Appendix B

Commitments for New and Continuing Project Actions from Consultation on Implementation of the CVPIA and Continued Operation and Maintenance of the CVP

Commitments for New and Continuing Project Actions

The biological opinion for the implementation of the CVPIA identified numerous ongoing and new commitments made by the Service and Reclamation. These commitments are applicable to the renewal of the Friant Division and Cross Valley Canal water contracts. It is assumed that these commitments and those described in the Project Description will be fully implemented. The commitments are categorized in eight sections as follows:

- A. Commitments Associated with Implementation of the CVPIA,
- B. Commitments Associated with Long-term Renewal of CVP Water Service Contracts,
- C. Commitments for Activities with CVP Water and/or Facilities,
- D. Commitments Associated with CVP Conveyance and Storage,
- E. Commitments Associated with Operations and Management Planning,
- F. Commitments Associated with Conservation Programs,
- G. Commitments Associated Drainage, and
- H. Commitments Associated with General Consultation Processes.

It is also assumed that Reclamation and the Service will obtain funding sufficient to implement the following commitments, as necessary, to implement this biological opinion.

If these commitments are not implemented, or new information becomes available, consultation would be reinitiated at the programmatic-level to ascertain how the lack of implementation of any actions, or new information, affects the evaluation of effects upon listed species associated with the overall implementation of the suite of actions being considered and the subsequent conclusions made in this biological opinion.

It is critical that these commitments be considered in any future consultations regarding Reclamation and Service actions because they are an essential part of the Environmental Baseline condition. Proper evaluation of the incremental effects of Reclamation and Service actions cannot be undertaken without a proper accounting of these measures and provisions. Subsequent tiered consultations addressing future actions or programs carried out by Reclamation (e.g., contract renewal) shall consider what incremental effect, if any, such action or program causes in addition to the effects included in the existing environmental baseline and not impacts that may result from past actions of operation and maintenance of the CVP.

A. Commitments Associated with Implementation of the CVPIA

The CVPIA includes numerous provisions, which are specifically designed to address past effects of the CVP by restoring species and habitat.

Anadromous Fisheries Restoration Activities. (§3406(b)(1)) *[Lead Agency: Service]*

Reclamation and the Service will continue to implement the Anadromous Fisheries Restoration Program consistent with the plan developed for that program and as defined in the proposed

alternative described in section I. Implementation of the CVPIA.

The CVPIA requires that a program be developed which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991, also known as the Anadromous Fish Restoration Program. This goal does not apply to the San Joaquin River between Friant Dam and Mendota Pool, for which a separate program is authorized under subsection 3406(c) of the CVPIA. The programs and activities authorized by this section shall, when fully implemented, be deemed to meet the mitigation, protection, restoration, and enhancement purposes established by subsection 3406(a) of the CVPIA. In the course of developing and implementing the AFRP, all reasonable efforts shall be made consistent with the requirements of section 3406.

The AFRP will give first priority to measures, which protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to CVP operations, and implementation of the supporting measures mandated by the CVPIA. The AFRP will be reviewed and updated every five years and will describe how the Secretary intends to operate the CVP to meet the fish, wildlife, and habitat restoration goals and requirements set forth in the CVPIA and other project purposes.

Habitat Restoration Program (Section 3406 (b) (1) other). *[Lead Agencies: Reclamation and Service]*

Reclamation and the Service commit to develop and implement the Habitat Restoration Program, as defined in the proposed alternative described in section I. Implementation of the CVPIA. Reclamation and the Service commit to request adequate funds be allocated to the (b)(1) "other" Program to protect and enhance ecosystems of listed species and to support recovery of listed species.

Habitat conservation projects that address this "other" mitigation component will be identified during the CVPIA implementation process. Specifically, this program will be designed during, but not limited to, the following activities: (1) ESA, Section 7 consultation for CVP contract renewals; (2) short- and long-term conservation programs being developed as a result of prior consultations (CVP Conservation Program); (3) the CVPIA-PEIS (environmental analysis under NEPA identified several important areas of wildlife conservation needs of both endangered species and other wildlife and ecosystem resources); and (4) implementation of other CVPIA activities. Representative projects include identification, protection, and restoration of habitat suitable for conservation of native species in areas impacted by the CVP.

The (b)(1) "other" Program has been based on the ranking of habitats and species of concern, the assessment of factors limiting native fish, wildlife, and associated habitats, and geographic areas where those habitats, species, and factors converge to the greatest degree. This will not be to the

exclusion of other concerns or opportunities, but has been Interior's emphasis. Species and habitat prioritizations are being reevaluated throughout implementation of the CVPIA, through regular prioritization meetings between Service, Reclamation staff, and DFG and yearly critical needs analysis. The critical needs analysis will be a collaborative effort between Reclamation and the Service and will include close coordination with DFG.

Habitats or ecosystems known or believed to have experienced the greatest percentage decline in quantity and quality since construction of the CVP, and whose impacts can be attributed, at least partially, to CVP construction and operation, will be a focus for the (b)(1) "other" Program. Populations of native species impacted by the CVP, not specifically addressed in other portions of section 3406 of the CVPIA, will be addressed in the (b)(1) "other" Program.

Management of Dedicated Yield.(§3406(b)(2)) *[Lead Agencies: Reclamation and Service]*

Reclamation and the Service have been and will continue to implement the management of water dedicated under section 3406(b)(2) of the CVPIA as defined in the proposed alternative described in section I. Implementation of the CVPIA, and consistent with Interior's *Decision on Implementation of Section 3406(b)(2) of the Central Valley Project Improvement Act*, released on October 5, 1999.

An annual amount of 800,000 acre-feet of CVP yield will be dedicated and managed by Reclamation and the Service for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by the CVPIA; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help meet such obligations as may be legally imposed upon the CVP under state or federal law following enactment of the CVPIA, including but not limited to additional obligations under the federal Endangered Species Act. Anticipated biological benefits for anadromous fish and other species include better instream temperatures for incubation and juvenile rearing, suitable migration conditions, and direct restoration of instream, riparian, wetland, and estuarine habitat.

The water will be in addition to the quantities needed to implement Level 2 refuge water supply described in section 3406(d)(1) and in addition to all water allocated to the Trinity River pursuant to section 3406(b)(23) for the purposes of fishery restoration, propagation, and maintenance, and will be supplemented by all water that comes under the Secretary's control pursuant to subsections 3406(b)(3), 3408(h)-(i), and through other measures consistent with subparagraph 3406(b)(1)(B). The water will be managed pursuant to conditions specified by the Service after consultation with Reclamation and DWR and in cooperation with DFG.

Operation of the CVP is coordinated between Reclamation and the Service for management of the 800,000 acre-feet of CVP yield made available under the CVPIA, and will remain consistent with the *Decision on Implementation of Section 3406(b)(2) of the Central Valley Project Improvement Act*, released on October 5, 1999. Deliveries of the water may be reduced up to 25 percent

whenever reductions due to hydrological circumstances are imposed upon agricultural deliveries of CVP water. Reductions will not exceed in percentage terms the reductions imposed on agricultural service contractors. Delivery of this water will not require the project to be operated in a way that jeopardizes human health or safety. If the 800,000 acre-feet of water dedicated for fish and wildlife enhancement, or any portion thereof, is not needed for the purposes of this section, such water will be made available for other project purposes.

Supplemental Water Acquisition Program. (§3406(b)(3)) *[Lead Agencies: Reclamation and Service]*

Reclamation and the Service will continue to implement the Supplemental Water Acquisition Program consistent with guidance provided under CVPIA and as defined in the proposed alternative in section I. Implementation of the CVPIA.

The Supplemental Water Acquisition Program is to develop and implement a program (in coordination and in conformance with the plan required under the AFRP that is described in section 3406(b)(1)) for the acquisition of a water supply to supplement the 800,000 acre-feet of water that is dedicated in section 3406(b)(2) for fish and wildlife purposes, and to fulfill the obligations for Level 4 refuge water supply established in section 3406(d)(2).

The water acquired through the Supplemental Water Acquisition Program will: increase restoration benefits for anadromous fish species provided by dedicated water; assist in reaching Level 4 refuge water supply; provide benefits to wetlands, adjacent terrestrial habitats, and estuarine areas; and furnish additional benefit to wildlife and resident and estuarine fish species. The program will identify how Interior intends to utilize the following options to acquire supplemental water: improvements in or modifications of the operations of the project; water banking; conservation; transfers; conjunctive use; and temporary and permanent land fallowing, including purchase, lease, and option of water, water rights, and associated agricultural land.

Other 3406(b) Programs.

Reclamation and the Service will continue to implement the CVPIA consistent with plans developed for associated programs and as defined in the proposed alternative described in section I. Implementation of the CVPIA.

In addition to the principal programs outlined above, CVPIA provides a number of other specific measures to improve the condition of species or habitat. In each case, Reclamation, the Service, and other Interior Agencies are implementing or developing programs to implement these

provisions. A listing of programs that are being implemented to specifically benefit fish and wildlife is provided below. Descriptions of these programs are provided in section I, Implementation of the CVPIA, of this Project Description.

- *Tracy Pumping Plant Mitigation (§3406(b)(4))*
- *Contra Costa Canal Pumping Plant Mitigation(§3406(b)(5))*
- *Shasta Dam Temperature Control Device (§3406(b)(6))*
- *Meet Flow Standards for Anadromous Fish (§3406(b)(7))*
- *Pulse Flows for Anadromous Fish (§3406(b)(8))*
- *Eliminate Flow Fluctuation Losses (§3406(b)(9))*
- *Modify Red Bluff Diversion Dam (§3406(b)(10))*
- *Coleman NFH Restoration and Keswick Fish Trap Modification (§3406(b)(11))*
- *Clear Creek Fishery Restoration* (§3406(b)(12))
- *Gravel Replenishment and Riparian Restoration (§3406(b)(13))*
- *Delta Cross Channel and Georgiana Slough (§3406(b)(14))*
- *Construct Delta Fish Barrier (§3406(b)(15))*
- *Comprehensive Assessment and Monitoring Program (§3406(b)(16))*
- *Anderson-Cottonwood Irrigation District Fish Passage (§3406(b)(17))*
- *Restore Striped Bass Fishery (3406(b)(18))*
- *Shasta and Trinity Reservoir Carryover Storage Studies (§3406(b)(19))*
- *Glenn-Colusa Irrigation District Pumping Plant (§3406(b)(20))*
- *Anadromous Fish Screen Program (§3406(b)(21))*
- *Agricultural Waterfowl Incentives Program (§3406(b)(22))*
- *Trinity River Fishery Flow Evaluation Program* (§3406(b)(23))

B. Commitments Associated with Long-term Renewal of CVP Water Service Contracts

1. Long-term contracts will be renewed, and Reclamation will complete tiered site specific consultations with the Service. No CVP water will be delivered or applied outside current contract service areas until either formal or informal consultation, as appropriate, is complete. Once formal site specific consultation has occurred that is in compliance with this opinion, it is assumed that changes in land-use practices, and impacts to listed and proposed species, in the districts have been addressed.

2. During the contract renewal process, a needs-analysis to determine beneficial use of CVP water will be completed, and all contract renewals will be subject to Section 7 consultation procedures and the NEPA process. A site specific biological assessment, to determine potential impacts of using CVP water on Federal and State listed and proposed species, will be completed for individual water districts or for groups of districts in close proximity to one another. The Service's SFWO Endangered Species Division will provide recommendations to Reclamation on the appropriate level of ESA consultation and *conservation measures* needed.

3. Reclamation also will continue to consult with the Service on a drainage-basin basis or ecosystem-level strategy for addressing new and amended water contracts outside and/or inside the American River watershed, including execution of diversion agreements associated with American River Water Forum.

