimated number of lagomorph per kit fox was higher on NPR-1 than on NPR-2 (GAO unpublished data). This suggests that prey availability alone can not account for the perceived differences between kit fox numbers on NPR-1 and NPR-2, and that some other factor or factors may have contributed to apparently differential kit fox declines on the two Reserves.

CDFG data suggest another pattern with respect to fluctuating kit fox numbers. According to the graph of these data (DOE 1991), in 1970 kit fox and lagomorph numbers appear to have been declining from earlier highs in the late 1960's. Their numbers then appear to have remained relatively low from approximately 1972 to 1979, when they began to incline sharply to highs in the early 1980's that were unequaled within the study period .The early 1980's is precisely when EASI began its systematic counts of kit foxes and lagomorphs on NPR-1 and NPR-2.

This suggests that EASI initiated its kit fox census on NPR-1 and NPR-2 when lagomorph numbers were at an unusual high, resulting from natural cyclic fluctuations or to some other factor such as rainfall. This in turn suggests that (1) kit fox numbers were unusually high in 1979 or 1980, when EASI census activities began (likely due to high lagomorph numbers), (2) that this high represented a cyclic fluctuation rather than average kit fox carrying capacity on NPR-1, and (3) that the initiation of intensive MER activities on NPR-1 and the observed kit fox decline on the Reserve was coincidental, not causally related (Harris et al 1987).

Other Natural Factors Other factors possibly contributing to the NPR-1 kit fox decline include coyote predation and disease. Since 1980, coyotes have been responsible for most known kit fox mortalities on NPR-1 (80.7 percent of

all dead foxes for which a cause of death could be determined) (DOE 1991). However, based on other studies this appears to be the normal interaction between kit foxes and the larger, more aggressive coyote (e.g., Linda Spiegel, CEC, pers. comm.); and EASI data indicate that coyote numbers on NPR-1 declined contemporaneously with kit fox numbers. Though coyote predation may have exacerbated kit fox problems originally caused by other factors, no data we reviewed suggest that kit fox-coyote interactions can account for the kit fox decline on NPR-1. The significance of coyote predation in kit fox populations is published in articles such as O'Farrell (1984, 1987), and Standley et al. (1992).

In 1981, 1982, and 1984, the kit fox population on NPR-1 was studied for the presence of disease by analyzing kit fox blood serum for the presence of 10 infectious pathogens (DOE 1991). Despite the occurrence of antibodies for canine parvovirus, tularemia, canine distemper, and canine hepatitis in kit fox blood samples, little clinical evidence of disease has been noted in the NPR-1 kit fox population (DOE 1991). Disease can therefore be largely ruled out in explaining the observed kit fox decline on NPR-1.

Summary The above discussion illustrates that the relationship between kit foxes, oil development, and other environmental factors on NPR-1 is complex. In short, it is difficult to ascribe the San Joaquin kit fox decline on NPR-1 conclusively to any single factor.

Nevertheless, several observations seem important. First, lagomorph and kit fox numbers appear to have declined jointly-(if differentially)-throughout the general area, not just on NPR-1. Second, although the disappearance of kit foxes from the central upland portions of NPR-1 has been pronounced and contemporaneous with intensive oil developments-suggesting a direct relationship-CDFG data suggest that kit fox presence in the central uplands in the early 1980's may have been the result of unusually optimal conditions at that time. If this is true, then kit foxes may not normally occupy this portion of NPR-1 because of natural factors (e.g. relatively steep terrain), and this area may have been the first to be abandoned when environmental conditions deteriorated--possibly, at least in part, because of the drought. On the other hand, oil development in the central uplands may have contributed to the adverse conditions-(already marginal because of natural factors)-that eventually caused kit foxes to abandon the area. In this respect, the Service considers EASI data suggesting that kit fox declines have been equivalent in developed and undeveloped habitats on NPR-1 to be inconclusive.

Third, the fact that kit fox declines on NPR-2 have been less severe than fox declines on NPR-1 may be significant and is difficult to explain. Several differences between the two Reserves that may account for this fact have been cited--(e.g., intensive oil development on NPR-1 and overall gentler topography on NPR-2), but here again results are inconclusive.

Based on existing data, the only factors that probably can be ruled out as causing or significantly contributing to the NPR-1 kit fox decline is coyote predation, disease, oil field chemicals, and the endangered species research program. Conversely, it seems likely that the decline may have resulted from a combination of the other effects discussed-(e.g., the drought, natural cyclic fluctuations, oil field developments, and naturally marginal conditions in the central uplands of the Reserve). Continued monitoring of the kit fox population on NPR-1 in the immediate future, especially in light of the end of the drought in the winter of 1992-1993, will be critically important in better understanding the respective roles of the factors discussed above in the NPR-1 kit fox decline.

Based on the above discussion, the Service concludes as follows with respect to the San Joaquin kit fox: (1) that MER oil production probably is not solely responsible for the kit fox decline on NPR-1 but likely has been a

contributing factor; (2) that intensive oil developments in the NPR-1 central uplands likely has contributed to the disappearance of the kit fox from this portion of the Reserve; (3) that proposed new developments in the central uplands, such as the larger facilities as described in the DSEIS (DOE 1992), SEIS (DOE 1993), will contribute to continuing habitat losses and adverse effects in this area and may inhibit effective future use of this area by kit foxes; and (4) that the latter effect is not likely to jeopardize the continued existence of the species because the central uplands probably represents, on average, marginal kit fox habitat except in optimal conditions, and provided that DOE implement the mitigation commitments described on pages 4 to 7 above.

Giant and Tipton Kangaroo Rats

Specific effects to giant kangaroo rats potentially resulting from continuing MER production on NPR-1 include: (1) Destruction of giant kangaroo rat burrow systems during construction of proposed facilities in Townships G, R, and S and by third-party pipelines; (2) removal of food sources (grasses and seeds) during construction activities; (3) alteration of soil conditions-e.g., soil compaction-making it more difficult for kangaroo rats to construct burrows; (4) accidental oil spills or wastewater discharge; (5) disturbance; and (6) accidental death or injury during EASI's trapping and research activities (DOE 1991). In 1986, for example, 12 kangaroo rats (species not identified) were killed when a DOE lessee discharged wastewater into a natural drainage adjacent to NPR-1. Furthermore, O'Farrell et al. (1987) reported that 73 percent of all giant kangaroo burrow systems on NPR-1 occurred at least 150 feet away from well pads, and numerous well pads may be constructed in known giant kangaroo rat habitats in Sections 6-7G, 14R, 20R, 25R, 28R, 26-27S, and 365 during continuing MER production.

However, construction of the larger facilities currently proposed-(e.g., the fourth gas plant, butane facility, and cogeneration plant)-is not expected to affect known giant kangaroo rat populations, and pre-construction surveys and flexibility in well pad location should minimize impacts to giant kangaroo rats elsewhere (DOE 1991). Furthermore, the majority of these wells would be constructed in the central upland portions of NPR-1 where giant kangaroo rats are relatively uncommon. Third-party pipelines-expected to disturb a total of 101 acres-may directly affect some giant kangaroo rat habitat in the Buena Vista Valley and other peripheral areas on the Reserve.

The Tipton kangaroo rat, which is present only in Section 23S east of the California Aqueduct, should not be affected by any planned DOE activities on NPR-1 because no development is planned in that area.

Blunt-nosed Leopard Lizard

Specific effects of continuing NPR-1 activities on blunt-nosed leopard lizards are expected to be similar to those cited above for giant kangaroo rats. In addition, leopard lizards are vulnerable to entrapment in well cellars, and, because they inhabit washes and are vulnerable to accidental wastewater discharges and oil spills. Both such forms of leopard lizard mortality have been documented either on or adjacent to NPR-1 in the 1980's (DOE 1991). In 1992, an aestivating leopard lizard was inadvertently unearthed during gravel mining on NPR-1 but this lizard was unharmed and was returned to its habitat (EG&G unpublished data). Other forms of potential leopard lizard effects on NPR-1 include vehicle strikes and destruction of small mammal burrows during construction activities and third-party projects such as seismic surveys and pipelines.

However, most construction of relatively large new facilities will occur in the central upland portions of the Reserve where little leopard lizard habitat exists, and pre-construction surveys and flexibility in well location should

minimize leopard lizard effects during DOE and third-party projects elsewhere on the Reserve.

Hoover's Woolly-star and Other Federally Listed Plants

The overall effects of the programmatic on listed, proposed, candidates, or sensitive plants cannot fully be assessed at this time because inventory information is incomplete and not always properly timed. Although some intensive surveys have been conducted, they have not always been floristic. Potential effects of proposed project activities on Hoover's woolly-star include (1) destruction of plants and plant habitats during grading, trenching and other construction activities, (2) crushing of individual plants and plant populations during off-road vehicle use and seismic surveys, (3) inundation of plant populations resulting from oil spills or hydrostatic water releases, (4) destruction of plant populations resulting from man-caused fires, and (5) dust from vehicular traffic that can reduce plant productivity. No known populations of Kern mallow or San Joaquin wooly-threads currently exist on NPR-1. However, similar adverse effects to these species might occur as a result of MER activities should they later be found or become established on NPR-1.

Adverse effects to federally listed plants would be minimized because (1) most proposed new activities would occur in the NPR-1 central uplands where Kern mallow and San Joaquin wooly-threads populations are not likely to exist, (2) NPRC agrees to initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants other than Hoover's woolly-star, (3) populations of Hoover's woolly-star would be avoided to the maximum extent practicable, as described on pages 8 and 9 above, and (4) where plant populations are not avoidable, DOE would implement other mitigation measures such as stockpiling of topsoil.

Habitat Disturbance

As of June 1988, an estimated 6,467 acres of native habitat originally existing on NPR-1 have been disturbed either permanently or temporarily as a result of oil development activities since the 1920's (DOE 1993). Of these, an estimated 3,227 acres have been disturbed since the inception of MER production in 1976 (DOE 1993).

The Department estimates that habitat disturbance on NPR-1 resulting from proposed new facilities between 1989 and 2025 will total 878 acres (DOE 1991), which includes 5 acres that were disturbed for a water well project covered by a separate consultation (File No. 1-1-92-F-39). This will result from proposed work on 382 wells (579 acres), gas operations expansion (15 acres), and construction of the cogeneration facility (3 acres), the butane isomerization facility (5 acres), steam generators for the SOZ Steam Flood Project (210 acres), gas compression facilities (10 acres), gas injection facilities (4 acres), and pipeline replacement and maintenance activities (50 acres) (DOE 1993). Of this, 750 acres would be affected by 1998.

Adding past MER disturbances to anticipated future disturbances yields total estimated habitat disturbance on NPR-1 resulting from DOE activities through the life of MER production (1976-2025), or 4,105 acres (3,227 +878 = 4,105). In addition, non-Federal third party pipeline projects are expected to disturb 691 acres through the year 2025 (DOE 1991). Because the Department has indicated its willingness to consider these as DOE disturbance for the purpose of this consultation (Jim Killen, DOE, pers. comm.), total disturbance resulting from DOE and related activities during MER production is 4,796 acres.

In addition, 547 acres within the NPR-1 civil boundaries have been disturbed in the past by activities not constructed or undertaken by the Department.

These include 133 acres disturbed by the California Aqueduct, 45 acres occupied by the town of Taft, and 369 acres of agricultural lands not owned by DOE (EG&G unpublished data). An estimated 79 acres have been disturbed since 1988 as a result of third party projects on NPR-1 (DOE 1991). However, these disturbances are either the result of non-DOE projects or are addressed and mitigated under separate biological opinions. Finally, third party seismic surveys are expected to result in minor temporary disturbances of 3,390 acres through 2025 (DOE 1991).

Estimated temporary disturbance on NPR-1 resulting from past MER development totals 432 acres, while estimated permanent disturbance totals 2,795 acres. Estimated temporary disturbance resulting from proposed new activities totals 50 acres, and estimated permanent disturbance totals 828 acres. Temporary disturbance throughout the life of MER development (1976-2025) totals 482 acres and permanent disturbance totals 3,623 acres (DOE 1995).

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

Our agency is aware of other projects currently under review by State, county, and local authorities where biological surveys have documented the occurrence of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, and San Joaquin wooly-threads. These projects include urban, mineral, and energy development, and flood control and reservoir construction.

However, we do not anticipate that the project under evaluation in this biological opinion, considered together with other non-Federal actions, would appreciably reduce the likelihood of survival and recovery of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, or San Joaquin wooly-threads.

Conclusion

After reviewing the current status of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads and the Hoover's woolly-star; the environmental baseline for the action area; the effects of the action and the cumulative effects; it is the Service's biological opinion that the proposed continuation of the oil development program on NPR-1 at Maximum Efficient Rate, as implemented, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species, therefore, none will be affected. This conclusion is based on (1) continuing implementation by DOE of its mitigation commitments, and (2) the fact that most proposed future MER-related disturbances would occur in the central upland portions of NPR-1 where few populations of threatened and endangered species currently exist.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Endangered Species Act prohibit any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed fish and wildlife species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly

disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not a intended as part of the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats, and Tipton kangaroo rats may be taken incidentally during continued MER production and proposed construction of new facilities on NPR-1. Project actions that may result in the mortality, harm, or harassment of these species have been previously discussed in this biological opinion. Mitigation measures proposed by the Department will substantially reduce but not eliminate the potential for incidental taking of these species during proposed NPR-1 activities.

Amount of Extent of Take

Based on information provided in the project biological assessment (DOE 1991), information on past incidental takings on NPR-1 provided by EASI, information in our files, and through prior consultations, the Service anticipates that the following numbers of kit foxes, leopard lizards, and kangaroo rats may be subject to harm or mortality during proposed NPR-1 project activities through the year 2025:

1. Ninety (90) San Joaquin kit foxes (3/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

2. Two hundred and ten (210) blunt-nosed leopard lizards (7/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

3. Nine hundred (900) giant kangaroo rats (30/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

4. Thirty (30) Tipton kangaroo rats (1/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

The number of animals subject to incidental take must not exceed the annual amounts stated above, and the total for 30 years is cumulative only.

The number of San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats and Tipton kangaroo rats subject to harassment from noise, vibrations, and capture or excavation of dens and burrows cannot be estimated because the number of individuals of these species within potential project areas is unknown. Therefore, the Service anticipates harassment of all individuals of these federally listed species inhabiting areas where project activities would occur provided that such harassment: (1) Is the result of bona fide project activities; (2) is inadvertent or for the express purpose of removing individual animals from construction areas to safe locations; and 3) that all terms and conditions specified below are fully implemented.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species discussed.

Reasonable and Prudent Measures

The Service states that the following reasonable and prudent measures are necessary and appropriate to minimize the potential for incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, and Tipton kangaroo rat authorized by this biological opinion.

1. The potential for harm or mortality to federally listed wildlife species and their habitats resulting from project related activities shall be minimized.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized.

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Department must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The terms and conditions specify measures considered necessary by the Service or modify mitigation commitments proposed by the Department. Unless otherwise indicated, all terms and conditions described shall be implemented by the Department at each project site. Where terms and conditions vary from or contradict mitigation commitments as proposed in this or any previous document, specifications in these terms and conditions shall apply.

1. The potential for harm or mortality to federally listed wildlife shall be minimized by implementing the following procedures:

   (a) The Department shall continue to conduct pre-activity surveys prior to all surface disturbing activities on NPR-1. Any change in preactivity surveys would have to be approved by the Service, and may involve reinitiation of consultation.

   (b) Biological monitors (see attachment 1), shall be present, or readily available, on NPR-1 construction sites during all critical construction activities occurring within or adjacent to sensitive endangered species habitat as identified during pre-activity surveys. Examples of activities for which such monitors may be

present include surveys or flagging necessary to determine and delineate specific construction areas, pipeline alignments, and location of access routes and storage areas; grading and trenching activities; checking of pipes, pipeline trench segments, and similar structures for entrapped wildlife; backfilling pipeline trench segments; den and burrow excavations; and other activities as determined by monitoring biologists to be necessary.

(c) The areas disturbed by construction related activities and routine day-to-day operation on NPR-1 shall be minimized to the maximum extent practicable. All NPRC and Contractor vehicles shall be confined to existing roads or to project areas which have received a preactivity survey.

(d) All spills of oil, liquids contaminated by oil, hazardous materials within NPR-1 shall be cleaned up in a manner consistent with the NPR-1 Spill Prevention, Control and Countermeasure Plan.

(e) Speed limits in all construction areas shall not exceed 25 mph.

(f) A litter control program shall be implemented during project activities. This program shall include daily collection of trash, especially that which is food-related, disposal in covered receptacles, and regular removal from project sites.

(g) Construction activities (but not drilling, operations, maintenance, or any other activities) between dusk and dawn shall be minimized.

(h) Personnel performing pre-activity surveys, wildlife handling, kit fox den excavations, and monitoring activities are to be qualified to perform these duties as described by Attachment 1. One supervisory biologist as a training officer who will be given responsibility over all trainees, with full authority to deny or grant trainees the ability to perform permitted activities. This will provide some level of consistency regarding qualifications and employee certification.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized by implementing the following procedures:

(a) The Department shall make every reasonable effort to avoid damage or destruction of San Joaquin kit fox dens, giant and Tipton kangaroo rat burrows, and burrows potentially utilized by blunt-nosed leopard lizards during proposed MER activities on NPR-1. Such avoidance measures may include minor re-location of project facilities and minimization of construction impacts to the least possible area.

(b) Known San Joaquin kit fox dens shall not be damaged or destroyed by project related actions unless written or verbal concurrence is obtained from the Service's Sacramento Field Office prior to such effects. If concurrence cannot reasonably be obtained in a timely manner (e.g., on weekends), destruction of known kit fox dens may proceed only if qualified personnel determine that the den cannot reasonably be avoided and if the Service is verbally notified as soon as possible after the fact. Any known kit fox den that must be destroyed shall first be monitored for three consecutive nights by qualified personnel to ensure that it is not occupied by kit foxes, and then shall be excavated by or under the direct supervision of qualified personnel and backfilled to preclude later use by kit foxes. Destruction of all known kit fox dens shall be documented in the annual report.

Potential San Joaquin kit fox dens may be excavated without prior notification to the Service, provided that qualified personnel have determined that the den is not a known kit fox den. Alternately, excavation of potential kit fox dens need not be conducted prior to construction activities, provided that no evidence of kit fox use of such dens is observed after three consecutive nights of monitoring, and that construction operations over such dens occur no more than 24 hours after such dens are last determined to be unoccupied. In the event the Service modifies the procedures for monitoring dens prior to excavation, NPRC shall adopt the revised procedures, so as to be in compliance with this term and condition.

(c) San Joaquin kit foxes, blunt-nosed leopard lizards, and giant and Tipton kangaroo rats may from time to time be captured and relocated from construction sites, provided (i) that burrows of these animals cannot reasonably be avoided during construction activities; (ii) that associated conditions and actions deemed appropriate by the Service are satisfied; (iii) that verbal or written approval from the Sacramento Field Office is obtained prior to any such capture and removal; and (iv) that any person or persons conducting capture and relocation activities possess an appropriate scientific collecting permit issued by the Service or are otherwise qualified to conduct such activities, as determined by the Service in writing.

(d) At the end of each day during all major NPR-1 construction projects, all open pipeline trench segments and other steep-walled holes or trenches greater than two feet deep shall either be covered with plywood or similar materials, or shall be equipped with escape ramps constructed of wooden planks, earth fill, or similar materials and spaced no further than one-quarter mile apart. Projects to which this term and condition applies include the same as those described in term and condition 3(a).

(e) If entrapped wildlife is observed, said wildlife shall only be removed by qualified personnel (see Attachment 1).

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured by:

(a) Prior to the sale of NPR-1, the Department shall initiate and complete a subsequent section 7 consultation as to this Federal action; and the reasonable and prudent measures and terms and conditions shall be adhered to by the subsequent owner until a section 10(a)(1)(B) permit and a CDFG 2081 permit are issued for their actions. In addition, as part of the subsequent section 7 consultation, the Department shall enter into a Conservation Agreement with the Service if the conservation area has not been established.

(b) Within 90 calendar days following the end of each fiscal year, the Department shall submit to the Services s Sacramento Field Office a brief annual report detailing the following information: (i) A summary of all major construction activities undertaken the previous year; (ii) dates that such construction occurred and the number of habitat acres permanently or temporarily disturbed; (iii) pertinent information concerning the Department's success in meeting project mitigation measures; (iv) an explanation of failure to meet such measures, if any; (v) known project effects on federally listed species, including an estimate of the number of kit fox dens and giant kangaroo rat burrows destroyed, including a general estimate of other small mammal burrows impacted, if any; (vi) known

occurrences of incidental take of listed species, if any; (vii) habitat reclamation efforts undertaken that year, if any; (viii) results of ongoing monitoring of habitats reclaimed in previous year; (ix) an estimate of habitat acres reclaimed to date; and (x) other pertinent information. The term "major construction activity" in this term and condition shall apply to the proposed gas plant, cogeneration plant, butane isomerization facility, all underground pipelines, and any other facility resulting in permanent disturbance of more than 3 acres at a time, or temporary disturbance of more than 5 acres at a time.

(c) If requested, upon completion of any proposed construction project, or at any reasonable time deemed appropriate by the Service, the Department or its contractors shall accompany Service personnel on site inspection tours of construction sites or other locations, as requested, to review project impacts to endangered species and their habitats.

(d) Unless otherwise authorized by the Service in writing, all terms and conditions within this biological opinion shall apply to all third party projects permitted by the Department on NPR-1.

Reviewing Requirement

The reasonable and prudent measures, with implementing terms and conditions, are designed to minimize incidental take that might otherwise result from project activities. If, during proposed project actions, the amount or extent of incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, or Tipton kangaroo rat is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Department must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Reporting Requirement

The Service is to be notified in writing within three working days of the accidental death or injury of a San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat or Tipton kangaroo rat or of the finding of any dead or injured kit fox, leopard lizard, or kangaroo rat, during project related actions. 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 for this information is the Assistant Field Supervisor for Endangered Species at (916) 979-2725. To determine disposition of dead or injured San Joaquin kit foxes, blunt-nosed leopard lizards, or giant kangaroo rats, the California Department of Fish and Came, Region 4 Office, Fresno should be contacted (209/222-3761).

CONSERVATION RECONMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species and the ecosystems upon which they depend. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Therefore, the Service recommends the following additional actions to protect federally listed species and their habitats during proposed continuing MER activities at NPR-1:

(1) The Department should consider placing into conservation status all lands outside of the primary production and conservation areas for the benefit of listed species. These lands could be subject to oil development activities, however, the quality of the habitat should be maintained.

(2) The Department should consider, in the event of the sale of NPR-1 selling only the sub-surface mineral rights. The surface ownership should be retained by the Federal government for the long-term survival and recovery of the listed species that occupy NPR-1.

(3) The Department should direct EAST to continue monitoring of kit fox and lagomorph population trends and rainfall patterns on NPR-1 and NPR-2. This information and information obtained from CDFG survey routes, should be utilized to further clarify the relative importance of factors potentially affecting kit fox distribution and abundance on NPR-1. In accordance with the concluding paragraph below, the Department should reinitiate consultation concerning MER activities on NPR-1 should any such new information suggest that MER production is resulting in effects to San Joaquin kit foxes not considered in this opinion, or that the conclusions in this opinion with respect to effects of MER production on kit foxes is incorrect or inadequate.

(4) The Department should direct EASI to increase monitoring of population trends on NPR-1 of other federally listed species-(i.e., the blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, Hoover's woolly-star, and San Joaquin wooly-threads). The Department should reinitiate consultation concerning MER activities on NPR-1 should any new information suggest that MER production is resulting in effects on these species not considered in this opinion or that the conclusions in this opinion with respect to effects of MER production on these species is incorrect or inadequate.

(5) The Department should contribute funds to be utilized for research projects on federally listed San Joaquin Valley species conducted either on NPR-1 but by researchers other than EASI, or off NPR-1 in adjacent, nearby, or other San Joaquin Valley locations. The rationale for this recommendation is as follows.

First, NPR-1 is a highly lucrative oil field, generating average net revenues of approximately $750 million per year. Second, NPR-1 occupies a key location in the configuration of remaining San Joaquin Valley habitats in Kern County (near or adjacent to the Lokern Road area, Buena Vista Valley, and others) and DOE activities on NPR-1 have resulted in temporary or permanent disturbance to over 6,000 acres of endangered species habitat within this area- -by any measure a significant effect. Third, over 3,500 acres of habitat disturbance on NPR-1 resulted from Federal activities conducted prior to the onset of MER development and no mitigation for the effect has been required under this or previous biological opinions. Fourth, in the Service's view, restricting DOE research funds non-competitively to a single group (EASI) does not result in the greatest benefit to affected endangered species. Finally, as a Federal agency, the Department has significant responsibilities under section 7(a)(1) of the Act to utilize its authorities in carrying out endangered species programs.

Based on these considerations, the Service recommends that DOE contribute a sum of approximately $100,000 per year through the life of the NPR-1 oil field, or until federally listed species affected by DOE activities are delisted, whichever comes first, to a suitable interest-bearing account to be administered by the Service for research and management of such species.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on proposed continuing MER production on NPR-1. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect federally listed species in a manner or to an extent not considered in this opinion; (3) the project is substantially modified in a manner that causes an effect to listed species that was not considered in this opinion; and/or (4) a new species is listed or critical habitat is determined that may be affected by the action.

We appreciate the cooperation of the Department, Chevron, and EASI throughout this consultation process. Please contact Jody Brown or Peter Cross of my staff at (916) 979-2728 if you have questions or information concerning this biological opinion with respect to federally listed wildlife species, and Kirsten Tarp at (916) 979-2120 if you have questions or information with respect to federally listed plants.

Sincerely,

Joel A. Medlin
Field Supervisor

Attachment

cc: ARD-ES, Portland, OR
Ms. Sandra Morey, CDFG Sacramento, CA
Regional Manager, CDFC, Fresno, CA
Mr. Jim Killen, U.S. Department of Energy, Tupman, CA
Mr. Brian Cypher, EASI Energy Advisory Services, Inc., Tupman, CA
Ms. Linda Spiegel, California Energy Commission, Sacramento, CA
Dr. Daniel F. Williams, SJVESRPP, Fresno, CA

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- Topical Report 110282-2178 'Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

- The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

- Construction project boundaries;

- Areas demarcated to avoid disturbing endangered species or their habitat;

- Specific measures identified during the preactivity survey to avoid impacts to endangered species;

- Project scope and schedule;

- Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.

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ATTACHMENT 1

DEFINITION OF QUALIFIED PERSONNEL
(FOR KIT FOX DEN EXCAVATION/REMOVAL OF ENTRAPPED WILDLIFE, PREACTIVITY SURVEYS AND MONITORING ACTIVITIES ONLY)

Kit Fox Den Excavation, Removal of Entrapped Wildlife, Preactivity Surveys

Personnel are to have either a 4-year degree in biology, or a related field, from an accredited college or university, plus 30 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person; or 2 years of field, or field related, experience working in an endangered species program on a full time basis, plus 90 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent to NPRC;

* Life history of protected and candidate species know to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titles "Protecting Endangered Species on NPR-1".

Demonstrating the ability to successfully conduct preactivity surveys is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the supervising biologist.

Monitoring

For the purposes of monitoring activities occurring within or adjacent to endangered species habitat, monitors are considered to qualified upon:

1) Successfully completing an 8 hour training course. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent of NPRC;

* Life history of protected and candidate species known to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

* Construction project boundaries;

* Areas demarcated to avoid disturbing endangered species or their habitat;

* Specific measures identified during the preactivity survey to avoid impacts to endangered species;

* Project scope and schedule;

* Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.