4. Reclamation and the Service will write a joint letter to the water districts, any member agencies, Planning Departments of cities or counties within the districts using CVP water, and other responsible parties regarding requirements under the ESA. The letter will include: (1) a discussion of Reclamation's need to ensure that CVP water is not used in a manner which could jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated *critical habitat*, and (2) an explanation of the prohibitions described under Section 9 of the ESA in regard to *take*. The letter will discuss the appropriate protection measures as described here and in subsequent contract renewal consultation and will be completed within 60 days of execution of long-term contracts .

5. Conservation strategies will be in place for the districts or areas receiving CVP water. The types of strategies that could be accepted are: *Habitat Conservation Planning* as described in section 10(a) of the ESA; programmatic land management actions that include protection of listed and proposed species; requirements resulting from site specific Section 7 consultation; or an expansion of the existing CVP Conservation Program that adequately compensates for the direct and indirect effects of increased water delivery to an area.

6. Reclamation will, subsequent to a determination of *may affect* to listed species and/or adverse modification to designated *critical habitat* in consultation with the Service's SFWO Endangered Species Division, consult on all Federal actions that result in changes in purpose of use for CVP water contracts, including changes from Agriculture to Agriculture/Municipal and Industrial purposes.

7. The Service and Reclamation will work together to convey information to the water districts, and individual water users (as appropriate), on listed species needs. Reclamation will establish an outreach and education program, in collaboration with the Service, to help water users integrate implementation of the CVPIA and requirements of the contract renewal process as it relates to the ESA.

8. Interior will work closely with the water users, providing them maps of listed species habitats within their service-areas and guiding them through the consultation process to address site

specific effects. Reclamation may encourage CVP contractors to complete HCPs encompassing the affected areas.

9. Reclamation and/or the Service will develop provisions for compensation for the loss of endangered species habitat resulting from the direct or indirect effects of a Reclamation action not covered under prior biological opinions that occur within the CVP service areas from the date of

this opinion until completion of either: (a) contract area specific Section 7 consultation, (b) any other required site specific Section 7 consultation on the effects of the conversion in question, or (c) the completion of an HCP that encompasses the area in question.

10. Reclamation and CVP contractors will comply with all applicable opinions related to the CVP (listed on pages 1-11 to 1-12). Flow standards that form the environmental baseline of the 1995 OCAP biological opinion will be met, and Reclamation will take no discretionary actions (e.g. new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until any required consultation is reinitiated and completed. (Appendix L, letter to the Service and NMFS from Reclamation, dated October 29, 1999.)

11. Contractors are required to conform with any applicable provisions of any biological opinions addressing contract renewal so as to prohibit the use of CVP water that results in unauthorized *take* or conversion of wildland habitat determined to have the potential to be occupied by listed species, or violation of any terms of the contracts pertaining to the conservation of listed species. All contracts (or related biological opinions) will also stipulate Reclamation will not undertake any discretionary action allowing the delivery of CVP water to native habitat for listed species depicted on the maps attached to the 18-month notices unless clearance pursuant to the ESA has been obtained from the Service.

12. Reclamation, relative to all new and renewed contracts will informally consult with the Service's SFWO Endangered Species Division to determine the need for formal consultation prior to contract execution.

13. Reclamation will make certain that applicable measures to ensure ESA compliance for the renewal of CVP water service contracts are provided within the text of new and/or amended long-term water contracts and related actions.

14. Reclamation will provide information related to proposed new water assignments of Project water to the Service's SFWO Endangered Species Division prior to execution of the assignment.

C. Commitments for Activities Associated with CVP Water and/or Facilities

San Joaquin River Exchange Contractors. *[Lead Agency: Reclamation]*

Interior will work with the Exchange Contractors to develop *conservation measures*, as appropriate, for listed species. Interior will communicate and coordinate with the Exchange Contractors in determining how to address any effects to listed species, as necessary, through Section 7 or Section 10.

Sacramento River Diverters. [*Lead Agency: Reclamation*]

Interior will work with the Sacramento River Water Rights Settlement Contractors to develop *conservation measures*, as appropriate, for listed species. Interior will communicate and coordinate with the Sacramento River Water Rights Settlement Contractors in determining how to address any effects to listed species, as necessary, through Section 7 or Section 10.

Surplus Flood Flows Water Contract [*Lead Agency: Reclamation*]

Approval of each Surplus Flood Flows water contract will be conditioned with the following understanding: the Water Service Contractors will be notified that some types of activities require formal consultation with the Service. The intent is that irrigation activities not *affect* the presence of threatened or endangered species and that previously untilled land must not be tilled and put into agricultural production using this water. This water will not be applied to grassland or shrub land which has never been plowed or irrigated. If the land has been fallow for five consecutive years or more, it must be inspected for endangered species prior to contract approval.

Reclamation will continue to assure that no Surplus Flood Flows will be authorized if it has a significant adverse impact on the ability to meet fish and wildlife obligations under the CVPIA. The availability of Surplus Flood Flows will be based on consideration of many operational requirements including inflow to reservoirs, downstream capacity, and maintaining flows at Vernalis. At this time, none of the State, Federal, or private wildlife refuges located near Los Banos hold any permits to divert water from the river. Supplemental water for these areas will be provided by Reclamation through the Delta-Mendota Canal. The execution of Surplus Flood Flows contracts for San Joaquin River water will not interfere with Reclamation's obligations to deliver water to these refuges. If new construction or modification of existing Project facilities is needed to receive Surplus Flood Flow deliveries, that construction or modification project will receive separate environmental review.

Inclusions and Exclusions [*Lead Agency: Reclamation*]

Reclamation will provide the Service with documentation of its procedures for processing exclusions and conducting site investigations.

Reclamation will coordinate with the Service via the process described on page 2-40 on (a) any requested inclusions or exclusions from contract service areas, and (b) any water contracts or water deliveries involving Reclamation facilities within the Final PEIS study area for service areas that are not addressed in any existing biological opinion. This coordination will address all endangered species that may be affected by these actions.

Other CVP Water-related Commitments [*Lead Agency: Reclamation*]

For Warren Act, water wheeling, and water transfers, Reclamation and the Service will establish a tracking program that assures compliance with the ESA.

Reclamation will continue to assure that no Warren Act type services will be provided if these services would have a significant adverse impact on the ability of Reclamation or the Service to meet fish and wildlife obligations under the CVPIA.

The effects of additional transfers (i.e., exceeding a cumulative 250,000 acre-feet annually) on delta smelt, as well as the indirect effects of all transfers on terrestrial species, have not yet been addressed and will undergo consultation as may be required when such transfers are proposed. Because of the high number of transfers that occur annually, the Service and Reclamation are collaborating on streamlining the consultation process to allow for expedited consultation on water transfers.

Conjunctive Use Project Coordination [*Lead Agency: Reclamation*]

Use of CVP water supplies to recharge aquifers can enhance stream flows and wetlands by minimizing seepage into groundwater systems. Within the affected groundwater basin, CVP water deliveries can also allow increased agricultural or urban development using groundwater (either within or outside designated service areas) by directly recharging the aquifer or indirectly freeing groundwater supplies for other users. Future conjunctive use projects involving Reclamation will be coordinated with the Service's SFWO Endangered Species Division to address effects to listed species.

D. Commitments Associated with CVP Conveyance and Storage

1. Reclamation has committed to reinitiate consultation on CVP-OCAP so that CVP operations can be re-evaluated in the context of current conditions.

2. Reclamation and the Service will coordinate, for ecosystem-level planning purposes relative to water deliveries to CVP contractors. Reclamation will provide information to the Service on annual deliveries each year, prior to or concurrent with informing the water districts of their allocation amounts. However, it is understood biological opinions for OCAP (1-1-94-F-70) and Los Vaqueros (1-1-95-F-117 and 1-1-95-F-134) are in place, and at no time can the total amount of these CVP deliveries exceed the total consolidated amount considered in these opinions. Further, individual tier water contract renewal processes will further address issues related to specific contract quantities as a part of their consultations under Section 7 the ESA.

3. If Reclamation determines effects, including interrelated or interdependent effects, resulting from these CVP deliveries *may affect* federally listed species and/or their designated *critical*

habitat, Reclamation will request consultation under Section 7 of the ESA. If, after review of annual delivery information provided by Reclamation (#2 above), the Service believes effects related to these CVP deliveries *may affect* federally listed species and/or their designated *critical habitat*s, the Service will request Reclamation to consult under Section 7 of the ESA.

4. The effects of additional transfers (i.e., exceeding a cumulative 250,000 acre-feet annually) on delta smelt, as well as the indirect effects of all such transfers on terrestrial species, have not yet been addressed will undergo formal consultation. Because of the high number of transfers that occur annually, the Service and Reclamation are collaborating on streamlining the consultation process to allow for expedited consultation on water transfers.

E. Commitments Associated with Operations and Maintenance Planning

1. Reclamation will coordinate closely with the Service during development and implementation of all O&M Plans and Resource Management Plans.

2. A plan to prevent *take* associated with operations and maintenance (O&M) of Reclamation facilities, and to help reduce *take* associated with pest control activities by farmers receiving Federal water will be developed and implemented. Reclamation will implement O&M plans for *take* avoidance as described in Appendix F of this biological opinion throughout the CVP. Reclamation will continue to work with California Department of Pesticide Regulation to assure that pesticides are not used in or adjacent to the habitat of listed species, prior to completion of Section 7 consultation or an HCP. The Service will consult with EPA to ensure that label restrictions for pesticides address needs of listed species and are used accordingly.

3. Reclamation Area Offices are developing, or have developed, O&M Plans for use by managers and those in the field doing O&M work, for avoidance and minimization of impacts to listed species. In addition to the Plans, O&M manuals are used to provide staff-level guidance on implementation of O&M Plans. These manuals are used to address listed and proposed species found within each office's jurisdiction, and include *take* avoidance measures for listed species. The South-Central California Area Office O&M Plan and manual are completed. The Central California Area Office and Northern California Area Office are currently developing manuals based on *take* avoidance measures in Appendix F. Each area office will combine the existing O&M manual with *take* avoidance information in Appendix F, in order to develop site specific documents for each area office, increase the number of species covered, and improve coverage for facilities in the Sacramento Valley. *Take* avoidance guidance will be updated as new information on the species becomes available and as new species are listed.

4. Reclamation will identify and seek to eliminate invasive species of plants and animals on Reclamation lands that have the potential to severely *adversely affect* native habitat. In addition, Reclamation, in cooperation with the water districts, will be responsible for the development and implementation of Integrated Pest Management Plans to reduce the use of pesticides on Reclamation lands and to further reduce the possibility of *adverse impact* to threatened,

endangered, and species of concern. Management direction for invasive species and Integrated Pest management will be included in the O&M Plans.

5. The O&M Plans and associated Manuals will also contain guidance to reduce impacts from earth moving, minor construction, erosion control, pest control, weed abatement, etc. on wetlands and sensitive, threatened, and endangered species.

Examples of additional information these O&M Plans and Manuals could contain is as follows:

- descriptions of various mitigation and *conservation measures* that would be implemented to reduce anticipated project related impacts related to O&M to a less-than-significant level and eliminate effects to sensitive, threatened and endangered species and wetlands.
- commitments to monitor construction sites to assess mitigation success according to defined success criteria and the provision of yearly reports to the Service, California Department of Fish and Game (DFG), and the Corps.
- establishment of and agreement to, success criteria for all mitigation and *conservation measures* to be implemented. If the success criteria are being met after three years of monitoring, no additional monitoring would be necessary. If the success criteria are not met, Reclamation would consult with the Service to determine any further monitoring needs.

6. As *take* avoidance measures are developed by the Service and DFG, they will be distributed and implemented on Reclamation lands as well as made available to private landowners receiving Reclamation water. This information will also be provided to the Department of Pesticide Regulation, where it may be shared, at their discretion, with certified applicators and licensed users.

F. Commitments Associated with Conservation Programs

Reclamation and the Service have, and will continue to implement a number of *conservation measures* designed to improve the conditions of threatened and endangered species or designated *critical habitat.* These *conservation measures* have been or will be undertaken pursuant to Reclamation and the Service's discretionary authorities, including, but not limited to, the authority provided by Section 7(a)(1) of ESA. The Service and Reclamation will work together to ensure that existing wildlife conservation programs are funded adequately and support the purpose of the ESA.

Wetland Development Program. *[Lead Agency: Reclamation]*

Reclamation commits to continued implementation of the Wetland Development Program as funding and authorizations allow, and will continue to seek funding for this program annually.

The Regional Wetlands Development Program (Program) is funded to conduct wetland, riparian, and associated upland habitat protection, enhancement, and restoration activities on Reclamation

lands, and on lands that affect or are affected by Reclamation's operations or activities. In addition, the Program allows Reclamation's participation in planning, monitoring, surveys, and public education programs focused on environmental awareness toward issues that are associated with Reclamation's interests.

Actions taken through this Program generally involve a partnership of Federal, or State agencies, and/or non-profit environmental interest groups whereby, through grants or cooperative agreements, funds are transferred to the partner to provide desired services on a cost-shared basis.

Actions that have been accomplished under this program are varied. Numerous brood ponds have been established on 12 properties in the Sacramento Valley for waterfowl production, in partnership with DFG , the California Waterfowl Association, and others. These ponds were developed in marginal rice production areas, and will provide giant garter snake habitat. The Program has provided funds to Colusa National Wildlife Refuge to restore giant garter snake and waterfowl habitat, and has provided funds to the American River Conservancy to assist in purchase and management of habitat for the California red-legged frog. Additionally, considerable funds have been provided to many non-governmental agencies to promote educational and outreach activities (*e.g.*, San Joaquin Audubon Society, American River Natural History Association, California Native Plant Society, Ducks Unlimited, California Waterfowl.

CVP Conservation Program *[Lead Agency: Reclamation]*

Reclamation commits to continued implementation of the CVP Conservation Program as funding and authorizations allow. Reclamation and the Service will seek increased annual base funding of the CVP Conservation Program.

Reclamation and the Service developed the CVP Conservation Program as one of the means to make operation of the CVP compatible with objectives of the ESA. During the consultation on Friant Division water contract renewals, Reclamation and the Service agreed to work together to enhance the condition of listed and sensitive species. The Friant Biological Opinion included conservation recommendations that specified that Reclamation and the Service identify critical needs of the species found in that part of the San Joaquin Valley. With time it became clear that the list of conservation actions to be done changed each year with new information. At the time of the Interim Water Contract Renewal consultation, Reclamation and the Service agreed to reexamine annually the list of actions to be done and identify which ones had the highest priority. This would ensure that important actions were undertaken and that money would be used effectively to solve problems. The CVP Conservation Program Framework Document was written to confirm the strategy. All of the species in the area affected by CVP were included because spending decisions would be done most cost-effectively during the prioritization process. Participation by both agencies would ensure that the interests of Reclamation and the Service would be considered in all decision-making.

Under the Framework Document, the CVP Conservation Program is a joint Reclamation/ Service

Program developed and implemented by both agencies and DFG with Reclamation funding. The primary goal of the CVP Conservation Program is to meet the needs, including habitat needs, of threatened and endangered and special-status species in the areas affected by the CVP. The special-status species whose needs will be addressed by the CVP Conservation Program include primarily federally listed species. In addition, species that are candidates or are proposed species for Federal listing, as well as other species of concern, will benefit from the Program if they have high-priority biological needs. The Conservation Program would be applicable to actions that would benefit even a single, specific species, if a declining trend were likely to occur due to any significant degree from the effects of ongoing actions of CVP, including those species that only began declining since 1992.

The Conservation Program, along with other initiatives (e.g., (b)(1) "other" Program, Land Retirement Program, Refuge Water Supply, and the Wetland Development Program), are intended to ensure that the existing operation of the CVP and implementation of the CVPIA occur in a manner compatible with the continued existence and recovery of listed or proposed species, or designated or proposed *critical habitat.*

The implementation process for the CVP Conservation Program is guided by the following principles:

- Implementing actions will respond directly to biological needs;
- Highest priority needs will generally be addressed first; and
- Priorities and needs, and thus the implementation plan, will change over time.

The CVP Conservation Program will identify actions for implementation mainly by synthesizing existing information about needs and specific actions rather than by duplicating other efforts. A prime example of existing information is an approved recovery plan. Recovery plans contain implementation schedules of actions needed to conserve the species and background material to aid preparation of scopes of work. However, for species that do not yet have a recovery plan,

where there are some scientific data gaps or where existing information is not available, the CVP Conservation Program may develop new information.

Comprehensive Mapping *[Lead Agency: Reclamation]*

Reclamation and the Service commit to developing a Comprehensive Mapping Program, consistent with existing biological opinions including the Friant and Interim CVP contract renewals, to identify remaining natural habitats within CVP service areas and identify any changes within those habitats that have occurred between 1993 and 1999. Reclamation will seek funding for this program.

Within 18 months of this biological opinion, the three phases described below will be completed. Once the habitat is located and quantified, CVP Contractors and State and local agencies with

jurisdiction over land use planning decisions will be notified of the comprehensive three phase mapping strategy. Mapping will be used to quantify listed species habitat within the service area of the water districts.

Phase I - A 1993 landcover database or basemap will be developed using the best available existing landcover data and satellite imagery. Classification of land or habitat types represented in the CDF&G/Ducks Unlimited database will be used for wetland types, and WHR (Wildlife Habitat Relationships) classification types will be used for upland types. Classification types will be correlated with the National Biological Diversity Database for determining species habitats. As part of Phase I, a demonstration area will be chosen to develop and test methods, procedures, and products.

Phase II - will determine areas of habitat change by comparing 1993 image data to year 2000 image data. Based on available GIS datasets and spectral change analysis, a preliminary change map will be created to guide sampling and remapping efforts in phase III.

Phase III - will create an updated landcover database representative of landcover and habitat conditions for year 2000. This process may include:

- Field sampling to determine the cause of change and identification of habitat types in change areas.
- Acquisition of large scale, orthorectified digital aerial photography for verification and remapping purposes.
- Additional mapping efforts in areas where existing datasets from 1993 are not adequate to meet the needs of this project.
- GIS analysis for habitat change monitoring

Land Use Monitoring and Reporting Program *[Lead Agency: Reclamation]*

Reclamation commits to the development and implementation of a Land Use Monitoring and Reporting Program, as funding and authorizations allow. Reclamation will seek base funding for this program.

The Service and Reclamation will collaborate on expediting the generation of baseline conditions for this opinion. Reclamation will work with the Service to provide maps produced as a result of the Land Use Monitoring and Reporting Program as soon as technically possible, to CVP water districts and county planning departments including updates of any new data from the Service.

The Comprehensive Mapping Program will be implemented immediately to test and track, for the purpose of validating over the life of the project, the assumptions made in this biological opinion that the baselines of the species in Appendix B are stable or increasing.

Monitoring will be used to assess the condition and impacts of Reclamation actions on listed species. Reclamation and the Service are actively developing a monitoring strategy based on the comprehensive mapping program. The land cover database for year 2000, described in Phase III, will be revisited every 5 years for monitoring purposes.

One use of this program is that changes and trend in potential listed species habitat will be reviewed by the Conservation Program Technical Team and will be used to determine the effectiveness of the Conservation Program and other local planning efforts in protecting and recovering listed species. This will help focus conservation efforts on acquisition needs with the highest priority. In addition, the team will identify other priority needs that are not habitat related. As needs for information gathering or additional interagency coordination needs are identified, the Service and Reclamation will put programs in place or bolster existing programs to meet those needs.

Reclamation and the Service will use the best scientific and commercial information available, in conjunction with data from aerial photograph analysis to monitor trends in the environmental baseline for listed species. It is the ultimate goal of Interior to assure that listed species are being recovered. For any species affected by the CVP that are continuing to decline, the Service and Reclamation will immediately assess critical needs for the species and determine whether it is appropriate to expand the Conservation Program or implement other *conservation measures*. Any native habitat converted to agricultural or municipal/industrial use within the water service area without prior biological surveys, as required by Reclamation prior to the delivery of Reclamation water, will be evaluated to determine what mitigation measures will be required.

Contingency Plans for Land Conversions. *[Lead Agency: Reclamation]*

Reclamation and the Service commit to working together to develop contingency plans for land conversions, and Reclamation will seek funding to implement these plans as appropriate.

Reclamation will establish and/or adopt a contingency plan to address conversions of potential habitat that have occurred in the absence of any required Section 7 consultation regarding any given Reclamation action. Reclamation will also work with the Service to develop/implement measures to help address such adverse land use changes that occur in CVP service areas but were not, or are not, subject to Section 7 consultation. The contingency plan(s) will address the means and funding to be used in acquiring, restoring, or otherwise protecting lands to compensate for the loss of listed species habitat. Reclamation recognizes that historic conversion of land in many cases cannot be directly linked to specific Reclamation actions. The purpose of these contingency plans is to address such conversions to the extent Reclamation can do so in a manner consistent with its statutory authorities. The plan will address compensation from the perspective of both

long term and temporary effects and will be developed, or substantially agreed upon, prior to contract renewal. In the event these plans cannot be completed prior to contract renewal, their effective date will nevertheless be the date of contract renewal.

Interagency Coordination for Ecosystem Protection *[Lead Agencies: Reclamation and Service]*

Interagency coordination for ecosystem protection is expected to benefit listed species. Reclamation and the Service will continue to collaborate and consult informally on this action.

Reclamation and the Service will establish a coordination team to ensure that the programs described in this biological opinion further the purposes of the ESA and are consistent with this biological opinion. The coordination team will meet at least quarterly. This team will develop and implement an integrated planning process to coordinate CVP actions and other State and Federal actions under State and Federal laws to further the purposes of the ESA. Recovery of listed species, biological diversity, and ecosystem functions will be considered in Reclamation's planning processes. The team will evaluate *adverse effects* of CVP actions on listed species, species of concern, and their associated habitats, and identify *conservation measures* to protect species populations and habitats, and help avoid the necessity of listing additional species under the ESA.

G. Commitments Associated with Drainage

1.(a) Discharges into surface water bodies and waterways resulting from implementation of the CVPIA and continued operations of the CVP, under the control of Reclamation and/or the interrelated and interdependent effects of Reclamations actions, including deliveries to CVP water contractors, will comply with standards set in the Description of the Proposed Action for the biological opinion on the Environmental Protection Agency's Promulgation of Numeric Criteria for Priority Toxic Pollutants for the State of California; California Toxics Rule (CTR) (Service File No. 1-1-98-F-21), in accordance with applicable implementation plans.

1.(b) The Service will work with EPA to ensure implementation of protective criteria for listed species.

2[8]. All components of the San Joaquin Valley Drainage Program's Final Report that pertain to the CVP's contract service area will be implemented in a manner that does not preclude recovery of listed and proposed species. Specifically, selenium discharges into the San Joaquin River will not *preclude recovery* of listed and proposed species or adversely modify designated *critical habitat* that are using impacted waterways, e.g. the San Joaquin River and its tributaries and the Sacramento San Joaquin Delta. Interior will conduct monitoring to determine whether existing discharges are impacting recovery of listed species such as the Sacramento splittail, delta smelt, and giant garter snake, as identified below.