EXHIBIT 2

COVERED SPECIES

COMMON NAME	SCIENTIFIC NAME
San Joaquin kit fox	*Vulpes macrotis mutica*
blunt-nosed leopard lizard	*Gambelia sila*
giant kangaroo rat	*Dipodomys ingens*
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*
Kern mallow	*Eremalche kernensis*
Hoover's woolly-star	*Eriastrum hooveri*
San Joaquin woolly-threads	*Lembertia congdonii*
western burrowing owl	*Athene cunicularia hypugea*
oil neststraw	*Stylocline citroleum*
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*

EXHIBIT 3

LIFE HISTORIES

EXCERPTS FROM THE

DRAFT RECOVERY PLAN FOR UPLAND SPECIES OF THE SAN JOAQUIN VALLEY, CALIFORNIA

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

1997

KERN MALLOW
(Eremalche Kernensis)

1. Description and Taxonomy

Taxonomy. - Kern mallow was first described as *Eremalche kernensis*, based on a specimen from the "Temblor Valley, 7 miles northwest of McKittrick", in Kern County (Wolf 1938, p.67). Both Kearney (1951) and Munz (1958) transferred this species to the genus Malvastrum then reconsidered (Kearney 1956, Munz 1968) and returned to the original name. Other combinations have been suggested (Leonelli 1986) but were not validly published. The most recently-published treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* ssp. *kernensis*. However, the taxonomy of Kern mallow remains controversial in terms of its rank and its relationship to Parry's mallow (*Eremalche parryi* ssp. *parryi*). Most local botanists continue to use the scientific name *Eremalche kernensis* (Medlin in litt. 1995*a*) for this member of the mallow family (Malvaceae).

Description. - The height and habit of Kern mallow vary depending on seasonal precipitation. The form can vary from single-stemmed to multiple-stemmed, with the central stem erect and the lateral stems trailing along the ground. Stem lengths at flowering may range from less than 2.5 centimeters (1 inch) to nearly 50 centimeters (20 inches). The flowers have 5 petals, and the wheel-shaped fruits are divided into single-seeded segments (Bates 1993).

Identification. - The taxonomic debate centers around the gender, color, and size of flowers indicative of Kern mallow versus Parry's mallow. Some populations in the Kern/Parry's mallow complex exhibit a condition known as *gynodioecy,* meaning that a population contains a mixture of plants that have only *pistillate* (female) flowers and plants that have only *bisexual* flowers (with both male and female parts). Bates (1992, 1993) considered any gynodioecious population in the Kern/Parry's mallow complex to be Kern mallow and those populations with only bisexual flowers to be Parry's mallow. On the other hand, Taylor and Davilla in litt. (1986) maintained that both Kern mallow and Parry's mallow were gynodioecious. Neither Wolf (1938) nor authors of early regional floras (Abrams 1951, Munz and Keck 1959) mentioned flower gender. Bisexual Kern mallow flowers produce fewer seeds per fruit (7 to 13) than do pistillate flowers (8 to 19). Parry's mallow and desert mallow *(Eremalche exilis)* fruits contain 10 to 22 and 9 to 13 segments, respectively (Abrams 1951, Munz and Keck 1959, Bates 1992, 1993, Mazer et al. in litt. 1993).

The strictest definition of Kern mallow applies only to populations in which white-flowered individuals predominate. Even in these areas, a few individuals may have pale lavender flowers (Wolf 1938, Bates 1992, Mazer et al. in litt. 1993), but lavender-flowered plants represented less than 10 percent of one population in 1994 (E. Cypher unpubl. data). Definite Parry's mallow populations consist of only pinkish-purple flowers, whereas those of questionable taxonomic affinity contain either exclusively pinkish-purple flowers or a very small proportion of white-flowered plants. Regardless of color, pistillate flowers have shorter petals than bisexual flowers in the same population (Bates 1992, 1993). Parry's

mallow has larger flower parts than Kern mallow. Another closely-related species that infrequently occurs with the other two taxa is desert mallow, which has trailing stems and bisexual flowers that are smaller than those of Kern mallow (Twisselmann 1956, Twisselmann 1967, Hoover 1970, Bates 1993). The populations of Kern mallow that are predominantly white-flowered are the object of conservation concern, and thus the strict interpretation is used in the following sections unless otherwise noted.

2. Historical and Current Distribution

Historical Distribution. - Kern mallow has always had a highly-restricted distribution. In the original description, Wolf (1938) mentioned specimens from the Temblor Valley, Belridge Oil Field, and two sites west of Buttonwillow; all these occurrences were in *western Kern County* north of McKittrick.

Current Distribution. - A 1986 status survey reported three additional occurrences in Lokern, which is the local name for the area between Buttonwillow and McKittrick (Taylor and Davilla in litt. 1986). More intensive surveys during the past few years (Anderson et al. 1991, Olson and Magney 1992, CDFG 1995, Stebbins et al. in litt. 1992, S. Carter pers. comm.) revealed that Kern mallow occurs intermittently within an area of approximately 100 square kilometers (40 square miles) in Lokern, which is best described as a single metapopulation. The California Native Plant Society (Skinner and. Pavlik 1994) and CDFG (1995) also accept reports of plants from three sites between Maricopa and McKittrick (in extreme western Kern County) as representing Kern mallow. Because specimens are not available to determine the color of the flowers and these sites are outside of the accepted range, they are treated here as representing Parry's mallow.

Pink-flowered plants fitting Bates' (1992, 1993) broader concept of Kern mallow are widespread. Recent reports indicated that these plants occurred in several areas of Kern County, including Buena Vista Valley, Elk Hills, Lost Hills, McKittrick Hills, Stockdale, and the Temblor Range. Recent and historical reports elsewhere included Corcoran in Kings County; the Carrizo Plain, Elkhorn Plain, Panorama Hills, and Temblor Range in San Luis Obispo County; the Cuyarna Valley in Santa Barbara County; and Pixley in Tulare County (Hoover 1970, Leonelli 1986, Olson and Magney 1992, Skinner and Pavlik 1994, CDFG 1995, Taylor and Davilla in litt. 1986, E. Cypher unpubl. observ., S. Wilson pers. comm.). Parry's mallow ranges from Alameda to Ventura Counties (Bates 1992).

3. Life History and Habitat

As with many arid-land annuals, the form, density, *phenology* (timing of different stages in the life cycle), and reproduction of Kern mallow vary greatly depending on precipitation.

Reproduction and Demography. - In Lokern, Kern mallow seeds typically germinate in January and February, and the plants begin flowering in March. Fruit production begins within a few days after flowers appear; flower and fruit production may continue into May if sufficient moisture is available. The seeds fall from the fruits as soon as they are mature. Seeds are capable of germinating in the following growing season, but at least some remain

ungerminated. The duration of seed viability in the soil is not known. Seed dispersal agents are unknown but probably include animals and wind (Taylor and Davilla in litt. 1986, Mazer et al. in litt. 1993, E. Cypher unpubl. observ.).

Preliminary studies showed that insects facilitated pollination of Kern mallow. However, small numbers of seeds were produced when pollinators were excluded, even in pistillate plants which did not produce pollen. Possible explanations for this phenomenon were *apomixis (i.e.,* seed set without fertilization), contamination of the test plants by researchers, or wind pollination. However, a higher frequency of seed set would have been expected if pollen was carried by the wind (Mazer et al. in litt. 1993). Pollen-covered bees (family Apidae) and beetles (order Coleoptera) have been observed inside Kern mallow flowers (E. Cypher unpubl. observ.), but the insects have not been identified to species.

Population size of Kern mallow varies with rainfall. Several botanists familiar with this species were unable to find Kern mallow at known locations in years of below-average rainfall (Wolf 1938, Twisselmann 1956, Bates 1992). In Lokern, Kern mallow density was nearly 10 times as high in 1995, a year of much higher than average rainfall, as in 1994, which had below-average rainfall during the growing season. Similarly, the number of flowers per plant ranged from 1 to 8 in 1994 and from 1 to over 700 in 1995 (E. Cypher unpubl. data.).

Habitat and Community Associations. - Kern mallow typically occurs in the Valley Saltbush Scrub natural community, where it grows under and around spiny and common saltbushes and in patches with other herbaceous plants, rather than in the intervening alkali scalds. Associated herbs include red brome, redstemmed filaree *(Erodium cicutarium),* woolly goldfields *(Lasthenia minor),* and white Sierran layla (Layia *pentachaeta* ssp. *albida).* Kern mallow typically grows in areas where shrub cover is less than 25 percent (Taylor and Davilla in litt. 1986). The amount of herbaceous cover varies with rainfall and microhabitat; in occupied areas of Lokern, herbaceous cover averaged 80 percent in 1993 and 48 percent in 1994 (Cypher in litt. 1994a, 1994b, E. Cypher unpubl. data). Kern mallow occasionally has reinvaded disturbed sites when existing populations remained in adjacent areas to provide sources of seed (Mitchell in litt. 1989; E. Cypher unpubl. observ.).

Kern mallow occurs on alkaline sandy loam or clay soils at elevations of 95 to 275 meters (315 to 900 feet) (Wolf 1938, CDFG 1995). Leonelli's (1986) comparison of Kern mallow habitat in Lokern with Parry's mallow habitat in the Temblor Range revealed that Kern mallow grew on soils that were more alkaline, less saline, and less sandy than those where Parry's mallow grew.

HOOVER'S WOOLLY-STAR
(Eriastrum Hooveri)

1. Description and Taxonomy

Taxonomy. - Hoover's woolly-star was named originally by Jepson (1943) as *Huegelia hooveri.* In a later taxonomic revision, Mason (1945) assigned the currently-accepted name of *Eriastrum hooveri* to the species. Both the scientific and common names honor Robert F. Hoover, who collected the type specimen in 1937 in Kern County, 11 kilometers (7 miles) south of Shafter (Mason 1945). Hoover's woolly-star is an inconspicuous member of the phlox family (Polemoniaceae).

Description. - The wiry stems of this species may or may not branch and vary in height from 1 to 20 centimeters (0.4 to 8 inches) at flowering. The leaves are thread-like and may have two narrow lobes near the base. Hoover's woolly-star has tiny (less than 5 millimeters; less than 0.2 inch long), white to pale blue flowers that are nearly hidden in tufts of woolly hair. The *stamens* (male reproductive parts) are shorter than the corolla.

Identification. - Many-flowered eriastrum *(Eriastrum pluriflorum)* frequently occurs with Hoover's woolly-star; the former has dark blue flowers that are 16 millimeters (0.6 inch) or greater in length, stamens that protrude from the corolla, and leaves with up to 10 lobes. Small-flowered *Eriastrum* species that occur within the same range are distinguished from Hoover's woolly-star by flower color and stamen length (Abrams 1951, Munz and Keck 1959, Patterson 1993, Taylor and Davilla in litt. 1986, Lewis in litt. 1992).

2. Historical and Current Distribution

Historical Distribution. - Prior to 1986, Hoover's woolly-star was known from 19 sites in 4 counties, based on herbarium collections and written observations. The majority of the occurrences were on the San Joaquin and Cuyama Valley floors, and the others were from the low mountains at the west side of the San Joaquin Valley. In Kern County, Hoover's woolly-star was known from the vicinities of Lokern, Oildale, Semitropic, Shafter, and the Temblor Range. In Fresno County, known occurrences were concentrated near Kerman, Mendota, and Raisin City, except for one site each in the Jacalitos and Panoche Hills. The Cuyama Valley records consisted of one collection each from Santa Barbara and San Luis Obispo Counties (Taylor and Davilla in litt. 1986).

Current Distribution. - Hoover's woolly-star since has been discovered in Kings and San Benito Counties and at numerous additional sites in the 4 original counties, particularly in foothill areas. Most of the occurrences are concentrated in 4 metapopulations. In descending order by estimated number of individuals, these metapopulations are (1) the Kettleman Hills in Fresno and Kings Counties, (2) Carrizo Plain - Elkhorn Plain - Temblor Range - Caliente Mountains - Cuyama Valley - Sierra Madre Mountains in San Luis Obispo, Santa Barbara, and extreme western Kern Counties, (3) Lokern - Elk Hills - Buena Vista Hills - Coles Levee Taft -Maricopa in Kern County, and (4) Antelope Plain Lost Hills - Semitropic in Kern County. Small, isolated populations occur in scattered areas including the Alkali Sink Ecological Reserve and the Guijarral, Jacalitos, Panoche, and Turney Hills

in Fresno County; Buttonwillow, Devil's Den, Lamont, Midway Valley, and Rosedale in Kern County; and the Panoche Hills in San Benito County (Lewis in litt. 1992, 1994b, CDFG 1995, Holmstead in litt. 1993, Danielsen et al. in litt. 1994, EG&G Energy Measurements in litt. 1995). According to Skinner and Pavlik (1994), the species also occurs in Tulare County.

3. Life History and Habitat

Reproduction and Demography. - Hoover's woolly-star is an annual, but the seeds germinate later in the growing season than do those of many of the associated annual plants. Seedlings may emerge from January or February until mid-April (Taylor and Davilla in litt. 1986, E. Cypher unpubl. data). The typical flowering period for Hoover's woolly-star extends from March into June (Munz and Keck 1959, Skinner and Pavlik 1994, Lewis in litt. 1992, Cypher in litt. 1994*a*). Pollination ecology has not been investigated. The tiny seeds probably are dispersed by wind or by tumbling of dead stems (Taylor and Davilla in litt. 1986). Unlike many other annuals, dead stems of Hoover's woolly-star may persist until the next growing season (Lewis in litt. 1992).

Within metapopulations, Hoover's woolly-star typically occurs as scattered groups of plants, with each group occupying an area of less than 0.4 hectare (1 acre) (Lewis in litt. 1994b). Densities are highly variable among sites and among years. In 1993, average densities reported for Hoover's woolly-star in occupied habitat were 3.6 per square meter (0.3 per square foot) at Elk Hills (EG&G Energy Measurements unpubl. data), 8.4 per square meter (0.8 per square foot) in Lokern, and 10.3 per square meter (0.9 per square foot) in the Kettleman Hills (Cypher in litt. 1994*a*). However, metapopulation densities would be considerably smaller due to the presence of unoccupied stretches between the groups of plants. Densities of Hoover's woolly-star fluctuate from year to year and are highest in years of above-average precipitation (Holmstead in litt. 1993). At Elk Hills, densities in natural colonies were 5 to 15 times greater in 1993, a year of above-average rainfall, than in 1991, which was a year of average rainfall (EG&G Energy Measurements in litt. 1995).

Habitat and Community Associations. - Hoover's woolly-star seems to be much more adaptable than other endemic plants of the San Joaquin Valley. Optimal habitats for Hoover's woolly-star are characterized by stabilized silt to sandy soils, a low cover of competing herbaceous vegetation, and the presence of *cryptogamic crust* (a layer of moss, lichen, and algae). However, this species also has been found on loamy soils, in areas of dense vegetation, and in areas lacking cryptogamic crust (Taylor and Davilla in litt. 1986, Cypher in litt. 1994a, Lewis in litt. 1994b, EG&G Energy Measurements in litt. 1995). Hoover's woolly-star may reinvade disturbed soil surfaces such as well pads and dirt roads within 1 year after the disturbance ceases if seed sources remain in the vicinity (Holmstead in litt. 1993, Danielsen et al. in litt. 1994, EG&G Energy Measurements unpubl. data, R. Lewis pers. comm.). In fact, this species may benefit from light to moderate soil disturbance in areas that are densely vegetated by exotic plants (Holmstead and Anderson in litt. 1993, EG&G Energy Measurements unpubl. data).

Populations of Hoover's woolly-star occur in alkali sinks, washes, on both north- and south-facing slopes, and on ridgetops. This species occurs in a wide variety of plant communities. Most are characterized by shrubs such as common saltbush, seepweed, and matchweed *(Gutierrezia califomica),* but shrub cover in occupied habitats typically is less than 20 percent. Herbaceous plant species frequently found in association with Hoover's woolly-star include red brome, goldfields, many-flowered eliastrum, and red-stemmed filaree. Populations of Hoover's woolly-star have been reported at elevations ranging from 50 to 915 meters (165 to 3,000 feet) (CDFG 1995, Taylor and Davilla in litt. 1986, Holmstead in litt. 1993, Cypher in litt. 1994a, Danielsen et al. in litt. 1994, Lewis in litt. 1992, 1994b, EG&G Energy Measurements in litt. 1995).

SAN JOAQUIN WOOLLY-THREADS
(Lembertia Congdonii)

1. Description and Taxonomy

Taxonomy. - In 1883, Gray named San Joaquin woolly-threads as *Eatonella congdonii.* The type specimen had been collected by Congdon near Deer Creek (Tulare County) in that same year. The current name, *Lembertia congdonii,* was published by Greene in 1897, who determined that San Joaquin woolly-threads should be separated from snowy eatonella *(Eatonella* nivea). Subsequent taxonomists have upheld Greene's taxonomy (Johnson 1993, Taylor in litt. 1989). San Joaquin woolly-threads is the sole species in the genus *Lembertia,* which is in the aster family (Asteraceae).

Description. - The common name "woolly-threads" is derived from the many long (up to 45 centimeters; 18 inches), trailing stems covered with tangled hairs. However, San Joaquin woolly-threads plants also can be tiny (less than 7 centimeters; less than 3 inches) and erect with a single stem (Cypher in litt. 1994*a*). The tiny, yellow flower heads are clustered at the tips of the stems and branches (Figure 13). Each flower head is approximately 6 millimeters (0.25 inch) long and contains two types of *florets* (the tiny flowers characteristic of the aster family); the 4 to 7 outer florets differ in shape from the numerous inner florets. The two types of florets produce *achenes* (tiny, one-seeded fruits) that also differ in shape (Johnson 1993, Taylor in litt. 1989).

Identification. - San Joaquin woolly-threads differs from snowy eatonella in the shape of the florets and achenes and in geographical range (Munz and Keck 1959, Johnson 1993, Taylor in litt. 1989).

2. Historical and Current Distribution

Historical Distribution. - The historical range of San Joaquin woolly-threads is based on 47 herbarium specimens and literature reports dating from 1883 to 1983; 30 of the occurrences were from the floor of the San Joaquin Valley, four were from the Cuyama Valley, and the remainder were in the hills west of the San Joaquin Valley (Figure 14). These occurrences were concentrated in eight areas (in descending order of abundance): (1) the plains between Avenal and Mendota in Kings and Fresno Counties, (2) from Bakersfield to Shafter in Kern County, (3) the inner Coast Ranges of western Fresno and eastern San Benito Counties, (4) from north of Lokern to Lost Hills in Kern County, (5) the Carrizo and Elkhorn Plains in San Luis Obispo County, (6) the Cuyama Valley in Santa Barbara County, (7) east of Edison in Kern County, and (8) the type locality. However, 33 of the historical occurrences had been eliminated by 1989 (Taylor in litt. 1989).

Current Distribution. - Many new occurrences of San Joaquin woolly-threads have been discovered since 1986, primarily in the hills and plateaus west of the San Joaquin Valley. These constitute four metapopulations and several small, isolated populations. The largest metapopulation occurs on the Carrizo Plain Natural Area, where the occupied habitat totaled over 1,100 hectares (2,800 acres) in 1993 (Lewis in litt. 1993*b*), which was a

particularly favorable year. In years of lower rainfall, the occupied area is much smaller (E. Cypher unpubl. observ.). Much smaller metapopulations are found in Kern County near Lost Hills, in the Kettleman Hills of Fresno and Kings Counties, and in the Jacalitos Hills of Fresno County. The isolated occurrences are known from the Panoche Hills in Fresno and San Benito Counties, the Bakersfield vicinity, and the Cuyama Valley (CDFG 1995, Taylor in litt. 1989, Stebbins et al. in litt. 1992, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993, USBLM in litt. 1994, S. Carter pers. comm., R. Lewis pers. comm., S. Wilson pers. comm.).

3. Life History and Habitat

Reproduction and Demography. - San Joaquin woolly-threads is an annual herb, and its phenology varies with weather and site conditions. In years of below-average precipitation, few seeds of this species germinate, and those that do typically produce tiny plants. Seed germination may begin as early as November but usually occurs in December and January. San Joaquin woolly-threads typically flowers between late February and early April, but flowering may continue into early May if conditions are optimal (B. Delgado pers. comm.). Populations in the northern part of the range flower earlier than does the Carriso Plain metapopulation. Each plant may have from 1 to more than 400 flower heads. Seed production depends on plant size and the number of flower heads; in 1993, achene production ranged from 10 to 2,500 seeds per individual (Mazer and Hendrickson in litt. 1993*b*, Cypher in litt. 1994*a*, E. Cypher unpubl. data). The seeds are shed immediately upon maturity, and all trace of the plants disappears rapidly after their death in April or May. Seed dispersal agents are unknown, but possible candidates include wind, water, and animals. Seed-dormancy mechanisms apparently allow the formation of a substantial seed bank in the soil (Twisselmann 1967, Taylor in litt. 1989, Lewis in litt. 1993*b*, Mazer and Hendrickson in litt. 1993*b*, Cypher in litt. 1994*a*).

Insect pollinators are not required for seed-set in San Joaquin woolly-threads (Mazer and Hendrickson in litt. 1993*b*). However, animals may be important to this plant species in other ways. On the Carrizo Plain Natural Area, giant kangaroo rat activity contributes to greater plant size and flower head production in San Joaquin woolly-threads, probably by increasing available soil nutrients and reducing competition from other plants. The microhabitat offered by giant kangaroo rat *precincts* also contributes to earlier seed germination and maturation of San Joaquin woolly-threads, possibly because precinct surfaces are warmer than the surrounding area during the winter months (Cypher in litt. 1994*a*, 1994*b*).

Habitat and Community Associations. - San Joaquin woolly-threads occurs in Nonnative Grassland, Valley Saltbush Scrub, Interior Coast Range Saltbush Scrub, and Upper Sonoran Subshrub Scrub (Cypher in litt. 1994*a*). This species typically occupies microhabitats with less than 10 percent shrub cover, although herbaceous cover may be either sparse or dense, and cryptogamic crust may or may not be present. Plant species that often occur with San Joaquin woolly-threads include red brome, red-stemmed filaree, goldfields, Arabian grass (*Schismus* spp.), and mouse-tail fescue (*Vulpia myuros*). Hoover's woolly-threads often occurs in populations of San Joaquin woolly-threads, although the reverse is not true (Taylor in litt. 1989, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993,

Cypher in litt. 1994*a*). In two cases San Joaquin woolly-threads was found at low densities in previously disced areas that were adjacent to undisturbed populations (Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993).

San Joaquin woolly-threads occurs on neutral to subalkaline soils that were deposited in geologic times by flowing water. On the San Joaquin Valley floor, this species typically is found on sandy or sandy loam soils, particularly those of the Kimberlina series, whereas on the Carrizo Plain it occurs on silty soils. San Joaquin woolly-threads frequently occurs on sand dunes and sandy ridges as well as along the high-water line of washes and on adjacent terraces. Occurrences have been reported at elevations ranging from approximately 60 to 260 meters (200 to 850 feet) on the Valley floor and surrounding hills, and from 600 to 800 meters (2,000 to 2,600 feet) in San Luis Obispo and Santa Barbara Counties (Hoover 1937, CDFG 1995, Taylor in litt. 1989, Lewis in litt. 1993*b*, Taylor and Buck in litt. 1993, E. Cypher unpubl. observ., R. van de Hock pers. comm.).

OIL NESTSTRAW
(Stylocline citroleum)

1. Description and Taxonomy

Taxonomy. - Oil neststraw was recently recognized as a distinct species, *Stylocline citroleum* (Morefield 1992), even though herbarium specimens were collected as early as 1883. Munz collected the type specimen in 1935 from flats near Taft, in Kern County (Morefield 1992). Oil neststraw is believed to have originated as a hybrid of two common species, everlasting neststraw *(Stylocline gnaphaloildes)* and California filago *(Filago californica)*. However, oil neststraw satisfies the definition of a species because it is capable of reproducing itself without further crossing of the parental species (Morefield 1992). Oil neststraw is a member of the aster family.

Description. - Oil neststraw is inconspicuous because it grows low to the ground and does not have showy flowers. It has trailing, woolly stems less than 13 centimeters (5 inches) long and small, woolly leaves. The round flower heads are 5 millimeters (0.2 inch) or less in diameter. Each flower head contains many individual florets, which consist of reproductive parts and papery scales covered with woolly hairs. The fruits are tiny, brown achenes. Oil neststraw is difficult to distinguish from closely related species because the identifying characters are microscopic (Morefield 1992, 1993).

2. Historical and Current Distribution

Historical Distribution. - Five populations of oil neststraw were known historically, based on collections made from 1883 to 1935. Four of the occurrences were in Kern County, in the vicinities of Bakersfield, McKittrick, and Taft (two sites, including the type locality). The fifth collection was made in San Diego County.

Current Distribution. - Morefield (pers. comm.) was unable to rediscover oil neststraw at any of the historical locations. Although natural land remains at most sites, the location descriptions are vague. Four new occurrences were discovered between 1988 and 1995 on the Elk Hills Naval Petroleum Reserves in California in Kern County (J. Hinshaw pers. comm., D. Taylor pers. comm.).

Life History and Habitat. - Oil neststraw, an annual, flowers in April and reproduces strictly by self-pollination. The extant occurrences and several of the historical localities are in petroleum-producing areas, giving rise to both the common and scientific names. This species grows on flats and on slopes. One of the Elk Hills populations of oil neststraw occurs on the bank of a wash in a very sparsely vegetated area that has well-developed cryptogamic crust. The few plant species associated with oil neststraw at that site are natives such as everlasting neststraw, California filago, Hoover's woolly-star, and many-flowered eriastrum. Plant species that occur with oil neststraw in the other Elk Hills sites are red brome, common saltbush, and white burrobush *(Hymenoclea salsola)*. All the extant occurrences are in the Valley Saltbush Scrub plant community in undeveloped areas.

Oil neststraw has been found at elevations of 60 to 320 meters (200 to 1,050 feet) on both sandy and clay soils (Morefield 1992, EG&G Energy Measurements unpublished data, D. Taylor pers. comm.).

GIANT KANGAROO RAT
(Dipodomys Ingens)

1. Description and Taxonomy

Taxonomy. - *Dipodomys ingens* was described as *Perodipus ingens* by Merriam (1904*a*), who listed the type locality as Painted Rock, 20 miles SE Simmler, Carrizo Plain, San Luis Obispo, California. The type locality was amended to 41 kilometers (25 miles) SE of Simmler by Williams and Kilburn (1991). The genus name *Perodipus* was used for several years to include all the kangaroo rats with five toes on the hind feet. Grinnell (1921) relegated *Perodipus* to a synonym of *Dipodomys.* This taxonomy has been sustained in the latest taxonomic review of the family Heteromyidae (Williams et al. 1993*b*).

Description. - The giant kangaroo rat is adapted for bipedal locomotion (two-footed hopping) (Eisenberg 1963). The hind limbs are large compared to the size of the forelimbs; the neck is short; and the head is large and flattened. The tail is longer than the combined head and body length and has a dorsal crest of long hairs towards the end of the tail, terminating in a large tuft. Large, fur-lined cheek pouches open on each side of the mouth. The pouches extend as deep invaginated pockets of skin folded inward along the sides of the head (Grinnell 1922).