3[1]. Reclamation, in consultation with the Service and consistent with the Interim Contract Renewal biological opinion (1-1-F-00-0056), will implement a study to identify the sources of selenium contamination in the Grasslands, San Joaquin River, and south Delta estuary. The study will identify and quantify all known sources of selenium that contribute to contamination of water supplies to the Federal, State, and private wetlands of the Grasslands area, the San Joaquin River, and southern Sacramento-San Joaquin Delta. The study will include an analysis identifying and quantifying loads from known sources such as the Delta-Mendota canal pumping project, the Mendota pool group groundwater pumping project, and discharges into the San Luis Drain from Panoche Creek flood flows. Further, the study should provide information regarding ongoing efforts to reduce selenium in the Grasslands Area, other studies being conducted related to this venture, and any applicable reports from other investigations that have been completed (e.g, California Central Valley Regional Water Quality Control Board investigations).

4[8]. Reclamation, consistent with the Interim Contract Renewal biological opinion (1-1-F-00-0056), will implement a Service approved monitoring program to assess the effects of selenium loading within the San Joaquin River on aquatic listed species or their surrogates (including but not necessarily limited to, Sacramento splittail, Delta smelt, and giant garter snake) using the lower San Joaquin River and southern Sacramento-San Joaquin Delta. Such a program should determine tissue concentration for these species (or appropriate surrogates) collected from these areas. Initial data from this program will be made available to the Service to be used in the effects analyses of long term contract renewal on aquatic listed species and used to minimize *take*.

5. Additionally, other drainage options not considered under or consistent with the San Joaquin Valley Drainage Program will comply with the ESA.

H. Commitments Associated with General Consultation Processes

1. Reclamation and the Service commit to continued identification and resolution of issues associated with project actions in a timely manner.

2. As part of this CVP comprehensive Section 7 process, Reclamation and the Service commit to developing and implementing an agreement which includes protocols that will specifically address the integration of continuing project actions with actions meeting the needs of listed species, consistent with the requirements of the ESA.

3. Reclamation will implement the planning and communication measures, including the letter to

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[1] Reclamation and the Service are working jointly to implement this effort. Together, Reclamation and the Service are seeking appropriate funding and are refocusing and intensifying existing efforts, helping to identify any additional data needs not being addressed through existing drainage and drainage monitoring programs, and are helping to secure funding for additional needs that cannot be accomplished within the existing programs.

water users associated with contract renewals and new and amended contracts, described in the Project Description of this opinion.

4. Reclamation and the Service will continue to comply with the Coordinated Operating Agreement, the Bay-Delta Plan Accord, applicable biological opinions, and other agreements and with limitations on export and transfers in the biological opinions on OCAP.

5. Reclamation and CVP contractors will comply with all opinions related to the CVP (listed on pages 1-11 and 1-12).

6. Any site specific effects to listed species will be consulted upon following site specific analysis and prior to the effect, and the Service and Reclamation are adequately funded and staffed to complete tiered site specific consultations from this opinion and track implementation of conservation actions.

7. Implementation of, and conformance with, recovery plans will be an integral part of all site specific consultations.

8. Regarding future tiered actions, Reclamation and/or the Service will provide to the Service's SFWO Endangered Species Division the best scientific and commercial data available when initiating Section 7 consultations (fulfilling the information requirements specified in 50 CFR 402.14(c)) in order to facilitate and expedite the Service consultation process.

9. Prior to implementation of any new actions undertaken pursuant to the CVP or CVPIA (i.e., signing a FONSI or ROD), Reclamation and/or the Service, in coordination with the Service's SFWO Endangered Species Division, will assess the potential impact upon listed species that may be affected by these actions or any potential modification of designated *critical habitat.*

10. Reclamation and the Service will establish a process to facilitate the completion of consultations and to develop a more streamlined and efficient process to ensure compliance with both the regulatory aspects of the ESA and implementation of conservation and recovery activities. Reclamation and the Service will establish a coordination team to ensure that the programs described in this biological opinion further the purposes of the ESA and are consistent with this biological opinion. The coordination team will meet at least quarterly. This team will develop and implement an integrated planning process to coordinate CVP actions and other State and Federal actions under State and Federal laws to further the purposes of the ESA. Recovery of listed species, biological diversity, and ecosystem functions will be considered in Reclamation's planning processes. The team will evaluate *adverse effects* of CVP actions on listed species, species of concern, and their associated habitats, and identify *conservation measures* to protect species populations and habitats and help avoid the necessity of listing additional species under the ESA. To facilitate implementation and operation of this team the Service will designate a point of contact that will act as a nexus for all Reclamation ESA related coordination activities. This person will ensure the efficient dissemination of ESA related materials and will provide input to

Reclamation on status of ongoing consultations. Reclamation will designate a point of contact in each of its CVP Area Offices that can act to facilitate information transfer on ESA related activities. The purpose of this action is to facilitate information transfer, to ensure that the Service is aware of ongoing Reclamation actions, and that the Service has a method of expeditiously providing any comments and concerns.

11. In order to consistently address future consultation needs for the programs described here, the Service will provide the technical support to expedite tiered consultations and implementation of *conservation measures*. Reclamation and the Service will develop and implement a collaborative and integrated process to coordinate CVP actions and other State and Federal actions under State and Federal laws, to aid in recovery of listed species. Reclamation and the Service will establish a coordination team within 90 days of the date of this opinion, to design and implement this process and to ensure that the programs described in this biological opinion are consistent with this biological opinion and the ESA. The coordination team will meet at least quarterly. Coordination team guidance may result in future, tiered programmatic consultation or collaboration in local area planning[2].

12. Reclamation and the Service are committed to continued progress on issues such as, but not limited to: incentive programs, joint efforts with DWR on common issues and striving toward common policy; collaborating with the California Department of Pesticide Regulation to share information pertinent to the protection, enhancement, or recovery of threatened and endangered species; implementation of CALFED; and pursuing common goals with other agencies, including local jurisdictions, water districts, Resources Conservation Districts, and Local Agency Formation Commissions.

13. The Service will continue to provide Reclamation with the most current *take* avoidance measures and *conservation measures,* in addition to any necessary *reasonable and prudent measures*. Reclamation and the Service will coordinate with all water districts and county planning offices, the California Department of Pesticide Regulations, and DWR to ensure consistency with Sections 2, 4, and 7 of the ESA. Reclamation and/or the Service will distribute the *take* avoidance measures and *conservation measures* in Appendices F and G to all water districts and county planning offices, the California Department of Pesticide Regulation, and DWR by March 1, 2001, and will continue to provide updates to these parties.

14. To implement long range planning and to assure efficient and effective implementation of CVPIA and ESA, Reclamation and the Service will continue coordination with the National Marine Fisheries Service (NMFS), California Department of Fish and Game (DFG), and California Department of Water Resources (DWR) on: (1) conservation actions needed to minimize the impact of the CVP on listed species and (2) developing a comprehensive evaluation process for actions that require further formal or informal consultation tiered from this opinion.

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[2] This coordination team is separate and distinct from the Conservation Program Technical team described on page 2-64, although some team members may be on both teams.

15. Reclamation is in the process of consulting with the Service regarding various operational and contractual changes within the American River basin. These changes will include new contracts, amended contracts, Warren Act contracts, land use easements, Folsom Dam long term reoperation for flood control, American River Water Forum actions, Placer County Water Agency pumps, and long term contract renewals. Reclamation also will continue to consult with the Service on a drainage basin basis or ecosystem level strategy for addressing new and amended water contracts outside of the American River watershed, including execution of diversion agreements associated with American River Water Forum.

16. In addition to commitments and conservation measures in this opinion, and within other consultations, Reclamation will develop, as appropriate, guidelines and policies that address: (1) conversion of listed species habitat prior to any required Section 7 consultation on Reclamation actions or assistance with implementation of an HCP, (2) indirect effects of groundwater recharge on listed species habitats inside and outside of water districts resulting from Reclamation actions, and (3) applications of CVP water outside of the place of use or for purposes other than the State approved purpose of use.

I. Service and Reclamation Strategy Statement to Ensure Compliance With the Endangered Species Act

The purpose of this section is to describe the specific commitments and strategy the Service and Reclamation agree to undertake in order to ensure all aspects of the CVP and the CVPIA, for which either agency has discretionary authority, are in compliance with the ESA. These are listed as follows:

1. Reclamation is committed to fully complying with the Endangered Species Act (ESA) with regard to the operation and maintenance of the CVP;

2. The Service and Reclamation are committed to fully complying with the ESA while implementing the CVPIA;

3. Consistent with their respective authorities and obligations concerning the effective and efficient operation of the CVP and implementation of CVPIA, the Service and Reclamation will utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species as provided in Section 7(a)(1) of ESA;

4. The Service and Reclamation will insure that their actions are not likely to cause jeopardy to the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat designated as *critical* to such species as provided in Section 7(a)(2) of ESA;

5. The Service and Reclamation will identify and distinguish between actions taken to comply with ESA that are discretionary programs developed and implemented under authority of Section

7(a)(1), and actions determined to be necessary or appropriate to minimize impacts of CVP and CVPIA actions or developed as a reasonable and prudent alternative to a proposed CVP or CVPIA action in order to avoid causing jeopardy or destruction or adverse modification of designated *critical habitat* under authority of Section 7(a)(2);

6. Discretionary programs under authority of Section 7(a)(1) have been, or will be, developed by the Service and Reclamation in consultation with the Service and implemented to conserve listed species and address impacts resulting from past and continuing actions related to the operation and maintenance of the CVP and implementation of the CVPIA. The programs implemented pursuant to the CVPIA are intended to provide mitigation for past CVP effects on all fish, wildlife, and associated habitats, including listed species and designated *critical habitat*;

7. CVP or CVPIA actions or parts of actions, which *may affect* listed species or for which there is not enough information available to estimate *take* or make a *not likely to adversely affect* determination, will receive future tiered analysis and consultation. Reclamation or the Service will provide to the Service's SFWO Endangered Species Division, dependent on lead agency status, clear descriptions of proposed CVP or CVPIA actions, specific areas that may be affected directly or indirectly by these actions, the manner in which the actions *may affect* any listed species or designated *critical habitat*, and other relevant reports and information. Reclamation and the Service will also identify any and all interrelated and interdependent actions and measures related to the proposed CVP or CVPIA action. In those situations where the lead agency, or the Service's SFWO Endangered Species Division, determines that an action *may affect* listed species or may adversely modify designated *critical habitat*, Reclamation and/or the Service will initiate informal or formal consultation as appropriate.

8. Reclamation and the Service will work together to develop means to more effectively facilitate ESA compliance through the coordination of activities and commitments discussed in this Project Description. This coordination will include establishment of a process within 3 months of this biological opinion that will provide necessary information to the Service's SFWO Endangered Species Division in situations where a determination of *no affect* has been made, sufficiently in advance, to enable the Service's review. .