Identification. - Giant kangaroo rats are distinguished from the coexisting species, San Joaquin kangaroo rat *(D. nitratoides)* and Heermann's kangaroo rat *(D. heermanni),* by size and number of toes on the hind foot. The hind feet of adult giant kangaroo rats each have five toes and are longer than 47 millimeters (1.85 inches) (Best 1993). The giant kangaroo rat is the largest of more than 20 species in the genus (Grinnell 1922, Hall 1981, Best 1993). Grinnell (1932*a*) reported a mean mass of 157.0 grams (5.54 ounces) for 15 adult males and 151.4 grams (5.34 ounces) for 7 adult females. Adult Heermann's kangaroo rats average 65 to 80 grams (2.29 to 2.82 ounces), with maximum weights not exceeding about 90 grams (3.17 ounces) (Williams 1992); the hind foot also has five toes but individuals' feet usually measure less than 45 millimeters (1.77 inches) (Best 1993). Average weight of San Joaquin kangaroo rats is less than 45 grams (1.59 ounces), and they have four toes on each hind foot. Length of the hind feet do not exceed 39 millimeters (1.54 inches) (Grinnell 1922).

2. Historical and Current Distribution

Historical Distribution. - Up until the 1950s colonies of giant kangaroo rats were spread over hundreds of thousands of acres of continuous habitat in the western San Joaquin Valley, Carrizo Plain, and Cuyama Valley (Grinnell 1932*a*, Shaw 1934, Hawbecker 1944, 1951). The historical distribution of giant kangaroo rats encompassed a narrow band of gently sloping ground along the western edge of the San Joaquin Valley, California, from the base of the Tehachapi Mountains in the south, to a point about 16 kilometers (10 miles) south of Los Banos, Merced County in the north; the Carrizo and Elkhorn Plains and San Juan Creek watershed west of the Temblor Mountains, which form the western

boundary of the southern San Joaquin Valley; the upper Cuyama Valley next to and nearly contiguous with the Carrizo Plain; and scattered colonies on steeper slopes and ridge tops in the Ciervo, Kettleman, Panoche, and Tumey Hills, and in the Panoche Valley. Within this circumscribed geographic range were about 701,916 to 755,844 hectares (1,734,465 to 1,867,723 acres), which included different estimates of the amount of nonhabitat depending on different assumptions. The most liberal estimate of historical habitat was about 631,724 hectares (1,561,017 acres; Williams 1992).

Current Distribution. - The species population is currently fragmented into six major geographic units: A) the Panoche Region in western Fresno and Eastern San Benito Counties; B) Kettleman Hills in Kings County; C) San Juan Creek Valley in San Luis Obispo County; D) western Kern County in the area of the Lokern, Elk Hills, and other uplands around McKittrick, Taft, and Maricopa; E) Carrizo Plain Natural Area in eastern San Luis Obispo County; and F) Cuyama Valley in Santa Barbara and San Luis Obispo Counties (Williams 1980, 1992, O'Farrell et al. 1987*a*, Williams et al. 1995). These major units are fragmented into more than 100 smaller populations, many of which are isolated by several miles of barriers such as steep terrain with plant communities unsuitable as habitat, or agricultural, industrial, or urban land without habitat for this species. Extant habitat was last estimated to be 11,145 hectares (27,540 acres), about 1.8 percent of historical habitat (Williams 1992).

Within the area of currently occupied habitat, populations of giant kangaroo rats have expanded and declined with changing weather patterns since 1979. At their peak in 1992 to 1993, there probably were about 6 to 10 times more individuals than at their low point in spring of 1991, when a majority of the 11,145 hectares (27,540 acres) probably was uninhabited and most of the rest was inhabited by less than 10 percent of peak numbers (Williams 1992, Williams et al. 1993*a*, Williams et al. 1995, Allred et al. in press, Williams and Nelson in press, D.F. Williams unpubl. data).

3. Life History and Habitat

Food and Foraging. - Giant kangaroo rats are primarily seed eaters, but also eat green plants and insects. They cut the ripening heads of grasses and forbs and cure them in small surface pits located on the area over their burrow system (Shaw 1934, Williams et al. 1993*a*). They also gather individual seeds scattered over the ground's surface and mixed in the upper layer of soil. Surface pits are uniform in diameter and depth (about 2.5 centimeters, 1 inch), placed vertically in firm soil, and filled with seed pods. After placing seeds and seed heads in pits, the animal covers them with a layer of loose, dry dirt. Pits are filled with the contents of the cheek pouches after a single trip to harvest seeds. Before being moved underground, the seeds, including filaree and peppergrass *(Lepidium nitidum),* are sun-dried which prevents molding (Shaw 1934).

Individuals in many populations of *D. ingens* also make large stacks of seed heads on the surfaces of their burrow systems (Hawbecker 1944, Williams et al. 1993*a*). The material is cured, then stored underground. Amounts cached in surface stacks may not correspond with annual herbaceous productivity. No stacks were found in 1990, a year

with no seed production, and 1991, a year with the second highest plant productivity between 1987 and 1994 (Williams and Nelson in press).

Grinnell (1932*a*, p. 313) examined three nursing females who had their cheek pouches "literally crammed with green stuff", and speculated that green foliage might be an important part of the diet during lactation. Other individuals, including a young female and adult males, were captured with foliage and fruits of peppergrass and foliage of filaree in their cheek pouches (Grinnell 1932*a*). In captivity, giant kangaroo rats have been maintained for periods from 2 weeks to more than 2 years on a diet of air-dried seeds, consisting primarily of millet, oat, and sunflower, occasionally supplemented with green plants. Of the green plants, captives preferred forbs to annual grasses, and usually ignored the blades of perennial grasses (Williams and Kilburn 1991). Shaw (1934) found a live insect of the bee and wasp family in the cheek pouch of a giant kangaroo rat. Eisenberg (1963) kept a giant kangaroo rat in captivity on a diet that included seeds, lettuce, and mealworm (darkling beetle) larvae (*Tenebrio* sp.).

Giant kangaroo rats forage on the surface from around sunset to near sunrise, though most activity takes place in the first 2 hours after dark. Foraging activity is greatest in the spring as seeds of annual plants ripen. Typically, plants such as peppergrass ripen first, and early caches, mostly in pits instead of stacks, consist of pieces of the seed-bearing stalks of this and other early-ripening species. The ability to transport large quantities of seeds and other food in cheek pouches and their highly developed caching behaviors, coupled with relatively high longevity of adults with established burrow systems, probably allow giant kangaroo rats to endure severe drought for 1 or 2 years without great risk of population extinction (Williams et al. 1993*a*, D.F. Williams unpubl. data).

Reproduction and Demography. - Results of studies conducted between 1987 and 1995 in colonies on the Elkhorn and Carrizo Plains indicate that giant kangaroo rats have an adaptable reproductive pattern that is affected by both population density and availability of food (Williams et al. 1993*a*, Williams and Nelson in press, Endangered Species Recovery Program unpubl. data). During times of relatively high density, females had a short, winter reproductive season with only one litter produced and there is no breeding by young-of-the-year. This was true both in years of high plant productivity and drought. In contrast, populations at low densities continue to breed into summer during drought. In 1990, a year of severe drought and no seed production, most females appeared not to reproduce; the few that bred apparently failed to raise young. In most years, females were reproductive between December and March or April, but in colonies with low densities, reproduction extended into August or September.

Giant kangaroo rats can breed the year of their birth when environmental and social conditions permit (sufficient food and space). At the Soda Lake colony, juvenile. females had their first litters at an estimated mean age of 5 months. Some females had 2 to 3 litters per year. This relatively high rate of reproduction probably was promoted by high plant productivity and low population density (Williams and Nelson in press).

Little information is available on litter size and none exists for age-specific litter size or a specific mating system. The mean of known embryo counts and litter sizes is 3.75,

probably a value higher than the number born (Williams and Kilburn 1991, D.F. Williams unpubl. data). A majority of females may have from 2 to 4 young.

The major time for dispersal of giant kangaroo rats seems to be following maturation of young, about 11 to 12 weeks after birth. However in years of high density, when most or all burrow systems are occupied, most young appear to remain in their natal burrows until opportunity to disperse arises or they finally are driven off by the mother or one of the siblings. Under these circumstances, death or dispersal of the resident does not leave a burrow system vacant for long. Williams and Nelson (in press) found on a study site at Soda Lake, San Luis Obispo County that more females than males dispersed although males more often moved longer distances. Females had a nearly 60 percent greater survival rate than males. Dispersal of adults with established burrow systems was occasionally detected; one adult male moved more than 120 meters (131.2 yards) from his established home to take up a new residence in a new burrow system he constructed (Williams et al. 1993*a*, Williams and Nelson in press, Williams and Tordoff in litt. 1988).

Estimated home range size ranges from about 60 to 350 square meters (71.8 to 418.6 square yards). There is no significant difference in size of home range between sexes. The core area of the territory, located over the burrow system *(precinct)* is the most intensely-used location in the home range (Braun 1985). Most often, territories are occupied by a single animal (Grinnell 1932*a*, Shaw 1934).

Estimates of density, employing both trapping and counts of precincts ranged from 1 to 110 animals per hectare (1 to 44 animals per acre) (Grinnell 1932*a*, Braun 1985, Williams 1992). Changes in density generally coincide with amount of rainfall and herbaceous plant productivity, though numbers in populations studied in 1989 remained high despite drought and low plant productivity. Large seed caches made in spring 1988 probably carried individuals through 1989 and 1990 during drought (Williams et al. 1993*a*, Williams and Nelson in press, D.F. Williams . unpubl. data). The population on the Elkhorn Plain typically was at much higher density than other populations recently studied, and fluctuated less than populations elsewhere, suggesting that the habitat on this part of the Elkhorn Plain is some of the best remaining.

Population Genetics. - Partial results of on-going studies of population genetics of giant kangaroo rats provide guidance for designing a recovery strategy. The northern populations in Fresno and San Benito Counties are highly differentiated genetically from the southern populations on the Carrizo Plain Natural Area.

The genetic structure of the Carrizo Plain population differs from northern populations in that it has effectively acted as one large population, though the genetic data strongly suggest that the inhabited areas there have gone through episodes of substantial expansion and contraction in size (Mosquin et al. in press). This is consistent with recent observations from population censuses (Williams 1992, Williams et al. 1993*a*, Williams and Nelson in press, Allred et al. in press, D.F. Williams unpubl. data).

In the north, the population along the edge of the Valley at the eastern base of Monocline Ridge (San Joaquin Valley population) is substantially differentiated genetically from the other large population in the southeastern end of Panoche Valley. These two populations show little evidence of gene flow between them, and the San Joaquin Valley population is closer genetically to the Carrizo Plain population than any other of the semi-isolated northern populations. Clearly, this represents the remnant of the historical population that was distributed along the western edge of the Valley between Merced and Kern Counties. The two large, northern populations (San Joaquin Valley and Panoche Valley) appear to have been the sources of the small, semi-isolated populations on ridge-tops in the Ciervo and Turney Hills. These latter populations are differentiated from both of the large populations, and from each other. They appear to have played the major role in gene flow between the Panoche Valley and San Joaquin Valley populations. Interpopulation movements appear to have been achieved over relatively long periods in a stepping-stone manner between small populations on these ridge tops. Though small, they contain a significant proportion of the rare and unique genes of the northern population (Mosquin et al. in press).

The genetic studies show that *effective population size* (number of successfully-breeding individuals) in the north is smaller than current population size, indicating there has been a large increase in the northern population size very recently. This is consistent with the increase measured after the end of the drought in 1991 (Williams et al. 1995). In the south, estimated effective population size is slightly greater than current population size, indicating that current and historical population sizes are approximately the same (Mosquin et al. in press).

The genetic structure of giant kangaroo rat populations also shows that the *effective dispersal* distance of giant kangaroo rats (i.e., dispersal of genes) is much greater than predicted on the basis of capture-recapture and behavioral studies. Results from trapping of kangaroo rats show most movements are less than 100 meters (328 feet) and rarely as much as 1 kilometer (0.62 mile) (Jones 1988, 1989, Williams and Nelson in press). The genetic data suggest that effective distances are several times greater than 1 kilometer. There are too few data, and analyses are too incomplete to make a precise estimate, but they do suggest effective dispersal over several kilometers and through highly inhospitable habitat in the northern population (Mosquin et al. in press).

Behavior and Species Interactions. - Little direct evidence exists on aggression by giant kangaroo rats, but they seem to be much more aggressive than the two co-occurring species. Wherever giant kangaroo rats were found by Grinnell (1932*a*), they dominated the community to the exclusion of other rodent species.

Hawbecker (1944, 1951) and Tappe (1941) corroborated Grinnell's observations, finding that giant kangaroo rats excluded all other nocturnal rodents from areas where they occurred.

Braun (1983), however, found that a population of giant kangaroo rats on the Carrizo Plain, San Luis Obispo County, did not exclude other species of rodents to the extent reported by others. Braun (1983) believed that the lack of exclusivity supported the hypothesis that this population was living in suboptimal habitat.

The giant kangaroo rat, by its relative abundance and burrowing activity, is a key species (i.e., keystone species) in grassland and shrub communities (Goldingay et. al. 1997). When abundant locally, giant kangaroo rats are a significant prey item for many species, including San Joaquin kit foxes (an umbrella species), American badgers *(Taxidea taxus)*, coyotes *(Canis latrans)*, long-tailed weasels *(Mustela frenata)*, burrowing owls *(Athene cunicularia)*, barn owls *(Tyto alba)*, great horned owls *(Bubo virginianus)*, and short-eared owls *(Asio flammeus)*. Snakes seen within giant kangaroo rat colonies included the coachwhip *(Masti- cophis flagellum)*, gopher snake *(Pituophis melano- leucus)*, common king snake *(Lampropeltis getulus)*, and western rattlesnake *(Crotalis viridis;* Williams 1992). Giant kangaroo rat burrows also are used by blunt-nosed leopard lizards and San Joaquin antelope squirrels. On the Carrizo Plain Natural Area, the endangered California jewelflower grows primarily on the burrow systems of giant kangaroo rats (Cypher in litt. 1994*a*). In spring, precincts show as distinct, evenly-spaced, dark green patches because of the more lush growth of herbaceous plants compared to intervening spaces (Grinnell 1932*a*). Measurements of plant productivity on and off precincts over an 8-year period show that when rainfall was sufficient to promote growth and fruiting of plants, the net productivity of herbaceous plants was two to five times greater on precincts than surrounding ground (Hawbecker 1944, Williams et al. 1993*a*, Williams and Nelson in press). Further, growth of herbaceous plants on precincts contained about 4 percent more protein than plants from surrounding ground. These differences were attributed directly to the presence and activities of the giant kangaroo rats (Williams et al. 1993*a*).

Activity cycles. - Giant kangaroo rats are active all year and in all types of weather. They do not migrate or become dormant or torpid. Although primarily nocturnal, giant kangaroo rats have been seen above ground during daylight, including midday in the hottest part of the year (Williams et al. 1993*a*, Williams and Tordoff in litt. 1988). Giant kangaroo rats typically emerge from their burrows soon after sunset and are active for about 2 hours (time of first emergence to time of last disappearance). There usually is no second period of activity before dawn. Animals are above ground only for about 15 minutes per night, Activity patterns appear to be unaffected by distance from the home burrow, snow, rain, wind, moonlight, or season (Braun 1985).

Habitat and Community Associations. - Historically, giant kangaroo rats were believed to inhabit annual grassland communities with few or no shrubs, well-drained, sandy-loam soils located on gentle slopes (less than 11 percent) in areas with about 16 centimeters (6.3 inches) or less of annual precipitation, and free from flooding in winter (Grinnell 1932*a*, Shaw 1934, Hawbecker 1951). However, more recent studies in remaining fragments of historical habitat found that giant kangaroo rats inhabited both grassland and shrub communities on a variety of soil types and on slopes up to about 22 percent and 868 meters (2,850 feet) above sea level. This broader concept of habitat requirements probably reflects the fact that most remaining populations are on poorer and marginal habitats compared to the habitats of the large, historical populations in areas now

cultivated. Yet these studies demonstrated that the preferred habitat of giant kangaroo rats still was annual grassland communities on gentle slopes of generally less than 10 percent, with friable, sandy- loam soils. Few plots in flat areas were inhabited, probably because of periodic flooding during heavy rainfall (Williams 1992, Williams et al. 1995, Allred et al. in press).

Below about 400 meters (1,312 feet), at Panoche Creek in western Fresno County and in the Lokern, Buena Vista Valley, and Elk Hills regions of the southern San Joaquin Valley, giant kangaroo rats are found in annual grassland and saltbush scrub. Scattered common and spiny saltbushes characterize areas where giant kangaroo rats are associated with shrubs. The most common herbaceous plants are red brome, annual fescue, and red-stemmed filaree (Williams 1992).

Upper Sonoran subshrub scrub associations support relatively large populations of giant kangaroo rats at elevations above about 400 meters (1,312 feet). In the southern portion of the extant geographic range of giant kangaroo rats, these communities are characterized by open stands of the dominant shrub, California ephedra. Annual grasses and forbs, particularly red-stemmed filaree, peppergrass, and Arabian grass dominate areas between shrubs. Giant kangaroo rats are most numerous where annual grasses and forbs predominate, with scattered ephedra bushes and fewer shrubs such as Anderson desert thorn *(Lyciuni andersonii),* eastwoodia *(Eastwoodia elegans),* and pale-leaf goldenbush *Isocoma acradenia var. bracteosa)* (Williams 1992).

Above about 600 meters (1,968 feet) in elevation, eastwoodia, California buckwheat, winter fat *(Krascheninnikovia lanata),* and chaparral yucca *(Yucca whipplei)* are more common on steep slopes (greater than about 5-6 percent) and sandy ridgetops. Cheesebush *(Hymenoclea salsola)* and matchweed are common only in arroyos. Only satellite colonies of giant kangaroo rats or scattered individuals are found in these latter associations. In the northern portion of the geographic range of giant kangaroo rats, Anderson desert thorn is absent; otherwise, the woody shrubs comprising the ephedra community are the same or closely-related species (Williams 1992, Williams et al. 1995).

TIPTON KANGAROO RAT
(Dipodomys Nitratoides Nitratoides)

1. Description and Taxonomy

Taxonomy. - The Tipton kangaroo rat is one of three subspecies of the San Joaquin kangaroo rat. The type specimen of the Tipton kangaroo rat was collected from Tipton, Tulare County, California, in 1893 (Merriam 1894). See account of the Fresno kangaroo rat for a discussion of taxonomic history of *D. n. nitratoides.* Hafner in litt. (1979) examined samples of Tipton and short-nosed kangaroo rats, and, using detailed analyses, established better-defined boundaries between the two subspecies than those of previous researchers. He concluded that samples from populations northeast and east of Bakersfield, and in upland saltbush communities above the southern and eastern borders of the Tulare Basin floor were characteristic of populations of short-nosed kangaroo rats, typified by reference samples from the Carrizo Plain, San Luis Obispo County. Hafner's in litt. (1979) analyses showed that the subspecies boundary on the southwest in Kern County nearly coincided with the California Aqueduct, which is positioned just above the Valley floor along the edge of the more steeply sloping foothills in areas that do not flood extensively. The natural boundary between these two subspecies on the southwest was probably a narrow zone of seasonal and permanent wetlands around Kern and Buena Vista lakes and the Kern River channel that meandered north from the east edge of the Elk Hills to historical Goose Lake. Historical barriers between the two subspecies probably were intermittent in some spots. More recent flood control and diversion of waters from the Kern River for irrigation and other purposes removed these barriers and probably allowed for increased genetic exchange between the two subspecies. Today, the California Aqueduct and large expanses of irrigated cropland again have isolated these populations.

Description. - See account of the Fresno kangaroo rat for a general description of the species. On average, adult Tipton kangaroo rats weigh about 35 to 38 grams (1.23 to 1.34 ounces), have a head and body length of about 100 to 110 millimeters (3.94 to 4.33 inches) and a tail about 125 to 130 millimeters (4.92 to 5.12 inches) in length. The Tipton kangaroo rat is larger than the Fresno kangaroo rat and smaller than the short-nosed kangaroo rat.

Identification. - See the Fresno kangaroo rat account for distinguishing Tipton kangaroo rats from other co-occurring species. The Tipton kangaroo rat can be distinguished from the Fresno kangaroo rat by its larger average measurements: total length for males, 235 millimeters (9.25 inches), for females, 221 millimeters (8.7 inches); length of hind foot for males 34.7 millimeters (1.37 inches), for females, 33.6 millimeters (1.32 inches); mean inflation of the auditory bullae for males, 22.1 millimeters (0.87 inch), for females, 21.8 millimeters (0.86 inch) (Hoffmann 1975) (see accounts of Fresno and short-nosed subspecies for corresponding average measurements).

2. Historical and Current Distribution

Historical Distribution. - The historical geographic range of Tipton kangaroo rats was estimated to cover approximately 695,174 hectares (1,716,480 acres) (Williams in litt. 1985). Tipton kangaroo rats were distributed within an area on the floor of the Tulare Basin, extending from approximately the southern margins of Tulare Lake on the north; eastward and southward approximately along the eastern edge of the Valley floor in Tulare and Kern Counties. The southern and western extent of their range was the foothills of the Tehachapi Mountains (south) and the marshes and open water of Kern and Buena Vista lakes, and the sloughs and channels of the Kern River alluvial fan. Farther north, the western boundary was approximately along the Buena Vista slough of the Kern River channel into Goose Lake. The approximate line on the northwest is marked by the city of Lost Hills, Kern County; Kettleman City, Kings County; and Westhaven, Fresno County. Prior to development of water-diversion and irrigation systems over the past several decades, this area bounded three large lakes, Tulare, Kern, and Buena Vista, together with marshlands that were unsuitable habitat for kangaroo rats (Boolootian 1954, Hoffmann 1974, Hafner in litt. 1979, Williams et al. 1993*b*, Williams in litt. 1985).

Current Distribution. - By July 1985, the area inhabited had been reduced, primarily by cultivation and urbanization, to about 25,665 hectares (63,367 acres), only about 3.7 percent of the historical acreage. Additional small parcels not surveyed by Williams (in litt. 1985) have since been found to be inhabited. Tipton kangaroo rats also have reinhabited several hundred to a few thousand acres that were in crop production in 1985 but have since been retired because of drainage problems or lack of water, or acquired by State and Federal agencies for threatened and endangered species conservation. Most notable has been a mix of mostly agricultural and some natural land acquired by the State for the Kern Fan Water Bank, managed by the California Department of Water Resources. This project was to provide over 2,023 hectares (5,000 acres) of habitat for threatened and endangered species management (Jean Hopkins & Associates in litt. 1994), though a lesser, unknown amount actually has been naturally recolonized from adjacent natural land. Offsetting these gains has been the loss of several hundred to a few thousand acres of habitat that have been developed. Thus, the current acreage of occupied habitat is unknown, but probably does not differ much from the 1985 estimate.

Current occurrences are limited to scattered, isolated areas clustered west of Tipton, Pixley, and Earlimart, around Pixley National Wildlife Refuge, Allensworth Ecological Reserve, and Allensworth State Historical Park, Tulare County; between the Kern National Wildlife Refuge and Delano, Kern County; and other, scattered units to the south in Kern County.

3. Life History and Habitat

Food and Foraging. - Tipton kangaroo rats eat mostly seeds, with small amounts of green, herbaceous vegetation and insects supplementing their diet when available. Most aspects of food and foraging of Tipton kangaroo rats are identical to those of Fresno kangaroo rats. See the account of the Fresno kangaroo rat for more information.

Reproduction and Demography. - Little specific information has been published on reproduction of Tipton kangaroo rats. Generally, this aspect of their biology is extremely similar to that of the Fresno kangaroo rat (see that account for details). Five Tipton kangaroo rats being held in captivity to prevent their death by permitted destruction of their habitats each gave birth to two young (D.G. Germano pers. comm., D.F. Williams unpubl. observ., S. Yoerg pers. comm.).

Reproduction commences in winter and peaks in late March and early April. Most females appear to have only a single litter, though some adult females have two or more, and females born early in the year also may breed (Endangered Species Recovery Program unpubl. data).

At the Paine Wildflower Preserve south of Kern Wildlife Refuge, Clark et al. (1982) estimated a density of 2.6 Tipton kangaroo rats per hectare (1.05 per acre) in the "best" habitat above flood level, and 1.5 per hectare (0.61 per acre) in "poor" habitats subjected to flooding and disturbance by past disking of the soil. Hafner in litt. (1979) estimated relative densities of Tipton kangaroo rats at 13 sites representing areas from throughout the geographic range and most plant communities in which Tipton kangaroo rats were known to occur. Densities ranged from a low of 1 to 2 per hectare (0.4 to 0.8 per acre) in alkaline and terrace grasslands with a sparse cover of seepweed to a high of about 7 to 9 per hectare (2.8 to 3.6 per acre) in saltbush scrub.

In 1985, surveys through the remaining extant habitat resulted in estimated densities, based on numbers of burrow systems, ranging from less than 1 per hectare to 50 per hectare (less than 0.4 to 20.2 per acre). Areas supporting very low densities had few noticeable features in common. Sites on the eastern perimeter of the geographic range in terrace grasslands had consistently low densities. Areas subjected to prolonged flooding also supported few kangaroo rats. Many sites showed no evidence of kangaroo rats on one or more randomly chosen transects. Although a cause for lack of occupancy could not be determined in most cases, the environment at the sites suggested periods of extensive flooding. Floods in the Tulare Basin were extremely severe in 1983 (Williams in litt. 1985).

At Pixley National Wildlife Refuge on two plots, density estimates in June 1991 during drought were 3.0 to 3.8 Tipton kangaroo rats per hectare (1.2 to 1.5 per acre). After the end of a 5.5 year drought in April 1991, a population irruption occurred, and peaked in January 1993. Subsequently, density declined from the high of 88.2 per hectare (35.7 per acre) in January 1993 to a low of 1.1 per hectare (0.45 per acre) in April 1995. The shape of this population decline is illustrated by the number of Tipton kangaroo rats known to be alive each month in Figure 47 (Endangered Species Recovery Program unpubl. data).

During the decline, annual rainfall was greater than average and little or no livestock grazing occurred in the pasture where the plot was located. Kangaroo rats could not use their usual defenses of speed and alertness, adaptations for habitats with sparse, low vegetation, and many may have been taken by predators. High rainfall also may have caused death from water penetrating burrows and drowning occupants, spoiling seed stores, or causing death from hypothermia or pneumonia-like diseases that have been observed to afflict these animals when placed in a cool, moist environment (Endangered Species Recovery Program unpubl. observ.).

Behavior and Species Interactions. - Tipton kangaroo rats live in ground burrows. Most burrows probably are dug by the occupant or a predecessor of the same species. Burrows are typically simple, but may be unbranched or branched, including interconnecting tunnels. Most burrows are less than 25 centimeters (10 inches) deep (Germano and Rhodehamel in litt. no date). Nothing else specific to the behavior of the Tipton subspecies has been published (see Fresno kangaroo rat for a general discussion of behavior and species interactions).

Tipton kangaroo rats are food for a variety of predators: coyotes, San Joaquin kit foxes, long-tailed weasels, American badgers, owls, hawks (San Joaquin kangaroo rats infrequently emerge from their burrows during daylight; Tappe 1941, Williams et al. 1993*a*), various species of snakes, and probably others. Except for small, isolated populations, predation is unlikely to threaten Tipton kangaroo rats. The increasing fragmentation of the range of Tipton kangaroo rats, however, increases the vulnerability of small populations to predation.

Habitat and Community Associations. - Tipton kangaroo rats are limited to arid-land communities occupying the Valley floor of the Tulare Basin in level or nearly level terrain. They occupy alluvial fan and floodplain soils ranging from fine sands to clay-sized particles with high salinity. Historically, populations apparently were most numerous and persistent in Relictual Interior Dune Grassland and Sierra-Tehachapi Saltbush Scrub communities. Today, much of the occupied remnants of their range have one or more species of sparsely scattered woody shrubs and a ground cover of mostly introduced and native annual grasses and forbs. Woody shrubs commonly associated with Tipton kangaroo rats are: spiny and common saltbushes, arrowscale *(Atriplex phyllostegia),* quailbush *(Atriplex lentiformis),* iodine bush, pale-leaf goldenbush, and honey mesquite *(Prosopis glandulosa var. torreyana).* A conspicuous semi-woody species is seepweed (Williams in litt. 1985).