9. Based upon the best available scientific and commercial data, Reclamation and the Service, in coordination with the Service's SFWO Endangered Species Division, will prepare any biological assessment(s) necessary to determine whether the proposed CVP or CVPIA action is likely to *adversely affect* endangered or threatened species or designated *critical habitat* and whether formal consultation or conferencing is required;

10. For the renewal of long-term water service contracts, in order to expeditiously complete consultation with the Service, Reclamation will provide to the Service the best scientific and commercial data available during the consultation for an adequate review of the effects these actions may have upon listed species (50 CFR 402.14(d)) and will fulfill the information requirements specified in 50 CFR 402.14(c) at the time of initiation of consultation. To assure a

timely and affordable process, Reclamation will endeavor to reduce the number and extent of ESA consultations by consolidating similar renewal contract actions based on activity and geographical area;

11. Reclamation and the Service will collaboratively develop the priority and schedule for initiating and completing any ESA consultations determined by Reclamation and/or the Service to be necessary to address a CVP or CVPIA action that *may affect* a protected species and/or their habitat(s). Future CVP or CVPIA actions will be evaluated to assure necessary compliance with ESA as they arise;

12. Reclamation will work with the Service's SFWO Endangered Species Division to conduct a comprehensive review of the current status of all requirements specified in all previously issued biological opinions addressing contract renewal (e.g., Friant and Interim Contract Renewals). Such comprehensive review will also be conducted for any existing biological opinions which address CVP operations, maintenance and construction, to avoid inconsistent and duplicative reasonable and prudent alternatives, measures and implementing terms and conditions and monitor effectiveness, identify new or continuing conservation needs. The intent of such a review is to establish a tracking system for all ESA compliance activities related to the CVP; and

13. Reclamation will establish a tracking program to assure conditions necessary for compliance with ESA are met within areas affected by the delivery of CVP water. Where Reclamation and/or the Service believe there are *adverse affects* on listed species, a conservation strategy will be required to be in place for the district or area to receive the contract water . The types of strategies that could be accepted are: *Habitat Conservation Planning*, as described in Section 10(a) of the ESA; requirements resulting from a Section 7 consultation, programmatic land management actions that include protection of listed and proposed species, implementation of site specific *conservation measures*, or an expansion of the existing CVP Conservation Program that adequately compensates for the direct and indirect effects of increased water delivery to an area. Other actions that include components of the above strategies could also be accepted.

Appendix C

Accomplishments of Conservation Measures in the Friant and Cross Valley Area

- Recovery projects implemented by Reclamation
- Recovery projects implemented by Friant Water Users Authority
- Recovery projects implemented by ESRP

Recovery Programs Implemented by Bureau of Reclamation

PROGRAM IMPLEMENTATION

COMMITMENTS MADE UNDER THE

1991 FRIANT BIOLOGICAL OPINION

FOR

RENEWAL OF LONG-TERM WATER SERVICE CONTRACTS

PROGRESS REPORT

DECEMBER, 2000

BUREAU OF RECLAMATION

Introduction:

The Bureau of Reclamation (Reclamation) has completed many of the commitments made under the Friant Biological Opinion (Opinion). Reclamation has also contributed significantly toward a cooperative effort to address the recovery of a number of Federally threatened and endangered species in the San Joaquin Valley. The attached *Friant Biological Opinion Implementation Schedule* (Schedule) provides a listing of commitments, completion dates and status information. Please see attached *Accomplishment* tables and narrative that list the many efforts that Reclamation has initiated under the Friant Opinion. For expediency, the accomplishments tables do not provide detail of the projects listed. That detail is provided in the narrative following the tables. The report herein is intended to provide a chronological description of events and actions undertaken by Reclamation over the past nine years. Events described follow the sequence of commitments in the Schedule attached to this report. Other commitments were not listed in the schedule but were agreed upon by Reclamation and Service. These commitments are also described below. Although some dates in the schedule were changed due to unforseen circumstances, all changes were made by Reclamation with written concurrence from the United States Fish and Wildlife Service (Service). Reclamation has periodically received letters from Service stating that the ongoing efforts by Reclamation continue to be satisfactory.

Background of 1991 Action:

On May 22, 1991, the Bureau of Reclamation Reclamation requested a formal consultation with the Service pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended, as part of renewal of 28 long-term water service contracts for the Friant Division.

Reclamation committed to the development and implementation of short and long-term programs to compensate and avoid adverse effects on listed species within the 28 Contractor's service area in the Friant Division as well as other areas within the San Joaquin Valley that may be affected by Reclamation activities, and to have a role in the recovery of listed species in the San Joaquin Valley. Also, Reclamation committed to initiating consultation on other aspects of the CVP so that the interrelated and interdependent impacts, and cumulative effects on species outside the San Joaquin Valley could be fully addressed. With that in mind, the Service issued its Biological Opinion on October 15, 1991 (Service File Number 1-1-91-F-22), and Amendment to the Opinion on May 14, 1992 . In their Opinion, the Service stated that the renewal of the 28 long-term water service contracts would not likely jeopardize the continued existence of fifteen threatened and endangered species found within the Friant Division service area. This program also committed the Service to participate by providing technical assistance and developing revised recovery plans for the San Joaquin Valley species needed for the timely resolution of listed species concerns. To accomplish the goals of providing technical assistance and writing revised recovery plans, Service established an Endangered Species Recovery Program (ESRP) with funding to be provided by Reclamation. The core team to cooperatively address implementation of the Friant Opinion consisted of a member from Reclamation, Service and

ESRP. Other individuals were consulted by the team on an as-needed basis, including species experts, other technical experts and agency representatives.

Species to be Addressed:

Reptiles

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

Birds

bald eagle, *Haliaeetus leucocephalus* (E)
Aleutian Canada goose, *Branta canadensis leucopareia* (T)
least Bell's vireo, *Vireo bellii pusillus* (E)

Mammals

San Joaquin kit fox, *Vulpes macrotis mutica* (E)
Tipton kangaroo rat, *Dipodomys nitratoides nitratoides* (E)
Fresno kangaroo rat, *Dipodomys nitratoides exilis* (E)
giant kangaroo rat, *Dipodomys ingens* (E)

Invertebrates

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

Plants

Hoover's wooly-star, *Eriastrum hooveri* (T)
Bakersfield cactus, *Opuntia basilaris* var. *treleasei* (E)
California jewelflower, *Caulanthus californicus* (E)
Kern mallow, *Eremalche kernensis* (E)
palmate-bracted bird's beak, *Cordylanthus palmatus* (E)
San Joaquin Woolly-Threads (*Lembertia congdonii*)

Reclamation's Commitments:

The primary focus is to identify a comprehensive approach to recover listed species with a Federal nexus to Reclamation throughout the San Joaquin Valley through the development and implementation of a long-term interagency program The program is being developed and implemented by Service, Reclamation, ESRP and other Federal, state, and local agencies whose activities have or are affecting listed species. State, Federal, and private actions that adversely affect listed species can be mitigated by contributing to the long-term comprehensive program.

Reclamation implemented a short-term program to protect listed species within the Friant service area because it was determined that development of a long-term program would take several years to complete. This short-term program was intended to be in effect until components of the

long-term conservation program could be developed and implemented. The short-term program had the following components:

1. Reclamation immediately issued notices to all Friant contractors regarding the imperative of protecting all remaining habitat of listed species in the Friant Service area.
2. Reclamation, with assistance from ESRP, initiated a comprehensive biological survey of Reclamation and private lands (with signed permission from landowners) in the Friant service area to ascertain the distribution of all remaining habitat of listed species, and upon full implementation will notify all contractors of the location of wild lands suitable for listed wildlife species.
3. Reclamation, in coordination with Service and ESRP, provided funds to develop and implement a critical needs plan to identify and secure those habitats requiring immediate protection throughout the Friant service area and also the remainder of the San Joaquin Valley that are vulnerable to agricultural conversion. This information was incorporated into the *Recovery Plan for Upland Species of the San Joaquin Valley, California* which was developed by Service with significant contributions by ESRP and Reclamation. The Recovery Plan was finalized by the Service on September 9, 1998.
4. Reclamation implemented a plan to prevent take associated with operations and maintenance of Friant Division facilities, and pest control activities by farmers receiving Federal water.
5. Reclamation has consulted with the Service on (a) any requested inclusions or exclusions from the Friant service area, (b) any water contracts involving Friant facilities other than the 28 long-term contracts subject to review in this biological opinion, and (c) any deliveries of water using Friant facilities beyond that addressed in this biological opinion.
6. Reclamation is implementing a long-term plan to prevent/minimize take and contribute to the survival of listed species throughout the San Joaquin Valley.

IMPLEMENTATION OF COMMITMENTS

Notification of Landowners of Their Responsibilities Under the Endangered Species Act:

On November 15, 1991 a notice was issued jointly by Reclamation and Service to Friant Division contractors regarding the imperative of protecting all remaining habitat of listed species in the Friant Service area. The notice contains the following information, in part:

"Reclamation should be contacted if you plan to deliver project water to lands which have not been recently tilled and have possibly developed into habitat which could harbor endangered species. This does not mean that the lands will not be allowed to be tilled, but rather than an evaluation process will need to be undertaken to avoid the destruction of species which have become so rare that they are in danger of becoming extinct.....If lands are found that contain endangered species, the Service will evaluate if development of the land will be allowed to continue with some type of mitigation, or whether the parcel of land is crucial to the continued survival of the species that are present. If the Service determines that a parcel is crucial to

survival of the species, the parcel would be evaluated for possible acquisition by the Federal Government. Other options, such as allowing the parcel to remain as natural habitat or mitigating for the loss of habitat values, would also be explored on a case-by-case basis."

Aerial Photography and Analysis:

Service and Reclamation agreed to analyze aerial photographs to identify potential habitat within the Friant Division and within the San Joaquin Valley and subsequently request permission to survey that potential habitat. Service was concerned that when the letter was sent to contractors on November 15, habitat might be destroyed prior to completion of the aerial photo analysis using new photos. Service therefore also wanted Reclamation to determine how much habitat was lost between the time the letter went out November 15 and acquisition of current aerial photographs. It was thought at the time that Landsat photos taken in January 1991 provided a good coverage of the area needed for comparison with the new photographs.

Because coverage was not complete for the January 1991 originally selected, Reclamation had to get complete coverage prior to the date originally selected by Reclamation and Service. The closest complete coverage of the project area was a set of photographs taken in April of 1990. To document up-to-date land use, Reclamation contracted to fly the San Joaquin Valley for the purpose of taking photographs at a scale of 1:24,000. These photographs became available October 12, 1992. Reclamation's Denver Technical Service Center completed aerial photo analysis of the new photographs taken in October 1992 by March of 1993, and subsequently compared the April 1990 photographs with the October 1992 photographs. Analysis focused on the determination of existing potential habitat for endangered species. Reclamation concentrated efforts in the Friant Division and in lands within the San Joaquin Valley that had been historically occupied by critically endangered species. Specifically the agreement between Reclamation and Service was that the total amount of possible remaining range for the Fresno kangaroo rat would be added to the total acreage in the Friant Service area (some of it overlapped into the Friant service area) for the purpose of aerial habitat analysis.

Priorities for analysis were as follows:

First: were the areas historically inhabited by Fresno kangaroo rats.
Second: were lands within the Friant service area closest to Fresno kangaroo rat range
Third: were all lands north of highway 198
Last:, lands south of highway 198

Type of habitat to be determined included three categories:

1) Unplowed grasslands
2) Land fallowed for two years or more
3) Vernal Pools (by complex, not individually)

Aerial photo analysis showed that (perhaps partly due to the continuing drought) more land was being fallowed than was being converted from potential habitat to agricultural production. Approximately 500 acres within the Friant Division was determined to be the result of agricultural conversion. The number of acres of habitat converted was to be mitigated by Reclamation through coordinated efforts with Service.

Biological Surveys for Endangered and Threatened Species on Private Property:

Following completion of the analysis of aerial photographs, Reclamation identified landowners of potential habitat both within the Friant Division and in the San Joaquin Valley. In 1993, letters requesting access to private properties for the purpose of conducting biological surveys on potential habitat were sent to land owners both within and outside the Friant Service area. The letter stated, in part:

"The Bureau of Reclamation is preparing to conduct sensitive species investigations in the Friant Division service area and outside the service area to complete programs detailed in a Biological Opinion rendered by the U.S. Fish and Wildlife Service for the Friant Division water service contract renewals (October 15, 1991).

.....Information required for this effort includes the types and intensity of agricultural practices that are compatible with endangered species. ..

Other research information needed is the distribution and habitat of these species and an estimate of remaining numbers. This will allow assessment of the present condition of critically threatened and endangered species that live in the San Joaquin Valley. Subsequent development and implementation of recovery and conservation plans will allow species survival while agricultural use and development of lands continue within the San Joaquin Valley. ....Your cooperation will assist in the resolution of what have in the past been controversial issues between wildlife and agricultural interests. ...Lands that are inspected where no evidence of listed or candidate species are found will cease to be considered as habitat for our administrative purposes under the Biological Opinion. ..Uncultivated parcels will likely be labeled as habitat if absence of species cannot be confirmed by inspection. If endangered species are present, your land use practices probably are compatible with their survival."

Public workshops were held in Madera, Visalia, and Bakersfield, California with team members from Reclamation, Service, and ESRP present to discuss the surveys and provide information on the species to be addressed by the effort.

Reaction from the Public and the Press:

The effort created considerable controversy and became a news item on network television and in local and national publications. The first article was in the Fresno Business Journal (*Bureau Letter Ignites Outrage Among Friant Water Recipients*, Mark Arcamonte, Aug. 16, 1993). The

perspective of the writer is described in the title. The Fresno Bee provided an editorial written by the vice president of the Fresno County Farm Bureau *(Farmers, Ranchers Insist upon "Just Compensation"*, Shawn Stevenson, Dec. 8, 1993) which suggested that "Ultimately, the government and others who view America's private property as a vast supply of habitat must realize that if the public good requires a partial or regulatory taking of private property than there must be just compensation. America's environmental ledger cannot be balanced on the backs of her farmers and ranchers." Next an article appeared in the Bakersfield Californian (*Teamwork for Species Count*, Dianne Hardisty, Dec 9, 1993). This article was more balanced, and urged a cooperative effort to address the issues. An article appeared on the front page of the Los Angeles Times (*Search for Rare Species Has State's Farmers Uneasy,* Marla Cone, Dec. 17, 1993,). This article was also relatively balanced in that it provided an impartial view of both sides of the issue. The issue was discussed on television programs throughout the San Joaquin Valley, particularly those emphasizing agriculture.

Public Controversy, Reclamation's Efforts and the Effect Upon Landowners:

Despite the level of controversy, access was granted by more than 230 landowners to conduct biological surveys on approximately thirty-five thousand acres of land (out of 151,000 acres requested to be surveyed). Access was provided by the landowner signing and returning a form to Reclamation giving permission to enter onto their property to survey for threatened or endangered plants and/or animals. If the form was not signed and returned, no surveys were conducted on that property. Only about 75% (26,355 acres) of the approximately thirty-five thousand acres of land was actually habitat (the Friant Division Service Area is about one million acres). In many cases the habitat area indicated on the 7.5' USGS quadrangle maps used to identify land owners was contained within a much larger parcel. This was particularly true in the case of riparian strips, and the original database included the total area for the parcels, not just the area that was requested. In other instances the parcel requested was not within the indicated habitat area, but adjacent to it and apparently included in the database by mistake. Categories included "Riparian" (narrow strips of habitat bordering various rivers and streams), "Fallow" (fields that showed clear signs of plow furrows), and "Ag Fields" (parcels, or portions of parcels, that were under cultivation on the aerial photos and were apparently added to the database by mistake). Drive by surveys were conducted in mid-December, 1993 by ESRP staff and subsequently arrangements were made with the owners to survey individual parcels.

Results of Wildlife Surveys:

Most of the properties surveyed held no listed species of animals or plants, although several areas did have suitable habitat. Many of the parcels surveyed were found to be too densely vegetated to allow colonization by any listed species, either plants or animals. Although many canid dens were found, they were all either inactive or appeared to be coyote dens.

The listed species that were located are listed below, although to respect the rights of private property owners, their names are not included, nor is the specific location.

Dipodomys nitratoides (Tipton kangaroo rat) — found on 3 properties
Gambelia sila (blunt-nosed leopard lizard) — found on 1 property
Branchinecta lynchi (vernal pool fairy shrimp) — found on 2 properties
Pseudobahia peirsonii (adobe golden sunburst) — found on 1 property
Opuntia basilaris var. *Treleasei* (Bakersfield cactus) — found on 1 property
Cordylanthus palmatus (palmate-bracted bird's beak)— found on 1 property

Over 10,000 acres of land around Los Banos, in Merced County appeared to have good potential upland habitat on the aerial photos, but a drive-by survey conducted in mid-December, 1993 showed all of the parcels to be flooded for duck ponds.

Biological Surveys on Reclamation Lands:

Subsequent Reclamation efforts have focused on Reclamation lands in the Friant Division and in other water service areas. There have also been significant cost-shared efforts with other entities to survey other publicly owned lands. Reclamation is compiling a report of the areas surveyed. Additional information on surveys are provided under *Accomplishments* below.

Continued Controversy Over Endangered Species Issues in the San Joaquin Valley:

For about a year following the request by Reclamation to survey private lands for threatened and endangered species, the press became relatively quiet until other unrelated actions involving endangered species brought the Reclamation project back into public view. An article appeared in the Christian Science Monitor in Aug 25, 1994 (*California Farmers Hit at Habitat Laws*, Danielle Starkey). The subject was included in broader discussions of the impact to farmers by the Endangered Species Act.

Market-to-Market is a television program produced in Iowa that features agricultural issues nation wide. They produced a program that included a segment on the Endangered Species issues in the Central Valley of California (May 14, 995). The MacNeil-Lehrer Report, a nationally syndicated program, featured a segment from Jeffrey Kay of KCET in Los Angeles on May 25, 1995. The focus was also on the impact of the Endangered Species Act and discussed the endangered species in the San Joaquin Valley. ESRP staff provided technical information on endangered species for both television programs, which were filmed on location on the Elkhorn Plain where many of the endangered species once found in the San Joaquin Valley can still be observed in the wild. Dr. Daniel Williams, Director of ESRP was interviewed on camera, as was Wayne White, Field Supervisor of the Service in Sacramento. Other footage on both programs showed farmers demonstrating against endangered species and the endangered species act.

Operations and Maintenance Plan to Prevent Take of Threatened and Endangered Species:

A draft Operations and Maintenance Plan was to be completed within three months of the issuance of the Opinion. A draft O&M Plan was completed in January 1992. It was reviewed by Service staff, ESRP, BOR, irrigation district personnel and CDFG. Reviewers included O&M staff. The document was reviewed twice and comments were incorporated in December of 1992.

Reclamation implemented a short-term plan to prevent take associated with operations and maintenance (o&m) of the Friant Division, and, in cooperation with the water authorities, is continuing to revise the o&m documents that constitute the O&M Plan. The revised documents presently consist of an *Operations and Maintenance Plan: Field Manual*, and an *Operations and Maintenance Plan: Endangered, Threatened and Sensitive Species*, intended for use in the field by Reclamation or contract staff as a guide to be used as a reference when conducting or planning operations and maintenance activities. Additionally, an *Operations and Maintenance Plan: Overview*, is intended to be used by managers and planners.

The field manual includes avoidance measures to be taken in areas where a particular threatened or endangered species might be present. Information on many species is in the Endangered, Threatened and Sensitive Species manual. More species are being added as staff and funding permit.

Training sessions have been conducted at yearly intervals for staff who apply pesticides. The training stresses avoidance of harm to non-target animals and plants using slides of the species and habitat. Taxidermy mounts of a kit fox (permit obtained), gray fox and pelt of a red fox are used for training. A Riker mount of various types of scat including kit foxes, other foxes and burrowing owls is also used to provide a general idea of the appearance of varying scat.

On several occasions, construction work has been done by contractor personnel within the range of the San Joaquin kit fox. In those instances, training has been provided along with distribution of kit fox photographs and kit fox avoidance measures. These training efforts are in addition to pre-activity surveys conducted prior to construction.

Training was initially conducted by Reclamation staff. However, there is now an operating agreement with the water authorities and they are responsible for training and pre-activity surveys.

Canal rights-of-way were surveyed by ESRP biologists, and BOR staff subsequently described sensitive areas along the canal by right and left bank according to milepoint from the dam. GIS maps are being completed showing the sensitive areas. Initially Reclamation did not have GIS data on the rights-of-way for the canals, but have recently obtained the Friant-Kern, Delta Mendota, and Madera Canals in GIS form. Sensitive areas and some areas with data gaps will have to be manually digitized on to those maps as time and staff are available. Avoidance measures are being implemented and the maps will be an added benefit for long term planning and monitoring when they are complete.

Friant Water User's Authority is conducting re-vegetation studies on the canal embankments to determine the most successful types of grasses for re-vegetation and also the best types of herbicides to use in selected areas to encourage grasses and discourage broadleaf weeds.

Biological pre-activity surveys are conducted by a qualified biologist prior to blading or backfilling of erosion gullies to assure no kit foxes are in the area where soil disturbance is to occur.

Integrated Pest Management Plan:

Friant Water User's Authority (FWUA) is developing an Integrated Pest Management Plan (IPM Plan) that will be used with the O&M Plan (A Draft of the IPM Plan is presently under review). A booklet containing information about sensitive, threatened and endangered species that could occur in the San Joaquin Valley, including photographs, has been created to be used in training for staff and as a reference. Because of the large number of species present in the valley, the booklet contained information about the species most likely to be found in connection with Reclamation lands and maintenance activities. More species are being added.

Cooperative Efforts with Department of Pesticide Regulation:

The South Central California Area Office (SCCAO) began working with the State of California Department of Pesticide Regulation (CDPR) in 1993 following implementation of the Friant Opinion. By 1995, CDPR had developed a number of slide presentations for use in pesticide applicator training. SCCAO provided some slides to them that are being used as part of the slide presentations and are also in the set of informational cards produced by CDPR and intended for field use. Training by CDPR includes not only providing the pocket size cards but endangered species presentations by a biologist (CDPR or CDFG biologist usually). There is also a website for CDPR which has extensive threatened and endangered species information available to download and print for individual use by growers. For those without computers, the same information is now available through the county agricultural commissioner's offices. The SCCAO is still actively working with CDPR and will be cooperating in the printing of additional cards and also in the development of new ESA information during FY 2000 and beyond.

Rosalie Faubion, SCCAO Project Biologist and licensed Pest Control Advisor, was asked to review some of the cards and other ESA information which is now available. Staff of the ESRP have and continue to work with CDPR on the effects of pesticides on threatened and endangered species.

Critical Needs Plan:

The May 14, 1992 amendment to the Biological Opinion states: "The Service shall develop and Reclamation shall implement (initiate acquisition of listed species habitat) a critical needs plan within 11 months of issuance of this biological opinion to identify and secure those habitats

requiring immediate protection throughout the Friant service aea. In addition, the Service shall develop and Reclamation shall implement (initiate acquisition of listed species habitat) a critical needs plan within 19 months of issuance of this biological opinion to identify and secure habitats needing immediate protection throughout the remainder of the San Joaquin Valley that are vulnerable to agricultural conversion. These high priority lands shall be protected in descending order of the priority by degree of threat (as defined by the Service) for listed wildlife species as follows: Fresno kangaroo rat, Tipton kangaroo rat, and giant kangaroo rat."

Draft critical needs plans were developed for both the Friant service area and the remainder of the San Joaquin Valley by Service and ESRP (The remainder of the San Joaquin Valley was also included in the Biological Opinion for Interim Water Service Contracts). At the time of the writing of the Friant B.O. the phrase "*initiate acquisition of listed species habitat*" would be easily accomplished by purchasing land adjacent to the Alkali Sink Ecological Preserve, which is designated critical habitat for the Fresno kangaroo rat. The intent was to enlarge the preserve and increase the existing population of Fresno kangaroo rats. However, as part of the biological surveys for threatened and endangered species, it was discovered that Fresno kangaroo rats on the Alkali Sink Ecological Preserve had effectively disappeared. Only one Fresno kangaroo rat was trapped on the Preserve despite successive years of intensive trapping. With the knowledge that there were no Fresno kangaroo rats on the Alkali Sink Ecological Preserve, the importance of Reclamation protecting habitat adjacent to that preserve disappeared. Reclamation and Service instead decided that if subsequent surveys on other lands showed the presence of Fresno kangaroo rats, Reclamation and Service could attempt to protect the newly identified habitat. As yet, no populations of the Fresno kangaroo rat have been found. It is possible that it has become extinct.