Winter rains and runoff from the surrounding mountain ranges (Sierra Nevada to the east, Tehachapi Mountains to the south, and Temblor Range to the west) flood much of the area occupied by Tipton kangaroo rats. Areas with standing water during portions of winter and spring (vernal pools) become alkaline playas when the water has evaporated. Tipton kangaroo rats sometimes colonize areas that are flooded in winter and spring. Important existing communities for Tipton kangaroo rats are iodine bush shrubland (Valley Sink Scrub) and Valley Saltbush Scrub (Griggs et al. 1992). Much of these extant communities are flooded seasonally. Alkaline water lies close to the surface of the soil, year around. Presumably during flooding, individuals are either drowned or captured by

predators after being forced from their burrows, or escape to higher ground (Williams in litt. 1985).

Although Tipton kangaroo rats occur in terrace grasslands devoid of woody shrubs, sparse-to-moderate shrub cover is associated with populations of high density. Typically, however, burrow systems are located in open areas; only in areas of dense shrub cover are burrows usually located beneath shrubs. Terrain not subject to flooding is essential for permanent occupancy by Tipton kangaroo rats.

Burrows of Tipton kangaroo rats are commonly located in slightly elevated mounds, the berms of roads (where placed above ground level), canal embankments, railroad beds, and bases of shrubs and fences where windblown soils accumulate above the level of surrounding terrain. Soft soils, such as fine sands and sandy loams, and powdery soils of finer texture and of higher salinity are generally associated with greater densities of Tipton kangaroo rats than are less saline and alkaline, sandy-loam, loam, and clay-loam soils of portions of the eastern margins of their geographic range, supporting terrace grasslands. This may relate to how crumbly the soils are, the type of plant communities they support, or both (Williams in litt. 1985).

At Pixley National Wildlife Refuge, Tipton kangaroo rats are the most numerous small mammal. They dominate grazed annual grassland on the refuge, where they typically outnumber Heermann's kangaroo rats, the second most numerous species. Other common, small mammalian associates are San Joaquin pocket mice and deer mice (Williams and Germano in litt. 1991, D.F. Williams unpubl. data). Other common, mammalian associates include San Joaquin kit foxes, coyotes, American badgers, California black-tailed hares, California ground squirrels, harvest mice, and house mice.

BLUNT-NOSED LEOPARD LIZARD
(Gambelia Sila)

1. Description and Taxonomy

Taxonomy. - The blunt-nosed leopard lizard was described and named by Stejneger (1890) as *Crotaphytus silus,* from a specimen collected in Fresno, California. Cope (1900), however, considered the blunt-nosed leopard lizard to be a subspecies of the long-nosed leopard lizard (*C. wislizenii),* and listed it as *C. w. silus.* Under this arrangement, leopard lizards and collared lizards were placed in the same genus. Smith (1946) separated the collared from the leopard lizards, placing the latter in the genus *Gambelia.* The bases for separation were differences in head shape, presence or absence of *gular* (throat area) folds, and differences in bony plates on the head. The subspecific status of *G. w. silus* was retained by Smith (1946). This generic split was not universally agreed upon and the status, both generic and specific, of the lizards remained controversial until Montanucci (1970) presented a solid argument for specific status based upon the study of hybrids between the long-nosed and blunt-nosed leopard lizards. Montanucci et al. (1975) again separated *Gambelia* from *Crotaphytus,* resulting in the name *Gambelia silus* (Jennings 1987). Frost and Collins (1988), Collins (1990), and Germano and Williams (1993) used the spelling *sila* to properly agree in gender with the genus *Gambelia.*

Description. - The blunt-nosed leopard lizard is a relatively large lizard of the family Iguanidae, with a long, regenerative tail; long, powerful hind limbs; and a short, blunt snout (Smith 1946, Stebbins 1985). Males are significantly larger than females, ranging in size from 87 to 120 millimeters (3.4 to 4.7 inches) snout-vent length (Tollestrup 1982). From snout to vent, females are 86 to 111 millimeters long (3.4 to 4.4 inches). Adult males weigh between 31.8 and 37.4 grams (1.3 to 1.5 ounces), and adult females weigh between 20.6 and 29.3 grams (0.8 to 1.2 ounces) (Uptain et al. in litt. 1985). Males are distinguished from females by their enlarged postanal scales, femoral pores (visible pores on the underside of the thigh), temporal and mandibular muscles (muscles on the skull that close the jaws), and tail base (Montanucci 1965).

Although blunt-nosed leopard lizards are darker than other leopard lizards, they exhibit tremendous variation in color and pattern on the back (Tanner and Banta 1963, Montanucci 1965, 1970). Background color ranges from yellowish or light gray-brown to dark brown depending on the surrounding soil color and vegetation association (Smith 1946, Montanucci 1965, 1970, Stebbins 1985). The under surface is uniformly white.

The color pattern on the back consists of longitudinal rows of dark spots interrupted by a series of from 7 to 10 white, cream-colored, or yellow transverse bands. In the blunt-nosed leopard lizard, the cross bands are much broader and more distinct than in other leopard lizards and extend from the lateral folds on each side to the middle of the back, where they meet or alternate along the midline of the back. With increasing age the cross bands may fade and the spots may become smaller and more numerous, particularly in males (Montanucci 1967, Smith 1946). Similarly colored bands or rows of transverse spots produce a banded appearance to the tail (Smith 1946). Juveniles have blood-red spots on

the back that darken with age, becoming brown when sexual maturity is reached, although a few adults retain reddish centers to the spots (Montanucci 1967).

Except for the throat, undersides are uniformly white to yellow in immature lizards and prenuptial females. Nuptial females have bright red-orange markings on the sides of the head and body and the undersides of the thighs and tail. This color fades to pink or light orange by late July. Males in many populations develop a nuptial color during the breeding season that spreads over the entire undersides of the body and limbs. This salmon to bright rusty-red color may be maintained indefinitely (Montanucci 1965).

Identification. - The blunt-nosed leopard lizard can be distinguished from the long-nosed leopard lizard by its color pattern, truncated snout, and short, broad triangular head (Stejneger 1890, Smith 1946). The blunt-nosed leopard lizard has dark blotches on the throat instead of parallel streaks of the long-nosed leopard lizard. Other distinguishing characteristics are a significantly smaller number of maxillary and premaxillary teeth (this may be directly related to the shortened snout) and a smaller variation in the number of femoral pores (Smith 1946). In general, blunt-nosed leopard lizards can be distinguished from all other leopard lizards by their retention into adulthood of the primitive color pattern shared by all young leopard lizards (absence of ornamentation around the dorsal spots; retention of wide, distinct cross bands; presence of gular blotches; and fewer spots arranged in longitudinal rows) (Smith 1946, Montanucci 1970).

2. Historical and Current Distribution

Historical Distribution. - The blunt-nosed leopard lizard is endemic to the San Joaquin Valley of central California (Stejneger 1893, Smith 1946, Montanucci 1965, 1970, Tollestrup in litt. 1979). Although the boundaries of its original distribution are uncertain, blunt-nosed leopard lizards probably occurred from Stanislaus County in the north, southward to the Tehachapi Mountains in Kern County. Except where their range extends into the Carrizo Plain and Cuyama Valley west of the southwestern end of the San Joaquin Valley, the foothills of the Sierra Nevada and Coast Range Mountains, respectively, define the eastern and western boundaries of its distribution. The blunt-nosed leopard lizard is not found above 792 meters (2,600 feet) in elevation (Montanucci 1970). The blunt-nosed leopard lizard hybridizes with the long-nosed leopard lizard where their ranges meet in Ballinger Canyon (Santa Barbara and Ventura Counties) in the Cuyama River watershed (Montanucci 1970, Le Fevre in litt. 1976).

Current Distribution. - The currently occupied range of the blunt-nosed leopard lizard is in scattered parcels of undeveloped land on the Valley floor, and in the foothills of the Coast Range. Surveys in the northern part of the San Joaquin Valley documented the occurrence of the blunt-nosed leopard lizard in the Firebaugh and Madera Essential Habitat areas (Williams in litt. 1990). Essential Habitat Areas were defined in previous recovery plan editions for this species as undeveloped wildlands containing suitable habitat for the blunt-nosed leopard lizard and essential to the continued survival of the species (USFWS 1980*a*, in litt. 1985).

In the southern San Joaquin Valley, extant populations are known to occur on the Pixley National Wildlife Refuge, Liberty Farms, Allensworth, Kern National Wildlife Refuge, Antelope Plain, Buttonwillow, Elk Hills, and Tupman Essential Habitat areas, on the Carrizo and Elkhorn Plains, north of Bakersfield around Poso Creek, and in western Kern County in the area around the towns of Maricopa, McKittrick, and Taft (Byrne in litt. 1987, R.L. Anderson pers. comm., L.K. Spiegel pers. comm.). Remaining undeveloped lands farther north that support blunt-nosed leopard lizard populations include the Ciervo, Tumey, and Panoche Hills, Anticline Ridge, Pleasant Valley, and the Lone Tree, Sandy Mush Road, Whitesbridge, Horse Pasture, and Kettleman Hills Essential Habitat areas (CDFG in litt. 1985). The species is presumed to be present still in the upper Cuyama Valley, though no recent inventory is known for that area.

3. Life History and Habitat

Food and Foraging. - Blunt-nosed leopard lizards feed primarily on insects (mostly grasshoppers, crickets, and moths) and other lizards, although some plant material is rarely eaten or, perhaps, unintentionally consumed with animal prey. They appear to feed opportunistically on animals, eating whatever is available in the size range they can overcome and swallow. Which lizards are eaten is largely determined by the size and behavior of the prey. Lizard species taken as prey include: side-blotched lizards *(Uta stansburiana),* coast horned lizards *(Phrynosoma coronatum),* California *whiptails (Cnemidophorus tigris),* and spiny lizards *(Sceloporus* spp.). Young of its own species also are eaten (Montanucci 1965, Kato et al. 1987*b*, Germano and Williams 1994*a*). Because they have similar diets, interspecific competition probably occurs between the blunt-nosed leopard lizard and California whiptail (Montanucci 1965, Tollestrup 1979).

Reproduction and Demography. - Breeding activity begins within a month of emergence from dormancy and lasts from the end of April through the beginning of June, and in some years to near the end of June. During this period, and for a month or more afterward, the adults often are seen in pairs and frequently occupy the same burrow systems (Montanucci 1965, Germano and Williams 1994*b*). Male territories may overlap those of several females, and a given male may mate with several females. Copulation may occur as late as June (Montanucci 1965).

Two to six eggs averaging 15.6 by 25.8 millimeters (0.6 by 1.0 inch) are laid in June and July, and their numbers are correlated with the size of the female (Montanucci 1967). Under adverse conditions, egg-laying may be delayed 1 or 2 months or reproduction may not occur at all (Montanucci 1965, Tollestrup 1979, 1982, Germano et al. 1994). Eggs are laid in a chamber either excavated specifically for a nest or already existing within the burrow system (Montanucci 1965, 1967). Females typically produce only one clutch of eggs per year, but some may produce three or more under favorable environmental conditions (Montanucci 1967, USFWS 1985*a*, Germano and Williams 1992, Williams et al. 1993*a*). After about 2 months of incubation, young hatch from late July through early August, rarely to September, and range in size from 42 to 48 millimeters (1.7 to 1.9 inches) snout-vent length (Montanucci 1965, Tollestrup 1982). Before their first winter, young leopard lizards may grow to 88 millimeters (3.5 inches) in snout-vent length (Montanucci 1967).

Sexual maturity is reached in from 9 to 21 months, depending on the sex and environmental conditions (USFWS 1985*a*). Females tend to become sexually mature earlier than males, breeding for the first time after the second dormancy, while males usually do not breed until later (Montanucci 1965, 1967).

The relative proportions of the three age groups (adult, subadult, hatchling or young-of-the-year) change through the activity season as young are added to the population only in August or later and entry into dormancy and differential mortality affects the proportions in age groups above ground. Data based upon surface activity do not give an accurate estimate of the population age structure because the adults cease activity above ground from about 4 weeks before to about the same time as the eggs hatch. The best estimate of the relative proportions of adults and subadults (animals hatched the previous summer) may be made from data gathered in May because both groups are active on the surface then. In May the proportions were 85 percent adults and 15 percent subadults (Montanucci 1965). Montanucci (1965) believed that data gathered in August for subadults and hatchlings yielded the best estimate of their proportions because both groups were active. His data were about 2:1 hatchlings to subadults. Combining these numbers, the population consisted of about 67 percent adults, 11 percent subadults, and 22 percent hatchlings. The age structure of a population on Pixley National Wildlife Refuge consisted of 62 percent adults, 27 percent subadults, and 11 percent hatchlings in 1984 (Uptain et al. in litt. 1985).

Age structure of adults during a 7-year period on the Elkhorn Plain (Williams et al. 1993*b*, Endangered Species Recovery Program unpubl. data), was determined in 1995; percentages of 2, 3, 4, and 5 year-old males were 69.5, 21, 6.5, and 2, respectively. Percentages of females 2, 3, and 4 years old were 70, 22, and 7.5; none were recaptured older than 4 years. Parker and Pianka (1976) made estimates for the long-nosed leopard lizard based on their data for a Utah population, which are consistent with the age structure and reproductive situation described for the blunt-nosed leopard lizard. Maximum longevity would thus be 8 to 9 years with an annual survivorship of about 50 percent.

In several populations, and during most of the year, males appear to outnumber females by a ratio of 2:1 (Montanucci 1965, Uptain et al. in litt. 1985, Kato et al. 1987*a*). Mullen (1981) reported that the ratio of males to females was 3:1, whereas Montanucci (1965) found that the numbers in a Valley floor population were equal. Uptain et al. (in litt. 1985) showed that, although 63 percent of the hatchlings in a population on Pixley National Wildlife Refuge were male, the male:female ratio varied seasonally from 2:1 in the spring, to 1:1 in the summer, and to 2:3 in the fall. These were all based on short-term studies. In contrast, populations on two plots on the Elkhorn Plain over several years typically had adult and subadult sex ratios of about 1:1 (1:1.04). Females outnumbered males more often than the reverse during census periods in May and June. Hatchling sex ratios, however, showed the opposite, with males outnumbering females, most censuses with ratios varying between about 1.5:1 and 2.5:1 male:female (Williams et al. 1993*a*, Germano and Williams 1994*b*, Endangered Species Recovery Program unpubl. data).

Male and female home ranges often overlap. The mean home range size varies from 0.1 to 1.1 hectares (0.25 to 2.7 acres) for females and 0.2 to 1.7 hectares (0.52 to 4.2 acres) for males (Tollestrup 1983, Kato et al. 1987*a*).

There are no current overall population size estimates for the species. Uptain et al. (in litt. 1985) reported densities ranging from 0.3 to 10.8 lizards per hectare (0.1 to 4.2 per acre) for a population on the Pixley National Wildlife Refuge in Tulare County. In a previous study of this population, Tollestrup (1979) estimated an average density of 3.3 lizards per hectare (1.3 per acre). In 1991, after three previous years of severe drought, two 8.1-hectare (20-acre) plots had estimated densities of 6.7 and 7.0 lizards per hectare (2.7 and 2.8 per acre) on Pixley National Wildlife Refuge (Williams and Germano in litt. 1991). On the Elkhorn Plain, estimated population size on two 8.1-hectare plots of adult and subadult blunt-nosed leopard lizards in June (period of peak above-ground activity) varied between 0 in 1990 to more than 170 in 1993. Only subadult lizards were active above ground in April and no lizards were active by June 1990, the year of severest drought (Williams et al. 1993*a*, Germano et al. 1994, D. J. Germano and D.F. Williams unpubl. data). Turner et al. (1969) estimated that the average density of a southern Nevada population of the long-nosed leopard lizard was 3 lizards per hectare (1.2 per acre). Population densities in marginal habitat generally do not exceed 0.5 blunt-nosed leopard lizards per hectare (0.2 per acre) (Mullen 1981, Le Fevre in litt. 1976, Madrone Associates in litt. 1979).

Behavior and Species Interactions. - Social behavior is more highly developed in the blunt-nosed leopard lizard than in the long-nosed leopard lizard. For example, territorial defense and related behavioral activity are completely absent in the long-nosed leopard lizard, whereas blunt-nosed leopard lizards are highly combative in establishing and maintaining territories (Montanucci 1970). In addition, Tollestrup (1979, 1983) observed six distinct behavioral displays specific to the blunt-nosed leopard lizard. Behavioral displays of all types were more frequent during the breeding season.

Leopard lizards use small rodent burrows for shelter from predators and temperature extremes (Tollestrup 1979). Burrows are usually abandoned ground squirrel tunnels, or occupied or abandoned kangaroo rat tunnels (Montanucci 1965). Each lizard uses several burrows without preference, but will avoid those occupied by predators or other leopard lizards. Montanucci (1965) found that in areas of low mammal burrow density, lizards will construct shallow, simple tunnels in earth berms or under rocks. While foraging, immature lizards also take cover under shrubs and rocks.

Potential predators of blunt-nosed leopard lizards include whipsnakes, gopher snakes, glossy snakes *(Arizona elegans)*, western long-nosed snakes *(Rhinocheilus lecontei)*, common king snakes, western rattlesnakes, loggerhead shrikes *(Lanius ludovicianus)*, American kestrels *(Falco sparverius)*, burrowing owls, greater roadrunners *(Geococcyx californianus)*, golden eagles *(Aquila chrysaetos)*, hawks, California ground squirrels, spotted skunks *(Spilogale putorius)*, striped skunks *(Mephitis mephitis)*, American badgers, coyotes, and San Joaquin kit foxes (Montanucci 1965, Tollestrup 1979). Blunt-nosed leopard lizards are hosts to endoparasites such as nematodes, and ectoparasites such as mites and harvest mites (Montanucci 1965).

Activity Cycles. - Seasonal above-ground activity is correlated with weather conditions, primarily temperature. Optimal activity occurs when ground temperatures are between 22 degrees and 36 degrees Celsius (72 and 97 degrees Fahrenheit) or slightly

higher (USFWS 1985*a*, J. Brode pers. comm.). Smaller lizards and young have a wider activity range than the adults (Montanucci 1965). This results in the smaller, subadult lizards emerging from hibernation earlier than adults, remaining active later in the year, and being active during the day earlier and later than adults (Montanucci 1965). Adults are active above ground in the spring months from about March or April through June or July, with the amount of activity decreasing so that by the end of June or July almost all sightings are of subadult and hatchling leopard lizards (Williams et al. 1993*a*). Also, following the breeding season, the proportion of each sex active changes as males tend to cease surface activity sooner than females (Montanucci 1967, Williams and Tordoff in litt. 1988). Adults captured on the surface in August are about 70 percent females (Montanucci 1967). Adults retreat to their burrows to *brummate* (dormancy in *poikilothermic* vertebrates [having a body temperature that varies with the temperature of its surroundings]), beginning in August or September, but hatchlings are active until mid-October or November, depending on weather.

Because diurnal activity is temperature dependent, blunt-nosed leopard lizards are most likely to be observed in the morning and late afternoon during the hotter days (Tollestrup in litt. 1976). Lizards are active on the surface when air temperatures are between 23.5 degrees and 40.0 degrees Celsius (74 and 104 degrees Fahrenheit) and surface soil temperatures are 22 to 50 degrees Celsius (72 to 122 degrees Fahrenheit) (O'Farrell and Kato 1980, Mullen 1981, Tollestrup in litt. 1976, Williams and Tordoff in litt. 1988). Body temperatures range from 32.2 to 42.0 degrees Celsius (90 and 108 degrees Fahrenheit) (Cowles and Bogert 1944, Mullen 1981).

Habitat and Community Associations. - Blunt-nosed leopard lizards inhabit open, sparsely vegetated areas of low relief on the San Joaquin Valley floor and in the surrounding foothills (Smith 1946, Montanucci 1965). On the Valley floor, they are most commonly found in the Nonnative Grassland and Valley Sink Scrub natural communities described by Holland (1986). The Valley Sink Scrub is dominated by low, alkali-tolerant shrubs of the family Chenopodiaceae, such as iodine bush, and seepweeds. The soils are saline and alkaline lake bed or playa clays which often form a white salty crust and are occasionally covered by introduced annual grasses. This may not have been the best habitat, historically, for blunt-nosed leopard lizards because the sandy and sandy-loam soils supporting perennial and annual grasses and forbs were the first to be developed and cultivated. Prior to agricultural development, Valley Sink Scrub was widespread around Kern, Buena Vista, Tulare, and Goose lakes and extended north to the Sacramento Valley along the trough of the San Joaquin Valley. Nearly all the remaining natural lands on the Valley floor are seasonally flooded fragments of this historical complex, and support elements of the alkali sink communities. This community corresponds to two that Tollestrup (in litt. 1976) described as *Allenrolfea* grassland and *Suaeda* flat.

Valley Needlegrass Grassland, Nonnative (Annual) Grassland, and Alkali Playa (Holland 1986) also provide suitable habitat for the lizard on the Valley floor. Valley Needlegrass Grassland is dominated by native perennial bunch grasses, including purple needlegrass *(Nassella pulchra)* and alkali sacaton. Associated with the perennial grasses are native and introduced annual plants. Both the Valley Needlegrass Grassland and Nonnative/Annual Grassland occur on fine-textured soils and probably were widespread in

the Valley before large areas were converted to agriculture. The Alkali Playa community occurs on poorly drained, saline and alkaline soils in small, closed basins. The small, widely spaced, dominant shrubs include: iodine bush, saltbushes, and greasewood *(Sarcobatus vermiculatus).*

Blunt-nosed leopard lizards also inhabit Valley Saltbush Scrub, which is a low shrubland, with an annual grassland understory, that occurs on the gently sloping alluvial fans of the foothills of the southern San Joaquin Valley and adjacent Carrizo Plain. This community is dominated by the chenopod shrubs, common saltbush *(Atriplex polycarpa)* and spiny saltbush *(Atriplex spinifera),* and is associated with non-alkaline, sandy or loamy soils. Tollestrup (in litt. 1976) described this plant community as *Atriplex* grassland. Similar to this community, but dominated principally by common saltbushes, are the Sierra-Tehachapi Saltbush Scrub (extending from the southern Sierra Nevada north of Porterville to the Grapevine in the Tehachapi Mountains) and Interior Coast Range Saltbush Scrub. The latter ranges from Pacheco Pass to Maricopa but, for the most part, has been converted by grazing and fire to Nonnative/Annual Grassland. Other foothill communities that occur within the range of the blunt-nosed leopard lizard are Upper Sonoran Subshrub Scrub and Serpentine Bunchgrass (Holland 1986). In general, leopard lizards are absent from areas of steep slope, dense vegetation, or areas subject to seasonal flooding (Montanucci 1965).

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). Today, only *V. m. macrotis* and *V. m. mutica* are recognized (Mercure et al. 1993). *V. m. mutica,* the San Joaquin kit fox, was first described by Merriam (1902). 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 Valley; 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).

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. 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, 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 29 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 which was then thought to be occupied (Morrell 1975). In 1990, USFWS (USFWS in litt. 1990) produced a range map for use by U.S. Department of Agriculture Animal Damage Control officers who were conducting coyote control programs. This range map was based on Morrell's 1975 map, with adjustments reflecting new information.

Kit foxes currently inhabit 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). Kit foxes are known from all the larger, scattered islands of natural land on the Valley floor in Kern, Tulare, Kings, Fresno, Madera, and Merced Counties. Kit foxes also occur in 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 (Laughrin 1970, Jensen 1972, Morrell 1975, O'Farrell 1983, Swick in litt. 1973, Waithman in litt. 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 (O'Farrell 1983). It is more probable that kit foxes have always occurred in these areas, possibly at low density, and their occurrence went unnoticed or unrecorded by biologists until the 1970s.

The largest extant populations of kit foxes are in western Kern County on and around the Elk Hills and Buena Vista Naval Petroleum Reserves in California, Kern County, and in the Carrizo Plain Natural Area, San Luis Obispo County. Smaller populations are found at several locations. The kit fox populations of the Naval Petroleum Reserves in California (B.L. Cypher pers. comm.), Carrizo Plain Natural Area (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 last recorded in the late 1980s at the 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 in litt. 1988), and in the Los Vaqueros watershed, Contra Costa County (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 in litt. 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, whitefooted 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, 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 4-5 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.).

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 miles; 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.). 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 two years (Egoscue 1975). One fox in another Utah study was estimated to be at least seven years old (Egoscue 1962). Kit foxes on Naval Petroleum Reserve-1 in California can live as long as eight years but such longevity is rare; animals less than one year old outnumber older foxes by 2.8:1 (Berry et al. 1987*b*). Annual survival rates of juvenile foxes have ranged from 0.26 on Naval Petroleum Reserve-1 in California (Berry et al. 1987b) to 0.21 to 0.41 on the Carrizo Plain (Ralls and White 1995). In captivity, kit foxes have lived up to ten years (McGrew 1919, M. Johnson pers. comm.).

An annual adult mortality rate of approximately 50 percent has been reported (Morrell 1972, Egoscue 1975, Berry et al. 1987b, Ralls and White 1995, Standley et al. in litt. 1992). The annual mortality rate for juvenile kit foxes may be closer to 70 percent (Berry et al. 1987b). The effects of disease, parasites and accidental death are largely unknown, but are thought to account for only a small portion of mortality (Berry et al. 1987*b*). 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 0.2-0.4 per square kilometer (0.52-1.04 per square mile). Morrell (1975) estimated densities of 1.2 per square kilometer (3.11 per square mile) in optimal habitats in "good" years. O'Farrell (1983) corrected Morrell's data for habitat losses and obtained an estimate of 0.5 per square kilometer (1.30 per square mile). 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 of Kern County (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).

O'Farrell (1983) estimated that the population rangewide 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 I 1,000 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 in litt. 1974*b*). Laughrin

(1970) reported an estimated total population size of 1,000-3,000 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. O'Farrell (1983) adjusted Morrell's data for known habitat losses (primarily due to agriculture) and obtained a corrected estimate of 6,961 foxes in 1975. When compared to the pre- 1930 estimate, this represents a possible population decline of 20-43 percent. Approximately 85 percent of the fox population in 1975 was found in only 6 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 (O'Farrell 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*a*), 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*a*). 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 (90 percent) have a slope of less than 40 degrees , usually between 19 degrees and 22 degrees. 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 in litt. 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.). 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 (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 in litt. 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).

Kit foxes are subject to predation or competitive exclusion by other species, such as the coyote, normative red foxes, domestic dog *(Canis familiaris),* bobcat *(Felis rufus),* and large raptors (Hall 1983, Berry et al. 1987*b*, O'Farrell et al. 1987*b*, Ralls and White 1995, CDFG in litt. 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 in litt. 1986, Scrivner in litt. 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 Altarriont 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 oil exploration and extraction equipment and 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, and survive adjacent to tilled or fallow fields (Jensen 1972, Ralls and White in litt. 1991), and petroleum fields (Morrell 1971, O'Farrell in litt. 1980). 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 agriculture where uncultivated land is maintained, allowing for denning sites and a suitable prey base (Jensen 1972, Knapp 1978, Hansen in litt. 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).