Information from both critical needs plans was incorporated into the *Recovery Plan for Upland Species of the San Joaquin Valley, California* in September 9, 1998 following several years of gathering existing and new data by ESRP.

Development of a Recovery Plan:

The Biological Opinion further states: "As part of this program the Service, working with Reclamation, will proceed with development and implementation of an integrated regional recovery plan for the eleven San Joaquin species in imminent danger of extinction".

The draft *Recovery Plan for Upland Species of the San Joaquin Valley, California* was written by ESRP with funding from Reclamation . The draft document was provided to Service and was edited and officially released September 9, 1998. Many of the species with which Reclamation has to deal had little or incomplete information available about them. ESRP, through surveys and specific research and monitoring studies, were able to provide valuable information in the Recovery Plan that will be crucial to ongoing efforts by everyone living or doing business in the San Joaquin Valley. Service has indicated that the multi-species recovery plan is being used as a model by others who are writing recovery plans (Pers. Communication, Cay Goude, Service).

Non-discretionary Consultations Under Section 7:

Reclamation has consulted with the Service on (a) any requested inclusions or exclusions from the Friant service area, (b) any water contracts involving Friant facilities other than the 28 long-term contracts subject to review in this biological opinion, and (c) any deliveries of water using Friant facilities beyond that addressed in this biological opinion. To avoid the need to repeatedly consult on each action Reclamation and Service are working to develop guidelines and/or seek approval for the same actions over a multi-year time period.

Long-term Conservation Plan:

Reclamation is implementing a long-term plan to prevent/minimize take and contribute to the survival of listed species throughout the San Joaquin Valley. Reclamation and the Service are providing an ecosystem-based approach to the recovery of listed species in the San Joaquin Valley. The program is one which allows other agencies to contribute efforts or funds to mitigate adverse effects of projects or programs on listed species in the San Joaquin Valley. Reclamation is implementing, as a component of a broader program, items identified in the recovery plan that are Reclamation's responsibility.

Geographic Information Systems (GIS) maps showing such features as: land use, potential habitat, and present species locations are being created by Reclamation. Some information is incomplete and it is anticipated that it may take several more years to complete the GIS maps. This information is being shared with responsible entities who have joined Reclamation and the Service's cooperative effort toward preserving endangered species in the San Joaquin Valley.

These and other aspects of the program should allow more wise future land management decisions to be made for mitigation purposes.

Potential Value of Reclamation Lands to Threatened and Endangered Species

It was noted in the Opinion that some lands along Reclamation rights-of-way fell within the historic range of the San Joaquin kit fox, Tipton kangaroo rat and the blunt-nosed leopard lizard. At the time of the writing of the Opinion the potential value of Reclamation lands to threatened and endangered species was not known but it was thought that there might be a potential value as a wildlife corridor, particularly for the passage of the San Joaquin kit fox. Reclamation committed to the following actions relating to its rights-of-way and other Reclamation owned lands in the Friant Opinion:

- Reclamation will evaluate its lands as habitat and as movement corridors for listed species historically using them as part of the long-term conservation program.
- Reclamation will evaluate its lands located within the San Joaquin Valley but outside the Friant service area for habitat and as movement corridors as part of the long-term conservation program.

- Reclamation will improve listed species habitat on Reclamation's Friant Division lands, where feasible.
- Reclamation will identify and manage Reclamation lands for endangered species purposes consistent with project operations.

Components of this plan could include such things as: (a)implementing a program to eliminate unauthorized uses of Reclamation properties along all canal and conveyance facilities by fencing or otherwise marking the boundaries and keeping adjacent use off Reclamation property (b) re-seeding rights-of-ways and other suitable areas with grass and shrubby species that benefit endangered species; and (c)limiting the use of rodenticides along canal rights-of-ways to only those areas where burrowing animals could cause structural damage to the canal.

Reclamation Lands - Actions Undertaken

Reclamation agreed to the following actions under the Opinion:

(a)implementing a program to eliminate unauthorized uses of Reclamation properties along all canal and conveyance facilities by fencing or otherwise marking the boundaries and keeping adjacent use off Reclamation property (b) re-seeding rights-of-ways and other suitable areas with grass and shrubby species that benefit endangered species; and (c)limiting the use of rodenticides along canal rights-of-ways to only those areas where the burrowing animals could cause structural damage to the canal.

Determination of boundaries was a necessary step before we could determine if we had an unauthorized use of Reclamation properties. Reclamation land rights-of-way records in SCCAO were not up to date due to insufficient staffing. It has been necessary to conduct boundary surveys, although they have not been conducted on all lands simultaneously. Once the boundaries are determined we will begin a more aggressive effort to keep adjacent use off Reclamation property. Presently, any known trespass is being dealt with as appropriate. Agricultural leases can be terminated at the request of the government and may be if the value to wildlife is such that a change in land management is needed.

As part of the long-term conservation program Reclamation has been evaluating its lands as habitat and as movement corridors for listed species. Because of more critical priorities and limited funding, this effort has proceeded more slowly than other efforts. All Reclamation lands have not been evaluated but the goal is that all eventually will be. Lands which were evaluated first were those located in areas known to be near threatened or endangered species range and known to not be in agricultural production. Some of Reclamation's rights-of-way parcels have agricultural leases from Reclamation and are in production. Some is in natural habitat and those lands are not approved for conversion from grazing to cropping. Grazing is compatible with development of a wildlife corridor and also reduces wildfire hazard.

Some parcels were to be managed for wildlife by the CDFG according to a written agreement between our agencies. Those have not been managed and have become overgrown. Reclamation is now undertaking efforts with Ducks Unlimited and Quail Unlimited to manage the parcels for wildlife. Success of these efforts will be reported in the future if the partnerships are successful.

Reclamation is improving listed species habitat on Reclamation's Friant Division lands, where feasible. All lands have not been targeted, but some lands have been identified for improvement and have a high potential as a wildlife corridor, particularly for the passage of San Joaquin kit foxes.

Friant Water User's Authority is conducting re-vegetation studies on the canal embankments to determine the most successful types of grasses for re-vegetation and also the best types of herbicides to use in selected areas to encourage grasses and discourage broadleaf weeds. Reclamation will identify and manage Reclamation lands for endangered species purposes consistent with project operations. Reclamation has been working with the water authorities to identify specific areas where escape dens and also natal dens for the San Joaquin kit fox may be installed. We are working with the Service to obtain a biological opinion for the proposed project. The water authorities will select locations that will not affect their ongoing operations and maintainance of Reclamation facilities.

Artificial dens for burrowing owls may be installed in the future. A relatively large colony lives on the right-of-way of the San Luis Drain. The area is flagged and maintenance restrictions are in place to protect the birds, particularly during nesting season.

Reclamation has designed a study to determine which den designs may be preferred by kit foxes. Information from this study will be applicable not only to Reclamation enhancement efforts but also to other agencies that have to mitigate for loss of San Joaquin kit fox dens.

Reclamation is also evaluating its lands located within the San Joaquin Valley but outside the Friant service area for use as potential wildlife habitat or corridors as part of the long-term conservation program.

Implementation of Commitments Made Under Friant Biological Opinion Outside Friant Division:

It should be noted that the terms and conditions to avoid jeopardy were somewhat different for the Friant B.O. than for the Biological Opinion for Interim Renewal of Water Service Contracts (1995) (Interim BO). Delta and Cross Valley Canal water users had most of the San Joaquin Valley species that were referred to in the Friant B.O. Reclamation therefore committed to not only implementing the Interim B.O. for the interim water districts, but also included some of the short and long-term measures that were in the Friant B.O., where applicable. This provided for consistency and addressed issues that were not limited to the Friant Division. A specific example is the evaluation of Reclamation lands to develop a wildlife corridor. Animals such as the San

Joaquin kit fox need to travel from one area of habitat to another to assure that populations will not become isolated and subject to genetic problems. This issue is specifically mentioned in the Friant B.O. Reclamation is evaluating its rights-of-way not only in Friant Division but also in the San Luis and Delta areas within the San Joaquin Valley to determine if the lands can be used as a wildlife corridor without causing problems with operations and maintenance of the facilities and if there is a value or need in a particular area to use the right-of-way as a corridor. Prior to implementation of any measures we coordinate with Service, CDFG, and the water authorities to be sure all are in agreement and that no unforseen problems will occur.

COURT FINDINGS AND ACTIONS:

- May 30, 1995, Judge Lawrence K. Karlton found a procedural violation of ESA by BOR in executing the contracts.
- February 27, 1995, Service issued a biological opinion (Service File Number 1-1-95-F-39) on the interim Water Contract Renewals (Interim Renewals Opinion - for districts other than Friant)
- On January 16, 1997, the Federal District Court for the Eastern District of California found the 14 Friant contracts to be invalid. The court stayed its order voiding the contracts until a ruling could be made by an appeal.
- January 20, 1998 Service and BOR re-initiated formal consultation to the Supplemental Interim Renewal of Central Valley Project Water Contracts to include the 14 Friant Water Contracts, as amended January 20, 1998.
- February 27, 1998, Service issued an amendment to the 1995 Interim Renewals Opinion (Service File Number 1-1-98-I-595) to include interim contract renewals for the 14 Friant water districts bringing the total number of districts covered under the Opinion to 68.
- The amendment adopts the reasonable and prudent measures of the Friant Opinion.

Partnerships:

Cost sharing and cooperation with other agencies has been significant. The partners' efforts included financial, as well as in-kind, staff, materials, and supplies assistance. Financial assistance has varied yearly from ten to over forty percent of the total costs with an average of approximately twenty five percent as of the period ending October 1, 2000. These joint efforts have contributed significantly to the recovery of species throughout the San Joaquin Valley.

Partners in the effort to address recovery needs include the following:

FEDERAL:
United States Fish and Wildlife Service
Bureau of Land ManagementDepartment of Defense - United States Navy
Department of Energy
United States Forest Service

STATE:
California Department of transportation
State of California Department of Fish and Game
University of California, Berkeley
California State University, Fresno
California State University, Stanislaus
California State University, Bakersfield
California Department of Parks and Recreation
California Department of Forestry
California Department of Water Resources

OTHER:
Conservation Tech. Support Program
Environmental Systems Research Institute Conservation Program
Smithsonian Institution
The Nature Conservancy
Recreational Vehicles
Tulare County
Sierra Foothill Conservancy
Monterey Fish Company
Nikon Corp
Environmental Defense Fund
EIP
Jones and Stokes
Trimble Navigation

Kern Coa

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office Ongoing and Initiated Projects			
Kings River, Riparian Habitat Enhancement (to enhance the riparian habitat values per the Friant Biological Opinion)	CDT, FWUA	Oct 1997	
Madera Equalizing Reservoir (to properly survey and record USBR land)	CDT		
Madera Equalizing Reservoir (to experimentally mitigate for project loss of vernal pools)	CDT, CSUF	Spring 1993	Summer 1996
Madera Equalizing Reservoir (to fence USBR land and allow for better grazing management)		Sep 1996	Jan 1997
Madera Equalizing Reservoir (to enhance riparian and wildlife habitat values)	CSUF	Summer 1998	Ongoing
Tulare County Habitat Conservation Plan (a grant from USBR to provide assistance for biological surveys for the county's HCP)	Tulare County		
Notice to Contractors (stating need to protect remaining habitat of listed species)		Nov 1991	
Interim Operations & Maintenance (O&M) Plan (creation and implementation for Reclamation-owned lands)		Oct 1991	Feb 1993
Draft Training Manual (development to accompany Interim Operations & Maintenance Plan)		Oct 1991	Oct 1993
Aerial Photographs (taken of San Joaquin Valley)		Sep 1992	Oct 1992
Photographs (taken of San Joaquin Valley on 1 Jan 1991 to compare with Oct 1992 aerials)		Oct 1991	Oct 1992
Photo Analysis (complete aerial photographs taken Oct 1992 of Friant Service Area only)		Oct 1992	Mar 1993