SAN JOAQUIN ANTELOPE SQUIRREL
(Ammospermophilus nelsoni)

1. Description and Taxonomy

Taxonomy. - The San Joaquin antelope squirrel is one of five species of antelope squirrels. Members of the genus *Ammospermophilus* are confined to desert, arid steppe, and open shrubland communities in the southwestern United States and northern Mexico. *Ammospermophilus nelsoni* was described by Merriam (1893) as a member of the genus *Spermophilus;* the type specimen was from Tipton, Tulare County, California. *A. nelsoni* also has been placed in the genus *Citellus.* Taylor (1916) distinguished the northern populations as a subspecies, *A. nelsoni amplus,* but *A. nelsoni* currently is considered to be monotypic (Hall 1981, Hafner 1981).

Description. - San Joaquin antelope squirrel has a typical ground-squirrel shape: tiny, rounded ears, and streamlined, *fusiform* (spindleshaped) body with relatively short legs and tail. The tail has laterally projecting thick fringes of hairs, and is usually held cocked or curled over the back. The upper parts are colored buffy-tan with a light stripe along the sides. The underside of the tail is light grayish or whitish. Individuals range from about 218 to 240 millimeters (8.5 to 9.4 inches) in length (Hall 1981), and adults weigh from about 130 to 170 grams (4.6 to 6.0 ounces) (Williams 1980).

Identification. - The San Joaquin antelope squirrel can be distinguished from the co-occurring California ground squirrel by much smaller size; shorter, less bushy tail with a flattened shape rather than the bottle-brush shape of the California ground squirrel; and the presence of a light-colored stripe along the sides of the body. Many people think antelope squirrels are chipmunks, but antelope squirrels lack the light and dark stripes on the face and the light and dark stripes on the back, which are characteristic of western chipmunks *(Tamias* spp.).

2. Historical and Current Distribution

Historical Distribution. - The historical distribution of the San Joaquin antelope squirrel included the western and southern portions of the Tulare Basin, San Joaquin Valley, and the contiguous areas to the west in the upper Cuyama Valley and on the Carrizo and Elkhorn Plains. They ranged from western Merced County on the northwest, southward along the western side of the San Joaquin Valley to its southern end. They were distributed over the floor of the San Joaquin Valley in Kern County and along the eastern edge of the Valley northward to near Tipton, Tulare County (Hall 1981, Williams 1980). San Joaquin antelope squirrels range in elevation from about 50 meters (165 feet) on the San Joaquin Valley floor to about 1,100 meters (3,609 feet) in the Temblor Mountains. Antelope squirrels are not common above about 800 meters (2,625 feet) on the ridges and plains west of the San Joaquin Valley proper (Williams 1980, D.F. Williams unpubl. data). The area encompassed by the distribution records prior to cultivation was approximately 1,398,600 hectares (3,456,000 acres). Grinnell and Dixon (1918) wrote that San Joaquin

antelope squirrels were unevenly distributed and occurred in abundance in only a few localities; one was in the Lokern and Elk Hills region of western Kern County.

Current Distribution. - Extant, uncultivated habitat for San Joaquin antelope squirrels was estimated in 1979 to be 275,200 hectares (680,000 acres) (Williams 1980). This estimate encompassed the land occupied by towns, roads, canals, pipelines, strip mines, airports, oil wells, and other developments. None of the best habitat described by Grinnell and Dixon (1918) remained. Only about 41,280 hectares (102,003 acres) was rated as fair to good quality, supporting from 3 to 10 antelope squirrels per hectare (1 to 4 per acre). Antelope squirrels had been nearly eliminated from the floor of the Tulare basin, and existed mainly in marginal habitat in the mountainous areas bordering its western edge. Substantial populations were found only in and around Lokern and Elk Hills in western Kern County, and on the Carrizo and Elkhorn Plains in eastern San Luis Obispo County.

Since 1979, San Joaquin antelope squirrels have disappeared from many of the smaller islands of habitat on the Valley floor, including Pixley National Wildlife Refuge, Tulare County; Alkali Sink and Kerman Ecological Reserves, Fresno County; and several areas within the Allensworth Conceptual Reserve area of Tulare and Kern Counties (Williams 1980, Harris and Stearns 1991, D.F. Williams unpubl. observ., Endangered Species Recovery Program unpubl. data).

3. Life History and Habitat

Food and Foraging. - San Joaquin antelope squirrels are omnivorous. The amount and type of food consumed are mostly dependent upon availability. The squirrels eat green vegetation, fungi, and insects more often than seeds, even when seeds are relatively abundant (Hawbecker 1975, Harris 1993). Vegetation and seeds of filaree and red brome are the main food plants (Hawbecker 1953). Insects, principally grasshoppers, are eaten regularly when available. Seeds of shrubs such as ephedra and saltbush also are staples. Seeds and insects may be necessary in the diet as sources of protein. When seeds and grasshoppers are scarce, antelope squirrels eat harvester ants (Hawbecker 1975). During spring, especially during severe drought, San Joaquin antelope squirrels eat large quantities of ovaries and developing seeds of ephedra (D.F. Williams unpubl. observ.).

Reproduction and Demography. - The breeding period for San Joaquin antelope squirrels is late winter through early spring. There is only one breeding period per year, coinciding with the time of year when green vegetation is present (Hawbecker 1953, 1958). Young squirrels do not breed their first year (Hawbecker 1975). Testes of males begin to enlarge in September or October and reach maximum size by November or December, long before the ovaries of females begin to develop (Best et al. 1990). Copulation and conception usually take place in February or March. By the end of March, testes begin to regress in size and maintain a minimum size of about 4-8 millimeters (0.2 - 0.3 inch) through the summer. All males are not reproductively active at the same time; some males may have enlarged testes in May (Hawbecker 1975).

Gestation lasts about 26 days. Embryos are present in late January, but development is concentrated in February and early March. Embryos range in number from 6 to 11, with an average of 8.9 (Hawbecker 1975).

Young are born between March and April and are first seen above ground when about 30 days of age (Williams and Tordoff in litt. 1988). Young are weaned beginning in late April; the last young are weaned in mid- or late-May (Hawbecker 1975).

Timing, nature, and distance of dispersal are poorly documented; Hawbecker (1975) noted that weaned young were still together in late May. Williams and Tordoff (in litt. 1988) noted at least some family groups were still together in mid-July. Young San Joaquin antelope squirrels on the Elkhorn Plain Ecological Reserve had a mortality rate of about 70 percent during their first year of life, and adults had a mortality rate from about 50 to 60 percent (Williams and Tordoff in litt. 1988).

Behavior and Species Interactions. - San Joaquin antelope squirrels live in burrows, either of their own construction or ones dug by giant kangaroo rats. They may also take over and enlarge burrows dug by Heermann's kangaroo rats (Grinnell and Dixon 1918, Hawbecker 1947, 1953, Williams 1980). Hawbecker (1947, 1953) believed that antelope squirrels were dependent upon kangaroo rats to dig burrows because the many burrows examined by him all seemed to have been dug by kangaroo rats. In contrast, Grinnell and Dixon (1918) believed that they dug their own burrows. Burrows vary in complexity and length, but generally have two to six openings and are between about 30 and 50 centimeters (12 to 20 inches) deep. Favored locations for burrows are in the side of an arroyo, the berm of an unimproved road, or under shrubs (Williams 1980).

On shrubless plains with few or no erosion channels where they can burrow into the banks, they may be dependent upon burrows of giant kangaroo rats. Antelope squirrels make use of both shrubs and burrows of giant kangaroo rats as sites of refuge from predators as they move across their home ranges. They also regularly retreat to the shade of shrubs to avoid the heat of the sun and to dump excess body heat to the cooler, shaded ground. Burrows of giant kangaroo rats may serve the same purpose (Williams et al. 1988, Williams and Kilburn 1992).

California ground squirrels displace San Joaquin antelope squirrels and may even restrict the range of the antelope squirrel (Taylor 1916, Harris and Stearns 1991). Hawbecker (1953) noted that the range of the San Joaquin antelope squirrel may be determined, to some degree, by the range of co-occurring kangaroo rat species. The range of giant kangaroo rats most nearly coincides with that of the San Joaquin antelope squirrel, but their microhabitats generally differ in many areas. Populations of Heermann's kangaroo rats are common in most areas where antelope squirrels are found. San Joaquin kangaroo rats also occur in the same areas as San Joaquin antelope squirrels, but these kangaroo rats are much smaller; their small-diameter burrows would have to be enlarged considerably before antelope squirrels could use them (Williams 1980).

San Joaquin antelope squirrels probably compete with kangaroo rats for seeds, especially those of grasses and forbs, and, to a lesser extent, green herbaceous material. The extent to which kangaroo rats eat insects, an important staple for antelope squirrels, is unknown, but insects are probably only a minor part of their diets. Species of birds are probably the main competitors of antelope squirrels for insects (Williams and Tordoff in litt. 1988). San Joaquin antelope squirrels are prey for a variety of animals: hawks, falcons, eagles, snakes, kit foxes, coyotes, badgers and probably other predators (Williams and Tordoff in litt. 1988).

Activity Cycle. - San Joaquin antelope squirrels are primarily diurnal, usually active early or late in the day (Elliot 1904). Activity is reduced when ambient temperatures drop below about 10 degrees Celsius (Hawbecker 1958), but on sunny days they have been observed when air temperatures were around 0 degrees Celsius (D.F. Williams unpubl. observ.). Activity also is reduced at high ambient temperatures, but the amount and critical temperatures at which activity is curtailed is unclear. On the Elkhorn Plain Ecological Reserve, antelope squirrels were observed at all hours of the day and at ambient temperatures in excess of 42 degrees Celsius during July and August (Williams and Tordoff in litt. 1988). In contrast, Hawbecker (1958) noted that squirrels occasionally ventured into the hot sun only for short periods. They are active above ground for extensive periods during the day in the spring when temperatures are generally between about 20 degrees Celsius to 30 degrees Celsius.

Habitat and Community Associations. - San Joaquin antelope squirrels live in relatively arid annual grassland and shrubland communities in areas receiving less than about 23 centimeters (10 inches) of mean annual precipitation. They are most numerous in areas with a sparse-to-moderate cover of shrubs such as saltbushes, California ephedra, bladderpod, goldenbushes, matchweed, and others. Shrubless areas are only sparsely inhabited, especially where giant kangaroo rats are not present or not common.

Hawbecker (1953) believed that most antelope squirrels found in shrubless areas were nonbreeders. Yet, on the Carrizo Plain Natural Area antelope squirrels are widespread; permanent populations are found over thousands of acres without shrubs (Harris and Stearns 1991, D.F. Williams, unpubl. observ.). Grinnell and Dixon (1918) and Hawbecker (1953) observed that San Joaquin antelope squirrels rarely occurred on the Valley floor. In areas with alkaline soils supporting halophytes such as iodine bush and spiny saltbush. Highly alkaline soils on the Valley floor typically have water tables within a few centimeters to a meter (1 to 39 inches) or so from the surface, perhaps limiting habitation. Steep slopes and broken, rocky, upland terrain are also scarcely inhabited (Williams 1980).

San Joaquin antelope squirrels require areas free from flooding where they can place ground burrows. Soils must be friable. Substantial colonies investigated by Hawbecker (1953) were almost always confined to loam and sandy-loam soils with moderate amounts of soluble salts, but soils with a wide range of textures are used (Williams 1980). In shrubless areas, and many areas with sparse shrub cover, San Joaquin antelope squirrels are associated with giant kangaroo rats. The antelope squirrels are frequently seen entering and leaving the burrows of giant kangaroo rats. Most such observations indicate the burrows

are used for escape from heat and predators, but they also probably live in burrow systems made by giant kangaroo rats (Williams and Tordoff in litt. 1988, Williams et al. 1993*a*, D.F. Williams unpubl. observ.).

In the southern and western San Joaquin Valley, San Joaquin antelope squirrels are associated with open, gently sloping land with shrubs. Typical vegetation includes saltbushes and ephedra (Hawbecker 1975). Near Panoche, San Benito County, at an elevation of about 360 meters (1,181 feet), they are associated with such plants as California ephedra, California juniper, matchweed, one-sided bluegrass *(Poa secunda* ssp. *secunda),* red brome, and red-stemmed filaree (Hawbecker 1958). Near Los Banos, Merced County, and near Mendota, Fresno County, the habitat is mostly devoid of brushy cover (Hawbecker 1947).

WESTERN BURROWING OWL
(*Athene Cunicularia Hypugea*)

Burrowing Owls are medium-sized (body length averages 9.5 inches), yellow-eyed owls with disproportionately long legs, and no ear-tufts. Adults are sandy colored over the head, back and wings, and have barring on the breast and belly. Juveniles are buffy below. The Burrowing Owl breeds in midwestern and western North America and south-central florida. They winter throughout their breeding range and south to Central America. Several Breeding populations exist in the Central Valley. Burrowing Owls often wander outside their breeding range in the winter.

These owls will utilize burrows throughout the year. They most commonly use old burrows dug by other animals. In the Central Valley, Californian ground squirrel burrows are commonly used.

Burrowing Owls nest from early March to late August, with a peak from mid-April to mid-May. Nests in the southern San Joaquin Valley are often 2 or more feet below the surface, in at the end of burrows 5-18 feet long. Burrows may be on flat or sloping ground, and are often found on levees, spoil piles and other earth mounds. Surrounding vegetation is usually low and sparse.

Burrowing Owls may forage at any time of the day or night in areas adjacent to their burrows. They eat primarily insects and other arthropods, birds and small mammals.

Numbers of burrowing Owls have declined since the early 1900's, primarily due to habitat conversion. Assimilation of pesticides through prey, ground squirrel control with gas cartridges and alteration of prey base may also have affected this species. Burrowing Owls are often tolerant of human activity, but are vulnerable to predation by domestic pets. They are also vulnerable to accidental destruction of burrows, including those with active nests.

EXHIBIT 4

ADDITIONAL CONSERVATION MEASURES

Occidental shall comply with the following additional conservation measures for the Covered Species that are not specifically included in the Biological Opinion:

A. San Joaquin Antelope Squirrel

1. Any San Joaquin antelope squirrel discovered during pre-activity surveys shall be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where this species is present, known burrows will be excavated by hand if so required by the Department.

B. Western Burrowing Owl

1. Any burrowing owl discovered during pre-activity surveys shall be avoided, if reasonably practical.

2. Terms and conditions 2(a), 2(b) and 2(c) from the Biological Opinion (avoidance and relocation) shall apply, except that (i) notice shall be provided to the Department rather than the USFWS, and (ii) relocation shall be performed consistent with the relocation provisions in the Department's October 17, 1995, Staff Report on Burrowing Owl Mitigation, unless other arrangements are made with the Department.

C. Oil Neststraw

1. Any populations of oil neststraw discovered during floristic surveys or during the normal course of pre-activity surveys will be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where this species is present, the plant mitigation commitments numbered (3) c and (3) d in the Biological Opinion shall apply (seasonal and soil/seed salvage provisions).

3. The plant mitigation commitment numbered (6) in the Biological Opinion shall apply (protection of four known populations).

D. Kern Mallow and San Joaquin Woolly Threads

1. Any populations of either species discovered during floristic surveys or during the normal course of pre-activity surveys will be avoided, if reasonably practical.

2. If it is not reasonably practical to avoid a location where either or both of these species is present, the plant mitigation commitments numbered (3) c and (3) d in the Biological Opinion shall apply (seasonal and soil/seed salvage provisions).

copy

Bill Dixon

FIRST AMENDMENT TO CALIFORNIA ENDANGERED SPECIES ACT MEMORANDUM OF UNDERSTANDING AND TAKE AUTHORIZATION

By and Between

OCCIDENTAL OF ELK HILLS, INC.

And

THE CALIFORNIA DEPARTMENT OF FISH AND GAME

Regarding

ELK HILLS UNIT
(Formerly Known as Naval Petroleum Reserve-1)

This amendment to the California Endangered Species Act Memorandum of Understanding, hereinafter referred to as ("First Amendment"), is entered into between Occidental of Elk Hills, Inc., hereafter referred to as ("Occidental") and the California Department of Fish and Game, hereafter referred to as the ("Department").

Explanatory Recitals

1. There is now in effect between the parties a California Endangered Species Act Memorandum of Understanding and Take Authorization, hereinafter referred to as "CESA MOU," which governs the operation and management of the Elk Hills Unit and provides authority for "take" of identified state-listed threatened and endangered species and other species of concern under authority of the California Fish and Game Code. The CESA MOU was executed by the Department on December 29, 1997 and has therefore been affirmed by the California Legislature in accordance with Fish and Game Code section 2081.1.

2. The duration of the CESA MOU was limited to two years, pending the preparation of a permanent wildlife habitat and management plan and the creation of a wildlife habitat reserve of at least 7,075 acres. See section 5.9 and 5.10 of the CESA MOU. Occidental has now prepared a permanent wildlife habitat and management plan in accordance with section 5.9, and has created a habitat reserve in accordance with section 5.10.

3. The parties desire to amend the CESA MOU with this First Amendment to authorize Occidental to continue implementation of the Elk Hills Unit as provided in the CESA MOU for a period of 10 years.

Agreement

NOW THEREFORE, in accordance with Section 13 of the CESA MOU, and in consideration of the mutual covenant contained in this First Amendment, the parties agree as follows:

1. Section 5.8 of the CESA MOU is revised to read as follows:

   Elk Hills Unit Operator shall provide an annual summary of surface disturbances and reclamation to the Department in the first quarter of each year.

2. Section 5.9 of the CESA MOU is revised to read as follows:

   Elk Hills Unit Operator shall fully implement and adhere to the "Conservation Management Agreement/Declaration of Restrictions for the Elk Hills Unit" dated November 6, 1998 ("Conservation Management Agreement") (Exhibit 5).

3. Section 5.10 of the CESA MOU is revised to read as follows:

   The Elk Hills Unit Operator shall manage the 7801 acre Conservation Area in accordance with the Conservation Management Agreement.

4. Section 5.12 of the CESA MOU is revised to read as follows:

   Occidental shall secure its faithful performance of its obligations under Section 5.10 above in accordance with the Conservation Management Agreement.

5. Section 14 of the CESA MOU is revised to read as follows:

   This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 2009, unless otherwise extended in writing executed by all Parties.

6. Section 18 of the CESA MOU is revised to read as follows:

This CESA MOU includes and incorporates the following:

EXHIBIT 1: FEDERAL BIOLOGICAL OPINION

EXHIBIT 2: COVERED SPECIES

EXHIBIT 3: LIFE HISTORIES

EXHIBIT 4: ADDITIONAL CONSERVATION MEASURES

EXHIBIT 5: CONSERVATIONMANAGEMENT AGREEMENT/ DECLARATION OF RESTRICTIONS FOR THE ELK HISS UNIT

Except as hereby amended, the CESA MOU and all exhibits thereto shall remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have executed this First Amendment to the CESA MOU to be in effect as of the date last signed below.

Date: September 27, 1999

CALIFORNIA DEPARTMENT OF FISH AND GAME

By: W. E. Loudermilk

William Loudermilk, ~~Acting~~ Regional Manager

Date: August 16, 1999

OCCIDENTAL OF ELK HILLS, INC.,
a Delaware Corporation

By: Don Romine

Don Romine, General Manager

Approved as to Form:

By: [illegible] for

Ann S. Malcolm
Acting General Counsel
CA Department of Fish and Game

Approved as to Form:

By: [illegible]

Harley F. Pinson
Managing Counsel
Occidental of Elk Hills Inc.

CALIFORNIA DEPARTMENT OF FISH AND GAME
CENTRAL REGION
1234 EAST SHAW AVENUE
FRESNO, CALIFORNIA 93710

AMENDMENT NO. 2
California Endangered Species Act
Incidental Take Authorization No. 2081-1997-000-04
Occidental of Elk Hills, Inc.
ELK HILLS UNIT IN KERN COUNTY
(Formerly Known as Naval Petroleum Reserve-1)

INTRODUCTION

On December 29, 1997, the California Department of Fish and Game (Department) issued a California Endangered Species Act (CESA) Memorandum of Understanding and Take Authorization (hereinafter, the CESA MOU) to Occidental of Elk Hills, Inc. (Occidental). (See Fish & G. Code, § 2081.1.) The CESA MOU authorizes take as defined by the Fish and Game Code of various plant and animal species incidental to oil and gas exploration, extraction, production, development, transport, processing and other related activities by Occidental in the Elk Hills Unit of what was formerly known as Naval Petroleum Reserve 1, located in western Kern County, California. (CESA MOU §§ 1.2, 1.4, 3.0. 5.0; see also Fish & G. Code, § 86.) "Covered Species" for which the CESA MOU provides take authorization include the giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), San Joaquin antelope squirrel (*Ammospermophilus nelsoni*), and San Joaquin kit fox (*Vulpes macrotis mutica*). (CESA MOU § 5.0 and Exhibit 2.) The giant kangaroo rat and Tipton kangaroo rat are designated as endangered species under CESA. (Fish & G. Code, § 2062; Cal. Code Regs., tit. 14, § 670.5, subd. (a)(6)(C), (D).) The San Joaquin antelope squirrel and kit fox are designated as threatened species under CESA. (Fish & G. Code, § 2067; Cal. Code Regs., tit. 14, § 670.5, subd. (b)(6)(B), (E).) In authorizing incidental take of these Covered Species as provided by the CESA MOU, the Department certified and made the findings required by Fish and Game Code section 2081.1. (CESA MOU § 6.0.)

The CESA MOU originally provided take authorization to Occidental through December 31, 1999, except as extended by written agreement between the Department and Occidental. (CESA MOU § 14.0.) The original term of the CESA MOU was limited to two (2) years, pending Occidental's preparation of a permanent wildlife habitat and management plan, and the creation of a wildlife habitat reserve of at least 7,075 acres. (*Id.* §§ 5.9, 5.10.) Occidental prepared the permanent wildlife and habitat management plan, and established the wildlife habitat reserve as required by the CESA MOU.

On September 27, 1999, the Department amended the CESA MOU for the first time (hereafter, Amendment No. 1). Amendment No. 1 authorized Occidental to continue operations and development of the Elk Hills Unit as provided by the CESA MOU for an additional period of ten (10) years, expiring on December 31, 2009 unless otherwise extended in writing by the Department and Occidental. Amendment No. 1 also modified the CESA MOU by requiring: (1) an annual summary of surface disturbances and reclamation to the Department in the first quarter of each year; (2) full implementation and adherence to the "Conservation Management Agreement/Declaration of Restrictions for the Elk Hills Unit" dated November 6, 1998; (3) management of the 7,801-acre Conservation Area in accordance with the Conservation Management Agreement; and (4) security of faithful performance of Occidental's obligations under Section 5.10 of the CESA MOU in accordance with the Conservation Management Agreement; and (5) allowed the Department to terminate the CESA MOU after thirty (30) days written notice to Occidental or the Elk Hills Unit Operator, and after reasonable notice and an opportunity to cure, in the event of any material default of any obligation under the CESA MOU. In issuing Amendment No. 1 the Department affirmed its certification and findings pursuant to Fish and Game Code section 2081.1, including a determination that Occidental's compliance with the CESA MOU, as amended, would fully mitigate impacts to and not jeopardize the continued existence of any Covered Species.

In a letter to the Department dated November 3, 2009, Occidental requested an extension of the CESA MOU, as amended, for an additional term of five (5) years. Occidental requested the extension in order to continue operations in the Elk Hills Unit as authorized under the CESA MOU, pending completion of and final action by the Department concerning a proposed incidental take permit (ITP) intended to supersede the existing CESA MOU, as amended. (See generally Fish & G. Code, § 2081, subd. (b).) The Department and Occidental, along with the Service under the federal Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.), have been working in close coordination since early 2003 on this updated permitting effort, including lead agency review by the Department and Service under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) and the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 et seq.), respectively. Due in part to the State of California's ongoing fiscal crisis, the Department has not be able to complete the environmental review and updated permitting effort during the term of the CESA MOU, as amended.

This Second Amendment to the CESA MOU (Amendment No. 2) extends the term of the CESA MOU, as amended in 1999, for an additional five (5) years, up to and including December 31, 2014.

Amendment No. 2 also modifies Section 5.0 of the CESA MOU (Take Authorization), clarifying that the authorization provided by the Department extends only to those Covered Species currently protected by the CESA take prohibition set forth in Fish and

Game Code section 2080. (See *Environmental Protection Information Center v. California Dept. of Forestry and Fire Protection* (2008) 44 Cal.4th 459, 507, fn. 18.)

As set forth below, the Department finds that Amendment No. 2 will not significantly modify the scope or nature of Occidental operations in the Elk Hills Unit as authorized, or any of the minimization or monitoring conditions, or the amount of mitigation required by the CESA MOU, as amended. (Cal. Code Regs., tit. 14, § 783.6, subd. (c)(4).)

AMENDMENT

The CESA MOU, including Amendment No. 1, is hereby amended as follows:

a. Section 5 under "Agreement" on page 2 of Amendment No. 1 as executed by the Department on September 27, 1999, which revised Section 14.0 of the CESA MOU, is replaced in its entirety with the following:

> 5. This CESA MOU may be terminated by the Department after thirty (30) days written notice to Elk Hills Unit Operator in the event of any material default by Elk Hills Unit Operator of its obligations hereunder or under the Biological Opinion, which default Elk Hills Unit Operator has failed to cure after reasonable notice and opportunity to cure. Additionally, this CESA MOU shall terminate without further action by any Party on December 31, 2014, unless otherwise extended in writing and executed by all Parties.

b. Section 5.0 of the CESA MOU, as executed by the Department on December 27, 1997, is replaced in its entirety with the following:

> Subject to the terms and conditions of the federal Biological Opinion and this CESA MOU, specifically including this provision of the CESA MOU and pursuant to Section 2081 of the Fish and Game Code, the Department authorizes take of Covered Species currently designated as endangered or threatened under CESA (but not any such Covered Species also designated as a Fully Protected Species under the Fish and Game Code) where such take is incidental to the Project as described in Section 3.0. Non-incidental take of the Covered Species by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors, or designated agents that is deliberate or that otherwise results from any act by Elk Hills Unit Operator or on Elk Hills Unit Operator's behalf by its employees, contractors or designated agents outside the scope of the Project as defined in Section 3.0 is not authorized. For any Covered Species not currently designated as endangered or threatened under CESA, where any such Covered Species is designated as an endangered or threatened under CESA during the term of the CESA MOU, as amended, or where any such

Covered Species is designated as a candidate species subject to the prohibition on take established by Fish and Game Code section 2080 during the term of the CESA MOU, as amended, Occidental shall seek to amend this CESA MOU to obtain take authorization for such Covered Species from the Department or, in the alternative, obtain take authorization as otherwise required by the Fish and Game Code.

The State Fully Protected blunt-nosed leopard lizard is known to occur on the Elk Hills Unit. Take of this species is prohibited by the Fish and Game Code and take of blunt-nosed leopard lizard is not authorized by the Department through this CESA MOU, as amended, despite the species' inclusion as a Covered Species.

c. All other requirements and provisions of the CESA MOU, as amended by Amendment No. 1, remain in full force and effect.

FINDINGS

Amendment No. 2 will not increase the amount of take of the Covered Species compared to the Project as originally approved, nor will this Amendment increase other Project impacts on the Covered Species for which take authorization is provided by the Department through the CESA MOU, as previously amended..

Discussion: This Amendment makes two specific changes to the CESA MOU as originally issued in 1997 and amended previously in 1999. Neither the extension of the term of the CESA MOU or the clarification regarding the take authorization allows for or otherwise authorizes any change or expansion in Project activities as previously authorized by the Department pursuant to the CESA MOU in 1997, and as also amended in 1999. The resulting impacts to the Covered Species, as a result, including the estimated acreage to be impacted on a permanent and temporary basis will remain the same with Amendment No. 2.

Amendment No. 2 does not affect the Department's *previous certification and finding that the CESA MOU, as previously amended, meets and is otherwise consistent with Fish and Game Code section 2081, subdivisions (b) and (c).*

Discussion: The Department certified and made findings in December 1997 consistent with Fish and Game Code section 2081.1. Amendment No. 2 does not alter the Department's earlier certification and finding that the CESA MOU meets the substantive criteria established by the Fish and Game Code section 2081, subdivision (b) because Amendment No. 2 modifies the CESA MOU, as previously amended, only in two respects, neither of which allows for any change or expansion of the Project, including authorized impacts on Covered Species. The Department finds, in this respect, consistent with its previous certification and findings, that the CESA MOU, now as further amended, only authorizes take incidental to an otherwise lawful activity; that required

mitigation and other measures will minimize and fully mitigate the impacts of the authorized taking of Covered Species; that Occidental has ensured adequate funding to implement such mitigation and other measures, and for monitoring compliance with and the effectiveness of such measures; and that the CESA MOU, as further amended, will not jeopardize the continued existence of any Covered Species.

None of the factors that would trigger the need for subsequent or supplemental environmental analysis of the Project under Public Resources Code section 21166 or California Code of Regulations, Title 14, sections 15162 and 15163, exist as a result of Amendment No. 2.

Discussion: The Department issued the CESA MOU in December 1997 as a responsible agency under CEQA after, among other things, considering the joint Supplemental Environmental Impact Statement (SEIS) and a Program Environmental Impact Report (PEIR) prepared under NEPA and CEQA, respectively. The Department amends the CESA MOU, as also previously amended, in the same capacity. (See generally Pub. Resources Code, §§ 21002.1, subd. (d), 21069; Cal. Code Regs., tit. 14, § 15096.) As explained above, in approving and issuing Amendment No. 2, the Department is not authorizing any change in Project activities as previously approved, and neither modification to the CESA MOU provided by Amendment No. 2 is expected to increase or otherwise change the environmental impacts previously considered in issuing the CESA MOU in 1997, or in previously amending the CESA MOU in 1999. In this respect, given the minor nature of Amendment No. 2, the Department finds that approval of Amendment No. 2 will not result in and does not have the potential to create any new significant or substantially more severe environmental effects than previously analyzed and disclosed by Kern County during its lead agency review of the Project, particularly with respect to the impacts authorized by the Department pursuant to the CESA MOU as amended. As a result the Department finds that no additional subsequent or supplemental environmental review is required by CEQA as part of the Department's approval of this Amendment.

The Department finds that Amendment No. 2 is a Minor Amendment pursuant to California Code of Regulations, Title 14, section 783.6, subdivision (c) (4).

Discussion: The two changes to the CESA MOU, as previously amended, provided by Amendment No. 2 will not: (1) increase the level of take or other Project impacts on Covered Species previously analyzed and authorized by the CESA MOU, as amended; (2) significantly modify the scope or nature of the Project; (3) affect Occidental's substantive mitigation, minimization or monitoring, or any other obligations under the CESA MOU, as amended; (4) require further environmental review under CEQA; or (5) increase temporal impacts on the Covered Species. As a result, the Department finds that Amendment No. 2 is a minor amendment under CESA pursuant to California Code of Regulations, Title 14, section 783.6, subdivision (c) (4).

AUTHORIZATION AND EFFECTIVE DATE

The authorization provided by Amendment No. 2 is not valid and effective unless and until Occidental signs and dates the acknowledgement below, and returns one of the duplicate originals of this Amendment to the Department at:

Department of Fish and Game
Habitat Conservation Planning Branch
Attention: CESA Permitting Program
1416 Ninth Street, Suite 1260
Sacramento, California 95814

APPROVED BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME ON

_____ Dean Maustas for 7-30-10

Jeffrey R. Single, Ph.D.
Regional Manager
Central Region

ACKNOWLEDGMENT BY OCCIDENTAL OF ELK HILLS, INC.

The undersigned: (1) warrants that he or she is acting as a duly authorized representative of the Permittee, (2) acknowledges receipt of the original CESA MOU, Amendment No. 1, and this Amendment No. 2; and (3) agrees on behalf of the Permittee to ensure that all terms and conditions of the CESA MOU, as amended, will be implemented by the Permittee.

By: _____ Date: 8/3/10

Printed Name: SHANN M. KERNS

Title: President & General Manager, OEHI

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

IN REPLY REFER TO:

In Reply Refer To:
1-1-95-F-102

November 8, 1995

Mr. Danny A. Hogan, Director
U.S. Department of Energy
Naval Petroleum Reserves in California
P.O. Box 11
Tupman, California 93276

Subject: Reinitiation of Formal Consultation Concerning Oil Production at Maximum Efficient Rate on Elk Hills Naval Petroleum Reserve, Kern County, California

Dear Mr. Hogan:

This responds to your October 9, 1991, request for reinitiation of formal consultation pursuant to section 7(a) of the Endangered Species Act of 1973, as amended (Act), on a proposal by the U.S. Department of Energy (DOE or the Department) to continue oil production activities at Maximum Efficient Rate (MER) on Elk Hills Naval Petroleum Reserve (NPR-1 or the Reserve), Kern County, California. At issue are effects of proposed MER production on the federally endangered San Joaquin kit fox (*Vulpes macrotis mutica*), blunt-nosed leopard lizard (*Gambelia silus*), giant kangaroo rat (*Dipodomys ingens*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Kern mallow (*Eremalche kernensis*), and San Joaquin wooly-threads (*Lembertia congdonii*), and the federally threatened Hoover's woolly-star (*Eriastrum hooveri*). Your request for formal consultation was received by this office on October 15, 1991. The U.S. Fish and Wildlife Service (Service) provided a draft biological opinion to DOE on May 28, 1993. Formal comments from DOE on the draft opinion were received on December 8, 1994. Subsequent meetings between representatives from the Service, DOE and Chevron U.S.A. (Chevron) were held on February 8, March 3, April 20, and May 18, 1995, to discuss the content of the biological opinion.

The Service addressed effects on federally listed species of MER production activities on NPR-1 in two prior biological opinions dated February 1, 1980 (Case No. 1-1-80-F-2) and December 16, 1987 (Case No. 1-1-80-F-2R). The 1980 biological opinion concluded that MER oil production on NPR-1 may jeopardize the continued existence of the San Joaquin kit fox and blunt-nosed leopard lizard, but included six reasonable and prudent alternatives that, if implemented, would allow MER production to continue. The Department agreed to implement these alternatives and to complete a future consultation to evaluate their success in minimizing adverse effects of MER production on federally listed species.

The subsequent 1987 biological opinion concluded that MER production on NPR-1 would not jeopardize the continued existence of the San Joaquin kit fox, blunt-nosed leopard lizard, Tipton kangaroo rat and giant kangaroo rat--which was listed as federally endangered in 1988. This conclusion was based, in part, on development and implementation by DOE of a comprehensive mitigation program designed to minimize adverse effects of MER production on federally listed species. In addition to this program, the 1987 opinion required the Department to implement several reasonable and prudent measures, including replacement of endangered species habitat lost as a result of project related actions.

The 1987 biological opinion also cited the Department's intent to develop a Supplemental Environmental Impact Statement (SEIS) concerning future oil production activities on NPR-1. The intent to develop such an update resulted from planning activities conducted concurrently with the 1987 consultation that determined that future oil development activities on NPR-1 could exceed some environmental impacts projected in the Department's original EIS completed in 1979 (DOE 1979). Accordingly, the Department published a Notice of Intent to prepare a supplemental EIS on NPR-1 activities in the **Federal Register** on April 4, 1988, completed a draft supplemental EIS (DSEIS) in May, 1992 (DOE 1992), and a final supplemental EIS (FSEIS) in July, 1993 (DOE 1993).

It is this supplemental EIS, together with Federal listing of several plant species--the Hoover's woolly-star, San Joaquin wooly-threads, and Kern mallow on July 19, 1990--that necessitates reinitiation of formal consultation and preparation of this revised biological opinion.

This biological opinion is based on the DSEIS (DOE 1992); the FSEIS (DOE 1993); a biological assessment prepared for currently proposed activities on NPR-1 (DOE 1991); several other reports (see Literature Cited section); meetings and discussions between the Service, Department, Chevron, and Energy Advisory Services, Inc.(EASI), the Department's biological contractor (formerly EG&G Energy Measurements); and information in our files.

BIOLOGICAL OPINION

Description of the Proposed Action

Elk Hills Naval Petroleum Reserve (or Naval Petroleum Reserve No. 1) was established in 1912 for national defense purposes, but was largely maintained in reserve shut-in status until 1976. Because of oil shortages in the early 1970's, Congress passed the Naval Petroleum Reserve Production Act in 1976, which provided for oil production on NPR-1 at the "Maximum Efficient Rate." Maximum Efficient Rate under this statute was defined as the maximum rate that optimizes both economic return and hydrocarbon recovery. The proposed action addressed in this biological opinion is continuing MER production on NPR-1 in compliance with the Naval Petroleum Production Act and as described in the DSEIS (DOE 1992).

NPR-1 consists of approximately 47,409 acres about 25 miles southwest of Bakersfield, California. Of this, 37,049 acres (78 percent) are administered by the Department of Energy; the balance of 10,360 acres (22 percent) is owned by Chevron (DOE 1992). To the south of and partially contiguous with NPR-1 lies Buena Vista Hills Oil Field which encompasses Naval Petroleum Reserve (NPR-2). Of approximately 30,000 acres comprising NPR-2, DOE administers about 10,000 acres and the balance is owned by private oil companies. The government's share of NPR-2 has been developed under lease by private oil companies since the 1920's. Together, NPR-1 and NPR-2 constitute what is known as the Naval Petroleum Reserves in California (NPRC).

Topographically, Elk Hills consists of a ridge about 16 miles long by six miles wide that runs east to west in the southern San Joaquin Valley. NPR-1 is surrounded on three sides by oil and gas fields and agricultural lands. On the north side, NPR-1 is immediately contiguous with a large area (approximately 30,000 acres) of relatively undisturbed endangered species habitat known as the Lokern Road area. Vegetation on NPR-1 consists primarily of saltbush scrub and grassland habitats.

Elk Hills is the seventh largest oil field in the United States (DOE 1991). It is a highly profitable field, cumulative net government revenues exclusive of Chevron's share from 1976 to 1990 totalling $11.6 billion (DOE 1992).

Hydrocarbon products recovered or produced on NPR-1 include crude oil, natural gas, and natural gas liquids including propane, butane, and natural gasoline. Of estimated original recoverable oil reserves on NPR-1, 860 million barrels have been produced--630 as the result of MER production since 1976 (DOE 1992). Oil production on NPR-1 peaked in 1981 at approximately 180,000 barrels per day and averaged approximately 74,000 barrels per day in Fiscal Year 1991 (DOE 1992). The Department estimates that oil production on NPR-1 could continue to be profitable until 2010 to 2025, perhaps longer (DOE 1992).

Existing Facilities

Existing operational facilities on NPR-1 include the following (DOE 1991): (1) 1,253 active wells (production, water source, gas injection, waterflood injection, wastewater disposal injection, and steam injection); (2) 1,055 existing wells that are shut-in (idle) or abandoned; (3) approximately 2,500 miles of pipelines and 1,000 miles of roads; (4) one crude oil tank farm; (5) 121 tank settings; (6) five LACT (lease automatic custody transfer) facilities used to separate oil from water and transfer oil to Chevron and Department purchasers; (7) 45 product storage tanks; (8) four gas-processing plants used to separate natural gas liquid products from natural gas; (9) five wastewater disposal facilities; (10) two gas injection plants; (11) 11 gas compression plants; (12) one steam injection facility used for thermally enhanced oil recovery; (13) several emergency wastewater sumps and two landfill facilities; (14) three building complexes for offices, maintenance, and storage; and (15) a variety of other supporting systems and infrastructure.

The majority of waste materials generated on NPR-1 are non-hazardous and include produced water, spent drilling fluids, and solid wastes such as paper, construction debris, and garbage (DOE 1991). Hazardous materials utilized or generated on NPR-1 include used oil, lubricants, and batteries; herbicides and pesticides; and solvent wastes (DOE 1991). Most produced water is re-injected on-site into subsurface formations; drilling fluids are placed into on-site land areas located in Sections 10G and 27R (the land area in Section 10G is temporarily idle). A hazardous waste facility in Section 27R was formally closed in 1992. Hazardous wastes are removed to off-site disposal facilities or are recycled (DOE 1991).

Despite careful handling, spills of oil or other chemicals occasionally occur on NPR-1. Since 1989, these have been handled in accordance with a Spill Prevention Control and Countermeasure Plan (BPOI 1989), which provides for an emergency response team, cleanup procedures, and documentation. Nonetheless, an unquantified number of acres on NPR-1 has been affected by such spills since 1976 and the Department currently is cleaning up approximately 64 sites known to have been contaminated by chromium, arsenic, and other materials (all 64 of these sites already have been remediated) (DOE 1991).

Activities necessary to achieve and maintain MER production on NPR-1 were first described in the original project EIS (DOE 1979). These activities have resulted in the construction of numerous oil production, processing, and storage facilities, associated infrastructure, and administrative facilities on NPR-1 since 1976 (see Environmental Baseline section). Because of evolving conditions, however, including better technical understanding of oil and gas reservoirs beneath NPR-1, the Department now proposes several new facilities believed to be necessary to maintain MER production through the 1990's and into the next century. These are described in the FSEIS (DOE 1993) and are summarized below. The Service completed a biological opinion in 1987 (File No. 1-1-80F-2R) that covers all of the on-going activities at NPR-1.

To maintain hydrocarbon production on NPR-1 at Maximum Efficient Rate, the Department proposes to conduct the following ongoing activities (DOE 1992) (those not pertaining to biological issues are omitted).

(1) Production at MER, estimated in the Long Range Plan to be approximately 99,000 bbl/day of oil in FY 1990, declining to approximately 72,000 bbl/day in FY 1995; 365 million ft/day of gas in FY 1990, increasing to 417 million ft/day in FY 1995; and 654,000 gal/day of natural gas liquid products in FY 1990, increasing to 768,000 gal/day in FY 1995;

(2) Drilling, redrilling or deepening approximately 382 existing wells (including 148 for the steamflood operation described below), performance of approximately 2,663 remedial jobs on existing wells, and abandonment of approximately 1,080 existing wells.

(3) Investigating, remediating, or otherwise managing numerous old and inactive waste sites.

(4) Activities to permit third parties to construct, operate, and maintain pipeline projects, geophysical surveys, and other projects on NPR-1 lands. Approximately 3-4 third-party projects are anticipated per year.

(5) A program to initiate revegetation on approximately 1,045 acres of previously disturbed lands no longer needed for production operations.

(6) Continued maintenance of the NPR-1 perimeter firebreak. This activity was addressed in prior biological opinions dated June 3, 1987 (Case No. 1-1-87-F-40), August 20, 1991 (Case No. 1-1-91-F-18), June 16, 1992 [Case No. 1-1-91-F-18(R)], and April 27, 1993 [Case No. 1-1-91-F-18(R2)].

In addition, the Department proposes to initiate the following new activities to maintain MER production on NPR-1 (DOE 1992).

(1) Construction and operation of a phased multi-year steamflood operation consisting of 148 wells on an approximately 500-acre area (referred to as the SOZ Steam Flood Project). This project represents an expansion of a 59-acre pilot steamflood project initiated in 1987 and addressed under a prior biological opinion (Case No. 1-1-85-F-22).

(2) Construction and operation of an additional waste water treatment facility.

(3) Construction and operation of a 5-acre butane isomerization facility.

(4) Construction and operation of a fourth gas compression and processing facility.

(5) Construction and operation of facilities to increase gas compression capacity for gas-lift and gas injection projects, and to increase waterflooding capacity.

To mitigate for adverse effects on federally listed species of ongoing and new MER production activities on NPR-1, DOE proposes to implement the following mitigation commitments as part of the proposed action. This program consists of the following components.

Mitigation Commitments

Conservation Area

Within three years of the date of this opinion, the Department shall place into protected status 7,075 acres of undisturbed endangered species habitat within, or adjacent to, NPR-1, and if appropriate NPR-2, preferably along the north side of NPR-1 adjacent to the Lokern Road area. This will be subject to agreement between the Service and the Department on a management agreement which would identify precise acreage amount, location, and management details

related to the conservation area. If this cannot be accomplished within 3 years, the Department agrees to reinitiate consultation if the Service is not satisfied with the progress that is being made. Such habitat shall be protected against major development activities in perpetuity through a management agreement or other appropriate document executed by and between the Director, NPRC and State Supervisor, FWS. The Department shall enter into written, legally binding agreement with the Service and other affected parties concerning the manner in which compensation lands shall be managed. This conservation area would satisfy any present or future requirements for compensating for the impacts described in the proposed action.

Prior to finalization of any land protection mechanism as required under this mitigation commitment, the Department shall submit for the Service's review the following information: (I) a description of lands selected for protection; (ii) the manner in which they would be protected; (iii) Department commitments with respect to how such lands would be managed, if necessary; and (iv) other information as deemed appropriate by the Department or Service. Finalization of the protection program shall not occur until written approval is obtained from the Service that the protection program is acceptable in all pertinent respects. The Service is available to assist the Department in selecting suitable NPR-1 lands for protection and for other assistance as necessary.

Wildlife Management Plan

This Plan was developed in 1987 to mitigate the effects of routine NPR-1 operation on endangered species and other wildlife; it requires or encourages the following: (I) conducting pre-activity surveys prior to surface disturbing activities; (ii) revegetation of disturbed areas; (iii) monitoring endangered species populations; (iv) controlling coyote populations as appropriate; (v) implementing operating guidelines; (vi) studying conservation and habitat restoration techniques; (vii) developing information and education programs for NPR-1 employees and contractors; and (viii) participating in endangered species recovery programs (O'Farrell and Scrivner 1987). Some activities conducted under the Wildlife Management Plan are discussed further below.

Endangered Species Research and Monitoring Program

In 1979 DOE initiated an endangered species monitoring program on NPR-1 and hired EG&G Energy Measurements, Inc. (EG&G) as its sole biological consultant. In part, EG&G was tasked with implementing reasonable and prudent alternative no. 1 in the Service's 1980 biological opinion--which required an evaluation of effects of oil field development on NPR-1, "basic research" on endangered species including collection of "baseline population and distributional" data, and development of methods to "increase carrying capacity" and "promote the conservation" of endangered species on NPR-1.

Since 1979 EASI has conducted extensive endangered species activities on behalf of the Department and has become an integral component of DOE's overall program on NPR-1 and NPR-2. From approximately 1979 to 1980, EASI conducted site-wide surveys on the Reserves to inventory endangered species populations (Thom Kato, EG&G, pers. comm.). From approximately 1980 to 1987, EASI gathered extensive data concerning kit fox distribution, abundance, mortality factors, and reproductive success within "developed" and "undeveloped" habitats on the Reserves (see Project Effects section). These data were reported in numerous topical reports prepared in 1986 and 1987 and in a biological assessment prepared in support of the 1987 formal consultation and biological opinion.

Operationally, EASI's role on the Reserves is currently divided into seven program "elements" (Thom Kato, EG&G, pers. comm.). These are (1) endangered

species monitoring, including monitoring of kit foxes, lagomorphs, small mammals, coyotes, and other federally listed species; (2) pre-activity surveys on NPR-1; (3) habitat reclamation and management (discussed below); (4) research and development (discussed below); (5) general program assistance, including section 7 consultation support; (6) assistance with third party projects on NPR-1 and NPR-2; and (7) endangered species support activities on NPR-2. An eighth program element previously included through approximately 1990--investigation of relationships between oil field materials and practices and wildlife--was placed as a task in the research and development element in Fiscal Year 1992, evidently because most tasks associated with this element either have been completed or deferred.

Under Element 4--research and development--EASI has conducted or proposed to conduct a variety of projects that are either independent of or indirectly related to other program tasks. Justification for these "research" studies derives in large part from language in the Service's prior biological opinions requiring or recommending, for example, development of methods to "increase carrying capacity" on NPR-1 (1980 opinion) and to conduct artificial kit fox den studies (1987 opinion). Projects conducted or ongoing under this element include, but are not limited to, a kit fox supplemental feeding study, a kit fox relocation project, a giant kangaroo rat habitat reclamation study, and a burn area re-seeding study. Projects proposed but not conducted to date include a kit fox artificial den study and a study of Bakersfield kit foxes associated with the relocation project (William Lehman, USFWS, pers. comm.).

NPRC has proposed an adjustment in the overall scope of its endangered species program from one that has been dedicated to gaining understanding (data collection, monitoring, research and studies) to one that for the most part is limited to reasonable avoidance, habitat reclamation, and habitat conservation, including the establishment of the on-site conservation area.

Monitoring would continue to be conducted in accordance with current scopes based on the following frequencies: Kit foxes would continue to be monitored annually through fiscal year 1996 (NPR-1, NPR-2, abundance, capture and tagging, prey and predators, i.e., lagomorphs, small mammals, coyotes and bobcats, diseases, sources and rates of mortality, and reproductive success). Absent a convincing scientific basis, after that kit fox abundance only would be monitored every 5 years. The abundance of all other protected species would be monitored annually through fiscal year 1999, and every 5 years thereafter.

NPRC proposes that no new data collection, research, or study activities would be initiated. Such activities currently in progress, however, would be completed, including a comprehensive effort that is in progress to integrate and document all data collected and all research/study information, analyses, and conclusions. The Service recognizes NPRC has conducted a great deal of valuable research of the sensitive species of Elk Hills. However, studies (particularly on the conservation area) should continue to gather information on endangered species management and range-wide recovery. Efforts can include habitat manipulations that will sustain and enhance the habitat quality on NPR-1; monitoring populations of listed and candidate species; beet leafhopper control and it's effect on blunt-nosed leopard lizards; etc. Ultimately, these studies should be designed to facilitate on-site endangered species conservation with an emphasis of range-wide recovery needs. The Department and the Service have agreed to address the issue of research/studies as part of the conservation area management agreement.

In late 1988, the DOE established an interagency committee to assist DOE and Chevron by providing additional perspectives on its endangered species programs on NPR-1 and NPR-2. Known informally as the Elk Hills Endangered Species Advisory Committee, this group is composed of representatives from DOE, Bechtel Petroleum Operations, Inc. (DOE's Unit Operator), EASI, Chevron,

the Service, California Department of Fish and Game, the California Energy Commission, the Bureau of Land Management, Enterprise Advisory Services, Inc., and the San Joaquin Valley Endangered Species Recovery Planning Program. The committee meets four times per year.

Habitat Reclamation and Compensation

Both prior biological opinions concerning MER production on NPR-1 discussed in detail the issue of habitat losses, resulting from MER production, and compensation for such losses. A reasonable and prudent measure in the 1980 opinion required DOE to "prepare a Master Plan for the restoration of disturbed habitat on NPR-1." The terms and conditions within the 1987 opinion required the Department to (1) complete an inventory of previously disturbed parcels at NPR-1 that could be rehabilitated to offset habitat loss associated with project activities, and (2) to develop a 10-year program to restore on-site disturbed acreage equivalent to that lost as a result of project activities.

Pursuant to these requirements, the Department in 1988 completed detailed disturbance mapping of NPR-1 based on current aerial photography, and in 1985 initiated a habitat reclamation program on NPR-1 and NPR-2. Through FY 1993, 899 acres of previously disturbed acres on NPR-1 had been replanted (EG&G 1995). While this represents all lands available for reclamation (i.e., lands that are abandoned and meet all reclamation criteria), the Department has estimated an additional 363 acres on NPR-1 will be available for abandonment and reclamation, through 1998 (DOE 1994). This would yield a total of 1,262 acres revegetated as a result of the Department's reclamation program through 1998. In addition, approximately 920 acres of disturbed lands on NPR-1 have revegetated naturally (DOE 1991).

The issue of how the Department's habitat reclamation program relates to its overall obligation to compensate for habitat losses on NPR-1 resulted in considerable discussion during the current consultation. Based on the requirement within the 1987 opinion to restore "equivalent on-site acreage" DOE questioned whether its habitat reclamation program alone was not sufficient to compensate for MER related disturbances, provided equivalent acreage was revegetated. However, for the following reasons the Service did not consider habitat reclamation alone to be adequate. First, the 1987 biological opinion states that equivalent on-site acreage should be restored "at a minimum.". Second, both prior opinions also mention other compensation methods, including zoning for no development, purchase of off-site habitats, and contribution of funds. Third, "equivalent" reclamation (at a 1:1 ratio) would not be consistent with San Joaquin Valley compensation policy as developed by the Service and California Department of Fish and Game through numerous prior projects--which typically requires a 3:1 compensation ratio for permanent habitat impacts and a 1.1:1 ratio for temporary impacts in saltbush scrub habitats. Finally, in previous projects, revegetation of disturbances resulting from a project typically is not credited to the compensation obligation for that project but is considered a separate mitigation measure.

On the other hand, the Service recognizes that DOE has in good faith expended considerable effort and expense on its habitat reclamation program based in part on the Service's recommendations and requirements. Because of this, the Service has worked with the DOE to develop a compensation program for NPR-1 that would utilize standard compensation policies, recognize the Department's reclamation efforts, and encourage continuation of such efforts.

Studies near completion demonstrate that in some cases reclamation projects are no more effective than natural revegetation for habitat restoration. In situations where natural revegetation is effective, NPRC would limit reclamation to only those activities needed to stabilize soils while natural revegetation is occurring. Procedures for reclamation would be developed in

collaboration with the Service and other professionals as appropriate. Otherwise, habitat reclamation and success monitoring would continue in a manner similar to current procedures. Existing disturbances would be reclaimed as they are identified as no longer being needed for oil field operations.

The resulting program is based on the following assumptions: (1) because MER development has primarily been considered a single integrated project under this and prior biological opinions, and not as a series of separate projects, the habitat compensation obligation for MER development should apply retro-actively to 1976 for the unfulfilled portion of habitat reclamation obligations stemming from the 1987 biological opinion; (2) that habitat disturbances resulting from MER development should be compensated at the same rate as other San Joaquin Valley habitat losses; (3) that habitat disturbances on NPR-1 that have recovered naturally should not count as credits toward DOE's compensation obligation, since they are fortuitous and not the result of its reclamation program; and (4) that <u>all</u> acres revegetated or planned for revegetation under the DOE's reclamation program should be credited toward its compensation obligation, even though many reclaimed areas were disturbed <u>after</u> MER development began. The latter assumption is also based on the fact that the Department's reclamation program is a relatively large-scale, systematic effort being applied to a wide variety of disturbances on NPR-1. We therefore regard it as a programmatic effort rather than merely a project effort.

Finally, to satisfy DOE's compensation obligation, the Service and Department have discussed conceptually the possibility of placing portions of NPR-1 into protected status for the primary purpose of endangered species management. The Service considers this a suitable strategy because significant areas of NPR-1 are relatively undisturbed (especially along its periphery); and because NPR-1 and undisturbed portions of NPR-2 are contiguous with other important native habitats, including the Buena Vista Valley and the Lokern Road area.

Based on the above discussion, the Department has agreed in principle to compensate for habitat losses associated with MER development on NPR-1 by placing into protected status a total of 7,075 acres of undisturbed lands on NPR-1 and NPR-2. This figure is based on estimated temporary disturbance of 318 acres and estimated permanent disturbance of 2,525 acres resulting from MER development, utilizing agreed-upon compensation ratios and minus all acres revegetated or planned for revegetation under DOE's reclamation program established pursuant to the 1987 biological opinion: i.e., 318 temporary acres X 1.1 = 350 acres; 2,525 permanent acres X 2 or 3 = 5,965 acres; 350 + 5,965 = 6,315 total compensation acres + 691 acres of temporary disturbance for third party projects (691 x 1.1 = 760); 6,315 + 760 = 7,075 (DOE 1995). The derivation of temporary versus permanent disturbances is explained in the Project Effects section below.

<u>Plant Mitigation Commitments</u>

To protect federally listed plants and plant species of concern on NPR-1, the Department also has agreed to the following measures.

(1) The Department will complete one comprehensive floristic survey of NPR-1 for all State and Federal endangered, threatened, candidate, and special concern species in the areas of NPR-1 where this kind of a survey has not already been completed. The Department agrees to complete the survey by the end of the fourth growing season, subject to adequate precipitation following permit issuance. Within 60 days of permit issuance, NPRC will provide a written scope of work for the survey to the Service for review, comment, and approval. The scope of the surveys will be developed informally in collaboration with Service personnel from the outset. The scope will address such things as priorities, precipitation criteria, reporting requirements, and schedules. Service comments and approval on

the scope are to be provided to NPRC within 60 days. Within 6 months following the completion of each year's survey, the Department will complete a topical report covering the results and findings for that year's survey, including mapping. Within 6 months following the completion of the last year's survey, the Department will complete a topical report covering the results and findings for the four year survey.

(2) With the exception of Hoover's woolly-star, the Department will initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants.

(3) To minimize adverse effects of oil and gas production on Hoover's woolly-star, the Department will implement the following protective measures:

a. The Department will conduct preactivity surveys for Hoover's woolly-star for all projects and to make every reasonable effort to conduct them during the Hoover's woolly-star's growing season.

b. If Hoover's woolly-star is known or thought to be in a project area, every reasonable effort will be made to avoid them by relocating and/or reconfiguring the project.

c. If it becomes necessary to locate a project in an area where Hoover's woolly-star is known or thought to be present, every reasonable effort will be made to wait until after seed set before beginning ground disturbances. When disturbances occur after seed set, 2 to 4 inches of topsoil will be conserved and respread within one year, if possible, within appropriate Hoover's woolly-star habitat at a site that is being revegetated outside the conservation area. If it is not possible to meet the 1-year time frame, the topsoil shall be stockpiled and respread within appropriate habitat outside the conservation area as soon as possible.

d. It will not be necessary to protect Hoover's woolly-star that has become reestablished in previously disturbed areas.

(4) The Department will include Hoover's woolly-star habitat in the conservation area.

(5) The Department will use locally obtained native seed for revegetation to the extent commercially available at competitive prices.

(6) The Department will ensure that the habitat of the four oil neststraw (*Stylocline citroleum*) populations known to exist in Sections 10R, 12R, and 17S, is not developed.

Species Account/Environmental Baseline

San Joaquin Kit Fox. The endangered San Joaquin kit fox historically was distributed within an 8,700-square mile in central California from the vicinity of Tracy in the upper San Joaquin Valley south to the general vicinity of Bakersfield. Intensive agriculture, urbanization, and other land-modifying actions have eliminated extensive portions of habitat and are the most significant causes of this species' endangerment. The coyote and the introduced red fox compete for food resources with the smaller kit fox, and are suspected of preying upon kit foxes as well. Predation, competition, poisoning, and road kills contribute substantially to the vulnerability of this species. Kit foxes currently are limited to remaining grassland, saltbush, open woodland, and alkali sink valley floor habitats, and similar habitats located along bordering foothills and adjacent valleys and plains.

Although in the southern San Joaquin Valley, they appear to make extensive use of habitat fragments in an urbanizing environment.

Giant Kangaroo Rat. The giant kangaroo rat was distributed historically from southern Merced County, south through the San Joaquin Valley, to southwestern Kern County and northern Santa Barbara County. Preferred habitat is native annual grasslands with sparse vegetation, good drainage, fine loamy soils, and slope of less than 10 percent. Significant populations survive only in a few areas of remaining habitat, including the Pahoche Hills, Cuyama Valley, Carrizo and Elkhorn Plains and the Lokern area.

Kangaroo rats typically inhabit areas of open ground which tends to facilitate their mode of locomotion. Such areas include rangeland, wildlands, and farmlands that have not been recently cultivated or disced. Kangaroo rats can repopulate formerly cultivated areas from adjoining occupied habitat.

Blunt-Nosed Leopard Lizard. The blunt-nosed leopard lizard was distributed historically throughout the San Joaquin Valley and adjacent interior foothills and plains, extending from central Stanislaus County south to extreme northeastern Santa Barbara County. The blunt-nosed leopard lizard prefers open, sparsely vegetated areas of low relief and inhabits valley sink scrub, valley saltbush scrub, valley/plain grasslands, and foothills grasslands vegetational communities.

Adult lizards often seek safety in burrows, while immature lizards use rock piles, trash piles, and brush. The lizards use burrows constructed by mammals, such as kangaroo rats, for overwintering and aestivation. The habitat of the lizard has been significantly reduced, degraded, and fragmented by agricultural development, petroleum and mineral extraction, livestock grazing, pesticide application, and off-road vehicle use. Today its distribution is limited to scattered parcels of undeveloped land, with the greatest concentrations occurring on the west side of the valley floor and in the foothills of the Coast Range. The 1985 revised recovery plan (FWS 1985) identified habitat essential for the survival and recovery of the species, priority habitat areas, and areas that could be restored to habitat.

Tipton Kangaroo Rat. The Tipton kangaroo rat inhabits saltbush scrub and alkali sink scrub communities in the Tulare Lake Basin of the southern San Joaquin Valley. They currently inhabit approximately 4 percent of their historic range. Tipton kangaroo rats commonly dig burrows on elevated ground which is not subject to flooding. However, areas which are flooded in winter and spring are occasionally colonized during the dry season. The preferred location for Tipton kangaroo rat burrows typically involves alluvial fans and floodplains and includes fine, highly alkaline sands and, to a lesser degree, alkaline sandy loams. In addition, they generally burrow around the bases of woody shrubs. One of the smallest kangaroo rats, the subspecies is often found in areas also occupied by the larger Heermann's kangaroo rat.

Hoover's woolly-star. Surveys have shown that Hoover's woolly-star populations range from the upper Cuyama Valley near Ventucopa, Santa Barbara County, northward to the Panoche Hills in San Benito County, a distance of approximately 140 miles. Hoover's woolly-star occurs in 42 USGS 7 ½ - minute quadrangles within Kings, Kern, San Luis Obispo, Santa Barbara, San Benito, and Fresno counties. Hoover's woolly-star occurrences primarily are located within four areas. The four areas from largest to smallest are: (1) the Kettleman Hills area, (2) the Carrizo Plain-Elkhorn Plain-Temblor Range-Caliente Mountains-Cuyama Valley-Sierra Madre Mountains area, (3) the Lokern-Elk Hills-Buena Vista Hills-Coles Levee-Maricopa-Taft area, and (4) the Antelope Plain-Lost Hills-Semitropic area. Additional, more isolated populations occur throughout the region. An intra-agency draft recovery plan has been developed for Hoover's woolly-star.

Kern Mallow. Kern mallow was first described as *Eremalche kernesis* (Wolf 1938). The most recent treatments (Bates 1992, 1993) assign Kern mallow the name *Eremalche parryi* (Greene) Greene ssp. *parryi*. Bates' treatment of Kern mallow, which includes both white- and purple-flowered gynodioecious plants, has not widely been accepted by the scientific community. Due to the debate within the scientific community over the newest treatment, the Service intends to undertake a status review to solicit available scientific information on which to base a determination of the appropriate taxonomic circumscription of Kern mallow. In the interim, the Service shall continue to consider the listed entity to be *E. kernensis* C.B. Wolf, which was the circumscription used when Kern mallow was listed in 1990. The endangered Kern mallow is a small annual herb of the mallow family 2 to 4-inches in height primarily with white flowers (USFWS 1989). Kern mallow is restricted to the eastern base of the Temblor Range, occurring from the vicinity of McKittrick to near Buttonwillow within valley saltbush scrub in Kern County (Taylor and Davilla 1986). The species is threatened by oil and gas development, transmission line maintenance or expansion, agricultural conversion, overgrazing by livestock, exotic plant competition, and off-road vehicle use. An intra-agency draft recovery plan has been developed for Kern mallow.

San Joaquin wooly-threads. The endangered San Joaquin wooly-threads is a small annual herb of the sunflower family and is endemic to the San Joaquin Valley of California. Its white-wooly stems, only three inches long, often trail along the ground. Flowers are about 1/4-inch in diameter, lack ray flowers, and have a yellow center. San Joaquin wooly-threads once ranged throughout the floor of the San Joaquin Valley from western Fresno County and eastern Tulare County south to the foothills of the Tehachapi Mountains, reaching into San Benito County on the northwestern part of its range following the rain shadow of the South Coast Ranges (Taylor, 1989). Little is known of the habitat preferences of San Joaquin wooly-threads. It appears to favor non-alkaline soils of sandy or silty sand texture and an arid climatic regime (Taylor, 1989). Much of the habitat for San Joaquin wooly-threads has been eliminated by conversion of annual grassland sites to agriculture. An intra-agency draft recovery plan has been developed for San Joaquin wooly-threads.

Endangered Species Surveys/Status

In 1979, when the Department began its endangered species program on NPR-1, kit foxes were numerous and widely distributed within the Reserve. In 1984, kit fox dens were observed on all but two sections (DOE 1991). However, since 1979 the kit fox population on the NPR-1 "study area" has declined from a high of 144 animals in the winter of 1981-1982 to a low of just 12 animals in the winter of 1991-1992. In addition, kit foxes have disappeared from the central upland portions of NPR-1--where most oil development has occurred--and now appear to be confined to the flatter peripheries of NPR-1. This decline and the status of kit foxes on NPR-1 is discussed in detail in the Project Effects section. However, Elk Hills continues to be very important for the long-term survival and recovery of the San Joaquin kit fox.

Distribution of other federally listed species on NPR-1 typically is more restricted than that of kit foxes. From 1979 to 1987, a total of only 136 blunt-nosed leopard lizards were observed in only 28 of NPR-1's 74 sections (DOE 1991). Leopard lizards typically are found in washes and areas of low relief around the periphery of the Reserve, especially in the Buena Vista Valley along the NPR-1/NPR-2 border; however, leopard lizards also have been observed in six sections in the NPR-1 central uplands. Recorded leopard lizard densities on NPR-1 vary from 0.16 to 0.24 individuals per acre (DOE 1991).

Giant kangaroo rat burrow systems have been observed in 30 sections of NPR-1 (DOE 1991). Like the leopard lizard, the majority of these burrow systems

occur in the Buena Vista Valley, though a few burrows also have been observed in the central uplands. In recent surveys, however, many of these burrow systems have been found to be inactive, possibly because of drought conditions from 1987 to 1991. Giant kangaroo rat burrows on NPR-1 were observed at elevations ranging from 316 to 1,510 feet.

The California Aqueduct is cited in Williams (1985) as the approximate line between the ranges of the Tipton kangaroo rat and the short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*). Consequently, Tipton kangaroo rat distribution on NPR-1 is confined to those small portions of the Reserve east of the aqueduct. During a three-night trapping census conducted in 1988, six to 12 Tipton kangaroo rats were captured per night in this area (DOE 1991).

Initial field surveys for the Hoover's wooly-star and other federally listed plants were conducted on NPR-1 in spring 1988 (EG&G 1988, DOE 1991). A total of 28 Hoover's wooly-star populations were observed, primarily restricted to alluvial fans along the lower flanks of the Reserve in Sections 4B, 10B, 12G, 7R, 8R, 10R, 12R, 13R, 32R, 17S, 18S, 20S, 21S, 22S, 23S, and 26S (DOE 1991). Further surveys were conducted in 1991 and additional wooly-star populations were observed in Sections 3B, 12B, 13B, 1G, 10G, 25S, 27S, 30S, 31S, and 14Z (EG&G unpublished data). Hoover's wooly-star populations on NPR-1 tend to occur in areas where other vegetation is sparse such as washes and formerly disturbed sites (e.g., the NPR-1 firebreak and abandoned roadways). Four populations were found at or above 1,000 feet in elevation (EG&G 1993).

The Kern mallow, San Joaquin wooly-threads, and California jewelflower (*Caulanthus californicus*) were not observed during these surveys. However, apparently suitable habitat for Kern mallow was observed in the northwestern portion of NPR-1 (Sections 12Z, 13Z, and 14Z), and the species likely exists here in low numbers or may become established within the foreseeable future (DOE 1991). Potential habitat for San Joaquin wooly-threads also was observed along the northern flanks of NPR-1, but these habitats may be suboptimal because of the dense cover of red brome present (DOE 1991). Based on these data the Service concludes that the Kern mallow and San Joaquin wooly-threads may be present within NPR-1 and may be affected by proposed project activities within the remaining life of the NPR-1 oil field. Suitable habitat for the California jewelflower probably does not exist on NPR-1 (DOE 1991).

Effects of the Proposed Action on Listed Species

Adverse effects of continued MER production on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads, and Hoover's woolly-star may result from numerous sources. During construction activities, individual animals may be directly injured or killed by vehicle strikes resulting from construction related traffic, through inadvertent crushing or entombment in collapsed dens or burrows, or through entrapment in construction related holes or trenches. Also during construction, individual mallow, wooly-threads, or woolly-star populations may be crushed or damaged by vehicle traffic or destroyed by grading, pipeline trenching, and related disturbances. Seedbanks of these plants also may be buried or otherwise destroyed. Other forms of death or injury to federally listed species may result from wildfires inadvertently ignited during welding operations, contact with oil spills, sumps, and inundation of animals during release of hydrostatic pipeline test water.

Individual kit foxes, leopard lizards, kangaroo rats, and plant populations also may be subject to harm and mortality during routine day-to-day operations on NPR-1. Factors contributing to such harm and mortality include routine vehicle traffic, routine grading associated with well drilling and access road construction, oil spills, contamination by commonly used oil field chemicals, habitat degradation (discussed below), and other routine operations.

In addition, individual kit foxes, leopard lizards, and kangaroo rats may be subject to harassment during NPR-1 construction and other activities resulting from increased levels of human disturbance, destruction or excavation of dens and burrows, entrapment in open pipes and construction related trenches, and other factors. Some animals may escape direct injury during such activities but become displaced into adjacent areas. These animals may be vulnerable to increased predation, exposure, and stress through disorientation and loss of shelter.

To date, effects discussed above have been substantially minimized by the Department's endangered species mitigation program. A key component of this program is the practice of conducting preactivity surveys prior to all surface disturbing activities. Preactivity surveys are conducted according to "Operational guidelines for conducting endangered species preactivity surveys on Naval Petroleum Reserve #1, Kern County, California" (Kato and O'Farrell, 1987). Based on available data, the Service concludes that DOE has done a good job of implementing its preactivity survey program (EG&G 1992). In 1980, 74 percent of all NPR-1 projects were conducted without preactivity surveys, while in 1984 and 1985 all projects conducted on NPR-1 were preceded by surveys (Kato 1986). Pre-construction surveys continue to be implemented on NPR-1 on a regular basis (Thom Kato, EG&G, pers. comm.). However, some problems exist in ensuring that recommendations resulting from such surveys actually are implemented. For example, in Fiscal Year 1991 recommendations were not implemented in 22 of 175 projects (12.6%) for which preactivity surveys were conducted, and recommendations were not followed in 3 of 90 surveys (3.3%) in Fiscal Year 1992. The instances noted above where the recommendations were not followed did not result in take of endangered species.

Since the December 1987 Biological Opinion, the number of deaths that occurred as a result of DOE/NPRC activities included 2 kit foxes and 2 blunt-nosed leopard lizards. Twenty-four giant kangaroo rat burrows were disked in 1988 during firebreak maintenance but the actual number of individuals killed was not determined. From a historical perspective, a total of 49 San Joaquin kit foxes, 7 blunt-nosed leopard lizards, and 72 giant kangaroo rats have been reported killed or injured as a result of the factors discussed above since 1980. (EG&G unpublished data). Of these, 11 San Joaquin kit foxes, 2 blunt-nosed leopard lizards, and 6 giant kangaroo rats have been killed or injured as a result of the Departments's endangered species research program. No Tipton kangaroo rats are known to have been killed or injured during MER activities on NPR-1.

Based on radio-collar data, 291 kit foxes were recovered dead on NPR-1 from 1980 to 1988. Of these, cause of death for 29.9 percent was classified as predation (primarily by coyotes), 24.7 percent as probable predation, 10.0 percent as vehicle strikes, and 3.1 percent as other causes (DOE 1991). Cause of death for 32.3 percent of kit foxes recovered could not be determined. Excluding these foxes, 80.7 percent of foxes for which cause of death could be determined were killed by predation, 14.7 percent by vehicle strikes, and 4.6 percent by other causes (DOE 1991). Mortality sources other than predation and vehicles included disease, shooting, drowning, and burying.

Following is a detailed discussion of the effects of past and proposed future MER activities on NPR-1 on the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, federally listed plants, and their habitats (USFWS 1987).

San Joaquin Kit Fox

DOE/NPRC has studied the San Joaquin kit fox population on NPR-1 intensively since 1980 on a 28,480-acre area encompassing the southern half of the Reserve and 2,880 acres in adjacent Buena Vista Valley known as the NPR-1 study area.

The NPR-1 study area contains 16,640 acres defined as "developed" habitat and 11,840 acres defined as "undeveloped" habitat; a square mile containing more than 15 percent of developed land (oil wells, roads, etc.) is defined as developed, and a square mile containing 15 percent or less of developed land is defined as undeveloped (DOE 1991). The areas (developed or undeveloped) are largely contiguous; the range of percent developed in the areas considered was 0.5% to 46.3%; and some sections were divided into half-sections when the developed and undeveloped areas were delineated. Studies conducted by EASI on NPR-1 have included monitoring of kit fox population size, reproductive success, diet, mortality factors, movement patterns, and den characteristics. In part, their purpose has been to determine effects of MER related oil development on the resident kit fox population.

Between 1981 and 1991, EASI has estimated the San Joaquin kit fox population on the NPR-1 study area and on NPR-2 (beginning in 1983) twice annually based on intensive trapping sessions and capture-recapture data (once annually since Fiscal Year 1992). In 1988, trapping sessions were extended to include the entire civil boundaries of NPR-1 in an effort to detect differences in kit fox abundance or distribution between the study area and the Reserve as a whole.

During the period since detailed studies began (1980), the minimum known kit fox population within the NPR-1 study area declined from a high of 165 foxes in the winter of 1981-1982 to 44 foxes in the winter of 1985-1986 (DOE 1991). Similarly, the minimum known population size declined from a high of 167 foxes in the summer of 1982 to 55 foxes in summer 1985 (DOE 1991). The population appeared to stabilize at 40 to 50 kit foxes through approximately 1990, but recent evidence suggests the population has again declined. In winter 1991 the minimum population size was as low as 12 in the NPR-1 study area, but has increased to 40 in 1993 (EG&G unpublished data).

This San Joaquin kit fox population decline on NPR-1 was discussed at length in the Service's 1987 biological opinion and remains a subject of concern. It has been discussed in the biological assessment (DOE 1991), DSEIS (DOE 1992), numerous Elk Hills Endangered Species Advisory Committee meetings, as well as other documents and forums. However, the exact cause of the decline has proven difficult to determine.

Several factors have been considered in attempting to explain this decline, including: (1) the effects of MER development; (2) the endangered species research program; (3) effects of an extended drought in California; and (4) other natural or human-caused factors. In addition, this decline may reflect a general decline in the species due to rangewide habitat degradation.

<u>MER Development</u>. As required under the Service's 1980 biological opinion, the Department attempted to determine the effects of MER development on kit foxes through studies conducted by EASI from 1980 through 1986. Based on these studies, EASI and DOE concluded that the NPR-1 kit fox decline has occurred at similar rates in developed and undeveloped habitats (DOE 1991). This conclusion in turn suggests that MER development has not affected the NPR-1 kit fox population in a significant manner.

However, several factors suggest that these conclusions may not be accurate. First, the kit fox population on NPR-2--where little oil development occurred compared to NPR-1 during the same time period--has declined significantly less than on NPR-1. The NPR-2 kit fox population numbered 177 animals in the summer of 1983 and 113 in the summer of 1989 (EG&G unpublished data). Based on winter data, the NPR-2 kit fox population appears even more stable compared to NPR-1 (119 foxes in the winter of 1983-1984 and 131 in the winter of 1988-1989) (DOE unpublished data). Recent kit fox trapping data presented in the draft FY93 annual progress report shows that kit fox abundance differed between NPR-1 and NPR-2, but that they exhibited similar trends. In addition,

the 1993 minimum population size has increased on NPR-2 to 108 foxes, just as on NPR-1.

Second, circumstantial evidence suggests that the kit fox decline on NPR-1 has been greater in the central upland portions of the Reserve, where most oil development has occurred, than in the flatter lands along its periphery, which are relatively undeveloped. This change in distribution is demonstrated by the fact that few foxes have been captured in the central uplands in recent years, where they were relatively numerous in the early 1980's. By far most kit foxes currently are captured in the flatter undeveloped periphery of the Reserve (Thom Kato, EG&G, pers. comm.). The Department has concluded that kit foxes are presently found on their preferred habitat on NPR-1.

Several factors with respect to MER development can probably be eliminated as causing the kit fox decline on NPR-1. First, it is unlikely that den loss has contributed significantly to the decline. Between 1980 and 1986, only 5 known kit fox dens were destroyed inadvertently as a result of the MER production and another 20 were intentionally excavated to avoid burial of resident foxes (DOE 1991). However, these losses appear to be relatively insignificant since during the same period approximately 946 dens were known to be utilized by kit foxes (Berry et al. 1987).

Contamination of kit foxes by heavy metals commonly associated with oil fields also appears to be minimal. Kit fox hair samples collected from kit foxes on NPR-1 developed lands, NPR-1 undeveloped lands, NPR-2, Camp Roberts, and the Elkhorn Plain were analyzed by Oak Ridge National Laboratory in Oak Ridge, Tennessee (Suter et. al. 1992). Results indicated that kit foxes on NPR-1 exhibited little evidence of contamination by the elements studied, including arsenic, barium, vanadium, chromate, or uranium. Although a few foxes showed high tissue concentrations of some elements, most levels were associated with background soil concentrations or were highest in undeveloped reference sites. Heavy metal concentrations evidently were not great enough to account for the kit fox decline on NPR-1.

<u>The Endangered Species Research Program</u>. The intensive kit fox research and monitoring program conducted on NPR-1 by EASI has occasionally been cited as a possible contributor to the NPR-1 kit fox decline (e.g., O'Neil and Greer 1988). Throughout the life of the program, approximately two thousand kit foxes have been captured and 486 foxes have been radio collared (Thom Kato, EG&G, pers. comm.). All foxes captured, whether collared or not, have been equipped with individually numbered ear tags. Research factors possibly contributing to the kit fox decline include lowering of kit fox survivorship as a result of wearing radio collars, spread of disease through trapping and handling, and loss of kit foxes to research accidents.

At the Service's request, DOE/NPRC considerably expanded their studies of the effects of EASI's radio-collar program on kit foxes in 1992. Utilizing EASI data from 1980 to 1992, DOE/NPRC evaluated effects of radio collars on numerous parameters, including collar to body weight ratio, collar design (heavy or light), survival period, and recapture interval, again comparing radio collared kit foxes to kit foxes with ear tags only. With one exception, no differences in survivorship were observed between radio-collared and ear-tagged foxes. Based on these results, and with reference to the large data set and thoroughness of EASI's study, the Service concludes that EASI's kit fox radio collar program has not significantly contributed to the kit fox decline on NPR-1.

However, DOE/NPRC found that kit fox pups radio collared prior to the month of July tended to survive for shorter periods than pups collared after July (EG&G unpublished data). This result probably has not significantly affected kit fox status on NPR-1 but may have important implications in how kit fox radio collar programs are managed on NPR-1 and elsewhere.

Effects of the Drought. By the early 1990's, endangered species populations throughout the San Joaquin Valley were exhibiting declines likely associated with California's five-year drought that lasted from 1987 to 1992. For example, surveys conducted on NPR-1 in 1991 found that most previously active giant kangaroo rat precincts were no longer occupied (EG&G, unpublished data). Similar giant kangaroo rat declines were observed in the Carrizo Plain (Dan Williams pers. comm.), and leopard lizards reportedly did not reproduce in the Carrizo Plain and elsewhere in 1991 (Dave Germano pers. comm.). Similarly, little kit fox reproduction was observed on NPR-1 in 1991 (EG&G, unpublished data). This harsh five-year drought has often been cited as a primary or contributing factor in the kit fox decline on NPR-1. The principal result of the drought thought to affect kit foxes was reduction in availability of prey species (typically, small mammals and lagomorphs).

Since 1983, EASI has conducted a bi-annual census of lagomorphs on NPR-1 and NPR-2, and, like the kit fox, lagomorphs have declined significantly on both Reserves (DOE 1991). On NPR-1, lagomorphs also were censused during road counts from 1980 to 1983 and declined annually over this period. Similarly, the California Department of Fish and Game (CDFG) has conducted two annual spotlighting routes near NPR-1 (the "Taft" and "McKittrick" routes) in which both kit foxes and lagomorphs have been censused since approximately 1970 (CDFG unpublished data). Results of CDFG data also indicate significantly declining lagomorph numbers along these routes, together with a decline in kit fox numbers that appears to strongly "mimic" the pattern of lagomorph decline. These data suggest that a decline in prey availability caused by the drought may be a primary contributor to the kit fox decline on NPR-1.

However, based on other available data this conclusion cannot be considered certain. For example, the lagomorph and kit fox decline on NPR-1 began prior to 1987, when the five-year drought began; while on NPR-2, where the kit fox decline has been less pronounced, lagomorph densities did not begin to decline until 1987, when the drought began (DOE 1991). Furthermore, in an analysis of EG&G data (kit fox numbers versus lagomorph numbers) on NPR-1 and NPR-2 conducted in 1991, the General Accounting Office (GAO) found that between 1984 and 1989 the estimated number of lagomorphs per kit fox was higher on NPR-1 than on NPR-2 (GAO unpublished data). This suggests that prey availability alone can not account for the perceived differences between kit fox numbers on NPR-1 and NPR-2, and that some other factor or factors may have contributed to apparently differential kit fox declines on the two Reserves.

CDFG data suggest another pattern with respect to fluctuating kit fox numbers. According to the graph of these data (DOE 1991), in 1970 kit fox and lagomorph numbers appear to have been declining from earlier highs in the late 1960's. Their numbers then appear to have remained relatively low from approximately 1972 to 1979, when they began to incline sharply to highs in the early 1980's that were unequaled within the study period. The early 1980's is precisely when EASI began its systematic counts of kit foxes and lagomorphs on NPR-1 and NPR-2.

This suggests that EASI initiated its kit fox census on NPR-1 and NPR-2 when lagomorph numbers were at an unusual high, resulting from natural cyclic fluctuations or to some other factor such as rainfall. This in turn suggests that (1) kit fox numbers were unusually high in 1979 or 1980, when EASI census activities began (likely due to high lagomorph numbers), (2) that this high represented a cyclic fluctuation rather than average kit fox carrying capacity on NPR-1, and (3) that the initiation of intensive MER activities on NPR-1 and the observed kit fox decline on the Reserve was coincidental, not causally related (Harris et al 1987).

Other Natural Factors Other factors possibly contributing to the NPR-1 kit fox decline include coyote predation and disease. Since 1980, coyotes have been responsible for most known kit fox mortalities on NPR-1 (80.7 percent of

all dead foxes for which a cause of death could be determined) (DOE 1991). However, based on other studies this appears to be the normal interaction between kit foxes and the larger, more aggressive coyote (e.g., Linda Spiegel, CEC, pers. comm.); and EASI data indicate that coyote numbers on NPR-1 declined contemporaneously with kit fox numbers. Though coyote predation may have exacerbated kit fox problems originally caused by other factors, no data we reviewed suggest that kit fox-coyote interactions can account for the kit fox decline on NPR-1. The significance of coyote predation in kit fox populations is published in articles such as O'Farrell (1984, 1987), and Standley et al. (1992).

In 1981, 1982, and 1984, the kit fox population on NPR-1 was studied for the presence of disease by analyzing kit fox blood serum for the presence of 10 infectious pathogens (DOE 1991). Despite the occurrence of antibodies for canine parvovirus, tularemia, canine distemper, and canine hepatitus in kit fox blood samples, little clinical evidence of disease has been noted in the NPR-1 kit fox population (DOE 1991). Disease can therefore be largely ruled out in explaining the observed kit fox decline on NPR-1.

Summary The above discussion illustrates that the relationship between kit foxes, oil development, and other environmental factors on NPR-1 is complex. In short, it is difficult to ascribe the San Joaquin kit fox decline on NPR-1 conclusively to any single factor.

Nevertheless, several observations seem important. First, lagomorph and kit fox numbers appear to have declined jointly-(if differentially)-throughout the general area, not just on NPR-1. Second, although the disappearance of kit foxes from the central upland portions of NPR-1 has been pronounced and contemporaneous with intensive oil developments-suggesting a direct relationship-CDFG data suggest that kit fox presence in the central uplands in the early 1980's may have been the result of unusually optimal conditions at that time. If this is true, then kit foxes may not normally occupy this portion of NPR-1 because of natural factors (e.g. relatively steep terrain), and this area may have been the first to be abandoned when environmental conditions deteriorated--possibly, at least in part, because of the drought. On the other hand, oil development in the central uplands may have contributed to the adverse conditions-(already marginal because of natural factors)-that eventually caused kit foxes to abandon the area. In this respect, the Service considers EASI data suggesting that kit fox declines have been equivalent in developed and undeveloped habitats on NPR-1 to be inconclusive.

Third, the fact that kit fox declines on NPR-2 have been less severe than fox declines on NPR-1 may be significant and is difficult to explain. Several differences between the two Reserves that may account for this fact have been cited--(e.g., intensive oil development on NPR-1 and overall gentler topography on NPR-2), but here again results are inconclusive.

Based on existing data, the only factors that probably can be ruled out as causing or significantly contributing to the NPR-1 kit fox decline is coyote predation, disease, oil field chemicals, and the endangered species research program. Conversely, it seems likely that the decline may have resulted from a combination of the other effects discussed-(e.g., the drought, natural cyclic fluctuations, oil field developments, and naturally marginal conditions in the central uplands of the Reserve). Continued monitoring of the kit fox population on NPR-1 in the immediate future, especially in light of the end of the drought in the winter of 1992-1993, will be critically important in better understanding the respective roles of the factors discussed above in the NPR-1 kit fox decline.

Based on the above discussion, the Service concludes as follows with respect to the San Joaquin kit fox: (1) that MER oil production probably is not solely responsible for the kit fox decline on NPR-1 but likely has been a

contributing factor; (2) that intensive oil developments in the NPR-1 central uplands likely has contributed to the disappearance of the kit fox from this portion of the Reserve; (3) that proposed new developments in the central uplands, such as the larger facilities as described in the DSEIS (DOE 1992), SEIS (DOE 1993), will contribute to continuing habitat losses and adverse effects in this area and may inhibit effective future use of this area by kit foxes; and (4) that the latter effect is not likely to jeopardize the continued existence of the species because the central uplands probably represents, on average, marginal kit fox habitat except in optimal conditions, and provided that DOE implement the mitigation commitments described on pages 4 to 7 above.

Giant and Tipton Kangaroo Rats

Specific effects to giant kangaroo rats potentially resulting from continuing MER production on NPR-1 include: (1) Destruction of giant kangaroo rat burrow systems during construction of proposed facilities in Townships G, R, and S and by third-party pipelines; (2) removal of food sources (grasses and seeds) during construction activities; (3) alteration of soil conditions-e.g., soil compaction-making it more difficult for kangaroo rats to construct burrows; (4) accidental oil spills or wastewater discharge; (5) disturbance; and (6) accidental death or injury during EASI's trapping and research activities (DOE 1991). In 1986, for example, 12 kangaroo rats (species not identified) were killed when a DOE lessee discharged wastewater into a natural drainage adjacent to NPR-1. Furthermore, O'Farrell et al. (1987) reported that 73 percent of all giant kangaroo burrow systems on NPR-1 occurred at least 150 feet away from well pads, and numerous well pads may be constructed in known giant kangaroo rat habitats in Sections 6-7G, 14R, 20R, 25R, 28R, 26-27S, and 36S during continuing MER production.

However, construction of the larger facilities currently proposed-(e.g., the fourth gas plant, butane facility, and cogeneration plant)-is not expected to affect known giant kangaroo rat populations, and pre-construction surveys and flexibility in well pad location should minimize impacts to giant kangaroo rats elsewhere (DOE 1991). Furthermore, the majority of these wells would be constructed in the central upland portions of NPR-1 where giant kangaroo rats are relatively uncommon. Third-party pipelines-expected to disturb a total of 101 acres-may directly affect some giant kangaroo rat habitat in the Buena Vista Valley and other peripheral areas on the Reserve.

The Tipton kangaroo rat, which is present only in Section 23S east of the California Aqueduct, should not be affected by any planned DOE activities on NPR-1 because no development is planned in that area.

Blunt-nosed Leopard Lizard

Specific effects of continuing NPR-1 activities on blunt-nosed leopard lizards are expected to be similar to those cited above for giant kangaroo rats. In addition, leopard lizards are vulnerable to entrapment in well cellars, and, because they inhabit washes and are vulnerable to accidental wastewater discharges and oil spills. Both such forms of leopard lizard mortality have been documented either on or adjacent to NPR-1 in the 1980's (DOE 1991). In 1992, an aestivating leopard lizard was inadvertently unearthed during gravel mining on NPR-1 but this lizard was unharmed and was returned to its habitat (EG&G unpublished data). Other forms of potential leopard lizard effects on NPR-1 include vehicle strikes and destruction of small mammal burrows during construction activities and third-party projects such as seismic surveys and pipelines.

However, most construction of relatively large new facilities will occur in the central upland portions of the Reserve where little leopard lizard habitat exists, and pre-construction surveys and flexibility in well location should

minimize leopard lizard effects during DOE and third-party projects elsewhere on the Reserve.

Hoover's Woolly-star and Other Federally Listed Plants

The overall effects of the programmatic on listed, proposed, candidates, or sensitive plants cannot fully be assessed at this time because inventory information is incomplete and not always properly timed. Although some intensive surveys have been conducted, they have not always been floristic. Potential effects of proposed project activities on Hoover's woolly-star include (1) destruction of plants and plant habitats during grading, trenching and other construction activities, (2) crushing of individual plants and plant populations during off-road vehicle use and seismic surveys, (3) inundation of plant populations resulting from oil spills or hydrostatic water releases, (4) destruction of plant populations resulting from man-caused fires, and (5) dust from vehicular traffic that can reduce plant productivity. No known populations of Kern mallow or San Joaquin wooly-threads currently exist on NPR-1. However, similar adverse effects to these species might occur as a result of MER activities should they later be found or become established on NPR-1.

Adverse effects to federally listed plants would be minimized because (1) most proposed new activities would occur in the NPR-1 central uplands where Kern mallow and San Joaquin wooly-threads populations are not likely to exist, (2) NPRC agrees to initiate a separate section 7 consultation for any project that would disturb habitat known to have federally threatened or endangered plants other than Hoover's woolly-star, (3) populations of Hoover's woolly-star would be avoided to the maximum extent practicable, as described on pages 8 and 9 above, and (4) where plant populations are not avoidable, DOE would implement other mitigation measures such as stockpiling of topsoil.

Habitat Disturbance

As of June 1988, an estimated 6,467 acres of native habitat originally existing on NPR-1 have been disturbed either permanently or temporarily as a result of oil development activities since the 1920's (DOE 1993). Of these, an estimated 3,227 acres have been disturbed since the inception of MER production in 1976 (DOE 1993).

The Department estimates that habitat disturbance on NPR-1 resulting from proposed new facilities between 1989 and 2025 will total 878 acres (DOE 1991), which includes 5 acres that were disturbed for a water well project covered by a separate consultation (File No. 1-1-92-F-39). This will result from proposed work on 382 wells (579 acres), gas operations expansion (15 acres), and construction of the cogeneration facility (3 acres), the butane isomerization facility (5 acres), steam generators for the SOZ Steam Flood Project (210 acres), gas compression facilities (10 acres), gas injection facilities (4 acres), and pipeline replacement and maintenance activities (50 acres) (DOE 1993). Of this, 750 acres would be affected by 1998.

Adding past MER disturbances to anticipated future disturbances yields total estimated habitat disturbance on NPR-1 resulting from DOE activities through the life of MER production (1976-2025), or 4,105 acres (3,227 + 878 = 4,105). In addition, non-Federal third party pipeline projects are expected to disturb 691 acres through the year 2025 (DOE 1991). Because the Department has indicated its willingness to consider these as DOE disturbance for the purpose of this consultation (Jim Killen, DOE, pers. comm.), total disturbance resulting from DOE and related activities during MER production is 4,796 acres.

In addition, 547 acres within the NPR-1 civil boundaries have been disturbed in the past by activities not constructed or undertaken by the Department.

These include 133 acres disturbed by the California Aqueduct, 45 acres occupied by the town of Taft, and 369 acres of agricultural lands not owned by DOE (EG&G unpublished data). An estimated 79 acres have been disturbed since 1988 as a result of third party projects on NPR-1 (DOE 1991). However, these disturbances are either the result of non-DOE projects or are addressed and mitigated under separate biological opinions. Finally, third party seismic surveys are expected to result in minor temporary disturbances of 3,390 acres through 2025 (DOE 1991).

Estimated temporary disturbance on NPR-1 resulting from past MER development totals 432 acres, while estimated permanent disturbance totals 2,795 acres. Estimated temporary disturbance resulting from proposed new activities totals 50 acres, and estimated permanent disturbance totals 828 acres. Temporary disturbance throughout the life of MER development (1976-2025) totals 482 acres and permanent disturbance totals 3,623 acres (DOE 1995).

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed action.

Our agency is aware of other projects currently under review by State, county, and local authorities where biological surveys have documented the occurrence of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, and San Joaquin wooly-threads. These projects include urban, mineral, and energy development, and flood control and reservoir construction.

However, we do not anticipate that the project under evaluation in this biological opinion, considered together with other non-Federal actions, would appreciably reduce the likelihood of survival and recovery of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Hoover's woolly-star, Kern mallow, or San Joaquin wooly-threads.

Conclusion

After reviewing the current status of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, San Joaquin wooly-threads and the Hoover's woolly-star; the environmental baseline for the action area; the effects of the action and the cumulative effects; it is the Service's biological opinion that the proposed continuation of the oil development program on NPR-1 at Maximum Efficient Rate, as implemented, is not likely to jeopardize the continued existence of these species. No critical habitat has been designated for these species, therefore, none will be affected. This conclusion is based on (1) continuing implementation by DOE of its mitigation commitments, and (2) the fact that most proposed future MER-related disturbances would occur in the central upland portions of NPR-1 where few populations of threatened and endangered species currently exist.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Endangered Species Act prohibit any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of listed fish and wildlife species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly

disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not a intended as part of the agency action is not considered prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

Sections 7(b)(4) and 7(o)(2) of the Act do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that the Act requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats, and Tipton kangaroo rats may be taken incidentally during continued MER production and proposed construction of new facilities on NPR-1. Project actions that may result in the mortality, harm, or harassment of these species have been previously discussed in this biological opinion. Mitigation measures proposed by the Department will substantially reduce but not eliminate the potential for incidental taking of these species during proposed NPR-1 activities.

Amount of Extent of Take

Based on information provided in the project biological assessment (DOE 1991), information on past incidental takings on NPR-1 provided by EASI, information in our files, and through prior consultations, the Service anticipates that the following numbers of kit foxes, leopard lizards, and kangaroo rats may be subject to harm or mortality during proposed NPR-1 project activities through the year 2025:

1. Ninety (90) San Joaquin kit foxes (3/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

2. Two hundred and ten (210) blunt-nosed leopard lizards (7/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

3. Nine hundred (900) giant kangaroo rats (30/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

4. Thirty (30) Tipton kangaroo rats (1/year for 30 years) in the form of direct mortality or injury through accidental death during project activities.

The number of animals subject to incidental take must not exceed the annual amounts stated above, and the total for 30 years is cumulative only.

The number of San Joaquin kit foxes, blunt-nosed leopard lizards, giant kangaroo rats and Tipton kangaroo rats subject to harassment from noise, vibrations, and capture or excavation of dens and burrows cannot be estimated because the number of individuals of these species within potential project areas is unknown. Therefore, the Service anticipates harassment of all individuals of these federally listed species inhabiting areas where project activities would occur provided that such harassment: (1) Is the result of bona fide project activities; (2) is inadvertent or for the express purpose of removing individual animals from construction areas to safe locations; and 3) that all terms and conditions specified below are fully implemented.

Effect of the Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species discussed.

Reasonable and Prudent Measures

The Service states that the following reasonable and prudent measures are necessary and appropriate to minimize the potential for incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, and Tipton kangaroo rat authorized by this biological opinion.

1. The potential for harm or mortality to federally listed wildlife species and their habitats resulting from project related activities shall be minimized.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized.

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Department must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The terms and conditions specify measures considered necessary by the Service or modify mitigation commitments proposed by the Department. Unless otherwise indicated, all terms and conditions described shall be implemented by the Department at each project site. Where terms and conditions vary from or contradict mitigation commitments as proposed in this or any previous document, specifications in these terms and conditions shall apply.

1. The potential for harm or mortality to federally listed wildlife shall be minimized by implementing the following procedures:

   (a) The Department shall continue to conduct pre-activity surveys prior to all surface disturbing activities on NPR-1. Any change in preactivity surveys would have to be approved by the Service, and may involve reinitiation of consultation.

   (b) Biological monitors (see attachment 1), shall be present, or readily available, on NPR-1 construction sites during all critical construction activities occurring within or adjacent to sensitive endangered species habitat as identified during pre-activity surveys. Examples of activities for which such monitors may be

present include surveys or flagging necessary to determine and delineate specific construction areas, pipeline alignments, and location of access routes and storage areas; grading and trenching activities; checking of pipes, pipeline trench segments, and similar structures for entrapped wildlife; backfilling pipeline trench segments; den and burrow excavations; and other activities as determined by monitoring biologists to be necessary.

(c) The areas disturbed by construction related activities and routine day-to-day operation on NPR-1 shall be minimized to the maximum extent practicable. All NPRC and Contractor vehicles shall be confined to existing roads or to project areas which have received a preactivity survey.

(d) All spills of oil, liquids contaminated by oil, hazardous materials within NPR-1 shall be cleaned up in a manner consistent with the NPR-1 Spill Prevention, Control and Countermeasure Plan.

(e) Speed limits in all construction areas shall not exceed 25 mph.

(f) A litter control program shall be implemented during project activities. This program shall include daily collection of trash, especially that which is food-related, disposal in covered receptacles, and regular removal from project sites.

(g) Construction activities (but not drilling, operations, maintenance, or any other activities) between dusk and dawn shall be minimized.

(h) Personnel performing pre-activity surveys, wildlife handling, kit fox den excavations, and monitoring activities are to be qualified to perform these duties as described by Attachment 1. One supervisory biologist as a training officer who will be given responsibility over all trainees, with full authority to deny or grant trainees the ability to perform permitted activities. This will provide some level of consistency regarding qualifications and employee certification.

2. The potential for inadvertent entrapment of federally listed wildlife species during construction activities shall be minimized by implementing the following procedures:

(a) The Department shall make every reasonable effort to avoid damage or destruction of San Joaquin kit fox dens, giant and Tipton kangaroo rat burrows, and burrows potentially utilized by blunt-nosed leopard lizards during proposed MER activities on NPR-1. Such avoidance measures may include minor re-location of project facilities and minimization of construction impacts to the least possible area.

(b) Known San Joaquin kit fox dens shall not be damaged or destroyed by project related actions unless written or verbal concurrence is obtained from the Service's Sacramento Field Office prior to such effects. If concurrence cannot reasonably be obtained in a timely manner (e.g., on weekends), destruction of known kit fox dens may proceed only if qualified personnel determine that the den cannot reasonably be avoided and if the Service is verbally notified as soon as possible after the fact. Any known kit fox den that must be destroyed shall first be monitored for three consecutive nights by qualified personnel to ensure that it is not occupied by kit foxes, and then shall be excavated by or under the direct supervision of qualified personnel and backfilled to preclude later use by kit foxes. Destruction of all known kit fox dens shall be documented in the annual report.

Potential San Joaquin kit fox dens may be excavated without prior notification to the Service, provided that qualified personnel have determined that the den is not a known kit fox den. Alternately, excavation of potential kit fox dens need not be conducted prior to construction activities, provided that no evidence of kit fox use of such dens is observed after three consecutive nights of monitoring, and that construction operations over such dens occur no more than 24 hours after such dens are last determined to be unoccupied. In the event the Service modifies the procedures for monitoring dens prior to excavation, NPRC shall adopt the revised procedures, so as to be in compliance with this term and condition.

(c) San Joaquin kit foxes, blunt-nosed leopard lizards, and giant and Tipton kangaroo rats may from time to time be captured and relocated from construction sites, provided (i) that burrows of these animals cannot reasonably be avoided during construction activities; (ii) that associated conditions and actions deemed appropriate by the Service are satisfied; (iii) that verbal or written approval from the Sacramento Field Office is obtained prior to any such capture and removal; and (iv) that any person or persons conducting capture and relocation activities possess an appropriate scientific collecting permit issued by the Service or are otherwise qualified to conduct such activities, as determined by the Service in writing.

(d) At the end of each day during all major NPR-1 construction projects, all open pipeline trench segments and other steep-walled holes or trenches greater than two feet deep shall either be covered with plywood or similar materials, or shall be equipped with escape ramps constructed of wooden planks, earth fill, or similar materials and spaced no further than one-quarter mile apart. Projects to which this term and condition applies include the same as those described in term and condition 3(a).

(3) If entrapped wildlife is observed, said wildlife shall only be removed by qualified personnel (see Attachment 1).

3. Compliance with the reasonable and prudent measures, terms and conditions, reporting requirements, and reinitiation requirements contained in this biological opinion shall be ensured by:

(a) Prior to the sale of NPR-1, the Department shall initiate and complete a subsequent section 7 consultation as to this Federal action; and the reasonable and prudent measures and terms and conditions shall be adhered to by the subsequent owner until a section 10(a)(1)(B) permit and a CDFG 2081 permit are issued for their actions. In addition, as part of the subsequent section 7 consultation, the Department shall enter into a Conservation Agreement with the Service if the conservation area has not been established.

(b) Within 90 calendar days following the end of each fiscal year, the Department shall submit to the Service's Sacramento Field Office a brief annual report detailing the following information: (i) A summary of all major construction activities undertaken the previous year; (ii) dates that such construction occurred and the number of habitat acres permanently or temporarily disturbed; (iii) pertinent information concerning the Department's success in meeting project mitigation measures; (iv) an explanation of failure to meet such measures, if any; (v) known project effects on federally listed species, including an estimate of the number of kit fox dens and giant kangaroo rat burrows destroyed, including a general estimate of other small mammal burrows impacted, if any; (vi) known

occurrences of incidental take of listed species, if any; (vii) habitat reclamation efforts undertaken that year, if any; (viii) results of ongoing monitoring of habitats reclaimed in previous year; (ix) an estimate of habitat acres reclaimed to date; and (x) other pertinent information. The term "major construction activity" in this term and condition shall apply to the proposed gas plant, cogeneration plant, butane isomerization facility, all underground pipelines, and any other facility resulting in permanent disturbance of more than 3 acres at a time, or temporary disturbance of more than 5 acres at a time.

(c) If requested, upon completion of any proposed construction project, or at any reasonable time deemed appropriate by the Service, the Department or its contractors shall accompany Service personnel on site inspection tours of construction sites or other locations, as requested, to review project impacts to endangered species and their habitats.

(d) Unless otherwise authorized by the Service in writing, all terms and conditions within this biological opinion shall apply to all third party projects permitted by the Department on NPR-1.

Reviewing Requirement

The reasonable and prudent measures, with implementing terms and conditions, are designed to minimize incidental take that might otherwise result from project activities. If, during proposed project actions, the amount or extent of incidental take of the San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat, or Tipton kangaroo rat is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Department must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Reporting Requirement

The Service is to be notified in writing within three working days of the accidental death or injury of a San Joaquin kit fox, blunt-nosed leopard lizard, giant kangaroo rat or Tipton kangaroo rat or of the finding of any dead or injured kit fox, leopard lizard, or kangaroo rat, during project related actions. 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 for this information is the Assistant Field Supervisor for Endangered Species at (916) 979-2725. To determine disposition of dead or injured San Joaquin kit foxes, blunt-nosed leopard lizards, or giant kangaroo rats, the California Department of Fish and Game, Region 4 Office, Fresno should be contacted (209/222-3761).

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species and the ecosystems upon which they depend. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Therefore, the Service recommends the following additional actions to protect federally listed species and their habitats during proposed continuing MER activities at NPR-1:

(1) The Department should consider placing into conservation status all lands outside of the primary production and conservation areas for the benefit of listed species. These lands could be subject to oil development activities, however, the quality of the habitat should be maintained.

(2) The Department should consider, in the event of the sale of NPR-1, selling only the sub-surface mineral rights. The surface ownership should be retained by the Federal government for the long-term survival and recovery of the listed species that occupy NPR-1.

(3) The Department should direct EASI to continue monitoring of kit fox and lagomorph population trends and rainfall patterns on NPR-1 and NPR-2. This information and information obtained from CDFG survey routes, should be utilized to further clarify the relative importance of factors potentially affecting kit fox distribution and abundance on NPR-1. In accordance with the concluding paragraph below, the Department should reinitiate consultation concerning MER activities on NPR-1 should any such new information suggest that MER production is resulting in effects to San Joaquin kit foxes not considered in this opinion, or that the conclusions in this opinion with respect to effects of MER production on kit foxes is incorrect or inadequate.

(4) The Department should direct EASI to increase monitoring of population trends on NPR-1 of other federally listed species-(i.e., the blunt-nosed leopard lizard, giant kangaroo rat, Tipton kangaroo rat, Kern mallow, Hoover's woolly-star, and San Joaquin wooly-threads). The Department should reinitiate consultation concerning MER activities on NPR-1 should any new information suggest that MER production is resulting in effects on these species not considered in this opinion or that the conclusions in this opinion with respect to effects of MER production on these species is incorrect or inadequate.

(5) The Department should contribute funds to be utilized for research projects on federally listed San Joaquin Valley species conducted either on NPR-1 but by researchers other than EASI, or off NPR-1 in adjacent, nearby, or other San Joaquin Valley locations. The rationale for this recommendation is as follows.

First, NPR-1 is a highly lucrative oil field, generating average net revenues of approximately $750 million per year. Second, NPR-1 occupies a key location in the configuration of remaining San Joaquin Valley habitats in Kern County (near or adjacent to the Lokern Road area, Buena Vista Valley, and others) and DOE activities on NPR-1 have resulted in temporary or permanent disturbance to over 6,000 acres of endangered species habitat within this area--by any measure a significant effect. Third, over 3,500 acres of habitat disturbance on NPR-1 resulted from Federal activities conducted prior to the onset of MER development and no mitigation for the effect has been required under this or previous biological opinions. Fourth, in the Service's view, restricting DOE research funds non-competitively to a single group (EASI) does not result in the greatest benefit to affected endangered species. Finally, as a Federal agency, the Department has significant responsibilities under section 7(a)(1) of the Act to utilize its authorities in carrying out endangered species programs.

Based on these considerations, the Service recommends that DOE contribute a sum of approximately $100,000 per year through the life of the NPR-1 oil field, or until federally listed species affected by DOE activities are delisted, whichever comes first, to a suitable interest-bearing account to be administered by the Service for research and management of such species.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on proposed continuing MER production on NPR-1. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect federally listed species in a manner or to an extent not considered in this opinion; (3) the project is substantially modified in a manner that causes an effect to listed species that was not considered in this opinion; and/or (4) a new species is listed or critical habitat is determined that may be affected by the action.

We appreciate the cooperation of the Department, Chevron, and EASI throughout this consultation process. Please contact Jody Brown or Peter Cross of my staff at (916) 979-2728 if you have questions or information concerning this biological opinion with respect to federally listed wildlife species, and Kirsten Tarp at (916) 979-2120 if you have questions or information with respect to federally listed plants.

Sincerely,

Joel A. Medlin
Field Supervisor

Attachment

cc: ARD-ES, Portland, OR
Ms. Sandra Morey, CDFG Sacramento, CA
Regional Manager, CDFG, Fresno, CA
Mr. Jim Killen, U.S. Department of Energy, Tupman, CA
Mr. Brian Cypher, EASI Energy Advisory Services, Inc., Tupman, CA
Ms. Linda Spiegel, California Energy Commission, Sacramento, CA
Dr. Daniel F. Williams, SJVESRPP, Fresno, CA

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ATTACHMENT 1

DEFINITION OF QUALIFIED PERSONNEL
(FOR KIT FOX DEN EXCAVATION/REMOVAL OF ENTRAPPED WILDLIFE, PREACTIVITY SURVEYS AND MONITORING ACTIVITIES ONLY)

Kit Fox Den Excavation, Removal of Entrapped Wildlife, Preactivity Surveys

Personnel are to have either a 4-year degree in biology, or a related field, from an accredited college or university, plus 30 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person; or 2 years of field, or field related, experience working in an endangered species program on a full time basis, plus 90 days of full time on-the-job training at NPRC performing preactivity surveys with another qualified person. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent to NPRC;

* Life history of protected and candidate species know to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titles "Protecting Endangered Species on NPR-1".

Demonstrating the ability to successfully conduct preactivity surveys is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the supervising biologist.

Monitoring

For the purposes of monitoring activities occurring within or adjacent to endangered species habitat, monitors are considered to qualified upon:

1) Successfully completing an 8 hour training course. Training is to be carried out under the supervision of and be certified by a NPRC supervising biologist. The supervising biologist is to have a 4-year degree in biology, or a related field, from an accredited college or university, plus a combination of advanced education and field experience qualifying that person to work in the NPRC endangered species program both as a biologist and as a supervisor.

Training is to include:

* Identifying protected and candidate species known to occur on or adjacent of NPRC;

* Life history of protected and candidate species known to occur on or adjacent to NPRC;

* Topical Report 110282-2178 "Operational Guidelines for Conducting Preactivity Surveys on Naval Petroleum Reserve No. 1" and its supplements; the current NPR-1 site wide Biological Assessments and Biological Opinions for NPR-1 and NPR-2; FWS's Standard Recommendations for Protection of protected species occurring on or adjacent to NPRC; and sections 9 and 10 of the Endangered Species Act.

* The video titled "Protecting Endangered Species on NPR-1.

2) Completing the following reviews with preactivity survey personnel and the lead person in charge of the project:

* Construction project boundaries;

* Areas demarcated to avoid disturbing endangered species or their habitat;

* Specific measures identified during the preactivity survey to avoid impacts to endangered species;

* Project scope and schedule;

* Designated points of contact and phone numbers.

Demonstrating the ability to successfully conduct monitoring is to be the basis for certification by the supervising biologist. Included in this is the knowledge to know when to ask for assistance from the person who conducted the preactivity survey, or from the supervising biologist.