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office **Ongoing and Initiated Projects**			
Photo Analysis (San Joaquin Valley Endangered Species Recovery Program compared aerial photographs taken 4 Dec 1990 to determine possible conversion of land to agricultural uses)		Apr 1990	Oct 1992
Land Ownership (determined in areas of biological interest)			
Permission To Enter Private Property (to survey for endangered species from 1200 landowners with total of 155,000 acres; permission given to survey 40,000 acres)			Jun 1993
Land Surveyed (40,000 acres of land was surveyed to determine possible presence of threatened and endangered species)			
Public Meetings (Reclamation held public meetings in Madera, Fresno, Visalia, and Bakersfield to answer questions from landowners)			Dec 1993
Pro-Active Cost Sharing (Reclamation with other agencies and organizations; by the exchange of both monies and in-kind services)		Oct 1991	Ongoing
Recovery Plan (Reclamation funded the majority of costs)		Oct 1991	Dec 1997
Sensitive Areas to Avoid (endangered species survey information used to prepare logs)			
Kit Fox Escape Shelters (requested initially as spoil material was removed, will continue with other right-of-way use proposals of the Delta Mendota Canal)		July 2000	Ongoing
Kit Fox Escape Shelters (requested some easement applicants provide along the right-of-way of the Friant-Kern Canal)		Oct 1992	Ongoing

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office Ongoing and Initiated Projects			
Information Exchange and Training Manual (exchanged operations and maintenance information with the Department of Water Resources. DWR has provided information on types of activities and avoidance measures and Reclamation has been working on a training manual that will benefit DWR maintenance staff as well as BOR maintenance staff in the San Joaquin Valley)		Oct 1991	Ongoing
Department of Pesticide Regulation and Addressing Endangered Species (Reclamation was instrumental in persuading the Department of Pesticide Regulation to address endangered species issues through training to pesticide applicators and advisors. DPR is now providing training through slide presentations and is preparing a series of cards with photographs of animals, tracks, burrows, etc. on a number of endangered species that will be made available to applicators and advisors. All applicators and advisors must receive ongoing training to renew their certificates and licenses. They will now receive training on the avoidance of adverse impacts to threatened and endangered species while applying pesticides. This information has not been previously available so widely in the State of California.			
Department of Pesticide Regulation (reviewed endangered species information cards; provided photographs and information, reclamation urged development of ongoing training sessions for pesticide applicators and advisors to prevent adverse impact to threatened and endangered species. DPR now has T&E information and training available)		Oct 1991	Ongoing
Pesticide Applicators and Advisors (sessions provided to prevent adverse impact to threatened and endangered species. DPR has T&E information and training available)		1993	Ongoing
Replace Habitat (develop and implement program to replace habitat lost between Apr 1990 to Oct 1992)		discussion s delayed	Ongoing
Future Adverse Effects (develop and implement mitigation plan for listed species in Friant Service Area)			

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office Ongoing and Initiated Projects			
Habitat maps and Best Management Practices (distributed information to contractors)		Dec 1997	Ongoing
Acquisition (determine need for listed species habitat and make recommendations as appropriate)			Ongoing
Major Funding San Joaquin Valley Multispecies Recovery Plan Draft (provide and develop a plan for upland species in the San Joaquin Valley)		Draft Oct 1997	
Reclamation's Component of Recovery Plan (implementation)		Underway	Ongoing
Site Specific Operations &Maintenance Plan (noting location of sensitive environmental areas)			Ongoing
Reclamation Lands Biological Surveys (decide which lands would benefit from enhancement)			
Riparian Brush Rabbits (coordinated with CDT to be a potential partner in creating refuges at Caswell Memorial State Park)			
Genetic Study of San Joaquin Kangaroo Rats (funded to determine relationships to assist in their recovery)			
Major funding for Recovery Planning Program (provided to help meet our commitments resulting from Friant Biological Opinion)		Oct 1991	2000
Best Management Practices for Landowners (develop and distribute management practices for landowners using USBR water, purpose is to avoid take of threatened and endangered species from routine operations and maintenance activities including pesticide use)			
Geographic Information Systems (GIS) Maps (create showing sensitive species habitat)			
Millerton Reservoir Watershed Improvement Soil and Moisture Conservation (plant survey, burn planning, exotic plant removal soil and moisture conservation, land surrounding Millerton Reservoir)	State Park	Sept 1997	Sept 1998

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office Ongoing and Initiated Projects			
Westlake Farms Demonstration Project (wetlands development, water purchase)	USFWS, CDWR	June 1993	Sept 1998
Groundwater Recharge Basin Waterfowl Enhancement Project Deer Creek / Lower Tule River Irrigation District (wetlands development, water purchase, and berm construction)	Audubon Society, FWUA, CWA, DCLTRWA	Sept 1997	Sept 1998
Yaundanchi Ecological Reserve, Revegetation/Pond Construction (wetlands development, pond lining)	Safari Club International, Tea Pot Dome WD, Vandalia ID	Sept 1997	Sept 1998
Camp Pashayan (San Joaquin River) Education Shelter Construction (Wetlands Development Program, watershed education grant for building facilities)	San Joaquin River Parkway and Trust	Sept 1997	Sept 1998
Su-Lii-Chen, WRP Project (cost share with USFWS on wetlands habitat resoration, near Volta Refuge)	USNRCS, USFWS	April 1998	Spring 1999
Pryse Farms, WRP Project (cost share with USFWS on wetlands habitat resoration, Tulare Lake Basin)	USNRCS, USFWS	April 1998	Spring 1999
Riparian Habitat Restoration - Merced National Wildlife Refuge	USFWS	Summer 1999	Spring 2000
Lucky Pistachio, WRP Project (cost share with USFWS on wetlands habitat resoration,Tulare Lake Basin)	USNRCS, USFWS	April 1998	Spring 1999
Riparian Habitat Restoration - Exotic Plant Removal, San Joaquin River, Millerton Reservoir	San Joaquin R. Parkway and Consv. Trust	Fall 1999	Summer 2000

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
USBR, South-Central California Area Office **Ongoing and Initiated Projects**			
H&P Farms, WRP Project (cost share with USFWS on wetlands habitat resoration,Tulare Lake Basin)	USNRCS, USFWS	April 1998	Spring 1999

Recovery Programs Implemented by Friant Water Users Authority

DOCUMENTATION OF IMPLEMENTATION OF THE FRIANT DIVISION BIOLOGICAL OPINION FOR THE FRIANT-KERN CANAL- FY 1999

Environmental education and implementation of environmental preactivity surveys for construction activities along the Friant-Kern Canal and associated facilities are the primary methods of ensuring protection of threatened and endangered species along the canal right-of-way and other facilities. Other significant wildlife protection measures involve the reduction and minimization of chemical use of herbicides and pesticides along the canal ROW and encouraging and demonstrating how those actions can be used on other water distribution systems, farms and ranches. Lastly, enhancement of habitat along the canal ROW and on adjacent lands and throughout districts of the Friant Division is another area to which the Friant Water Users Authority (Authority) is dedicated.

Some of the specific activities performed are noted below:

1) Conducted environmental preactivity surveys along the canal for construction activities and pest control, when applicable. These records are maintained by FWUA.

2) Provided endangered species Fact Sheets with photographs for posting at each field maintenance office for the primary endangered species. Reviewed the Bureau of Reclamation endangered species field manual with photographs and oriented foremen to its use.

3) Initiated development of an Integrated Pest Management Program that incorporates the practices of reducing soil sterilent and herbicide and pesticide use.

4) Conducted three years of experimental work in revegetation for weed and pest control. Completed third year sampling and prepared and submitted a report to the Department of Pesticide Regulation. The data indicate that following planting the density of squirrel burrows is reduced, and may be eliminated in many areas, that insect diversity increases significantly, that both beneficial and pest insects are found, but in balance. Beneficial insects were documented to move from the test plots several hundred yards into adjacent agricultural fields. The establishment of vegetation reduces the cover and density of noxious weeds over time, while increasing in cover. Continued to distribute tri-fold informational brochures and the CDFG "Farming for Wildlife" books.

5) Participated in and sponsored the workshop "Practical Applications of Habitat and Wildlife Management on Farms and Ranches". Displayed three "poster presentations": one on revegetation techniques, one on bird houses for raptors for pest control and a live raptor demonstration. Presented three papers: 1) policy and partnership development, 2) results of revegetation for canal rights-of-way, and 3) enhancing recharge basins for wildlife habitat.

6) Planned a 13-acre revegetation field trial to develop a cost-benefit analysis for revegetation for weed and pest control along the southern portion of the canal where there are wide barren areas along the canal. Mostly native species are being used as non-natives tend to harbor more pest insects than native do. The native species also are habitat for many native bees beneficial to crops.

7) Reviewed and commented on third party projects affecting the canal to ensure compliance with CESA and ESA and help maintain connectivity along the canal ROW. Constructed a field inspection of the extensive seismic work ongoing along the southern end of the canal to ensure compliance.

8) Prepared budgets for experimental erosion control for inside banks using raptor burrows and tackifiers for FY 2000.

9) Continued to develop and implement the Water for Wildlife demonstration program at the canal and Deer Creek and other district projects. Results of bird monitoring indicated that over half of all the bird species recorded in Tulare County use the habitats being created on and around the Deer Creek recharge basins. Basin expansion planning and additional habitat enhancement projects are in progress. Over 20 additional similar projects have been submitted by landowners and other districts interested in participating.

10) Participated in the San Joaquin River Management Program.

11) Reviewed and commented on the Recovery Plan and provided site-specific information.

12) Assisted with the development of special weed control implementation issues at Lake Woollomes. Relocated seedbed of spiny sepaled buttoncelery. Determined that taxonomic uncertainties exist with these plants (genus?). Developed an experimental burning program to help eradicate noxious and other exotic vegetation.

13) Developed and obtained a California Department of Fish and Game programmatic Section 1600 notification for all Friant-Kern canal channel crossings and toe-drains (80+).

14) Continued to provide technical assistance and referrals to incoming queries from other water districts, farmers and growers regarding endangered species protection, weed and pest control and enhancing habitats for wildlife. Provided field tours to university classes.

15) Participated in the San Joaquin Valley salmon team subcommittee and quarterly San Joaquin River coordination and review meetings.

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority Ongoing and Initiated Projects			
Provide Biological Assistance (Technical and Compliance) (for canal operations and maintenance 24 hours a day)	N/A	1994	Ongoing
Assistance In Designing and Implementing Habitat Restoration and Enhancement of San Joaquin River (Bureau?)	NRDC, PCFFA		
Conduct education and training for FWUA Field Personnel (developed and conduct annual training; and for the new Operations and Maintenance program)		1994	Ongoing
Developed and Distribute an Educational Brochure (on benefits of vegetation management to control weeds and pests)			
Educate Scientists and Others About Results of Vegetation and Canal Vegetation Management Research (by supporting and providing speakers to environmental and endangered species San Joaquin Valley workshops, The Biodiversity Council, etc.)	CDPR, TWS-SJ		
Contribute Funding and Presentations for Workshops (such as Practical Applications for Habitat and Wildlife Management on Farms and Ranches, Working at a Watershed Level (river restoration planning instructional workshop for the public))	TWS, SERCAL, DWR & others		
Contributed Funding and Technical Assistance for an Environmental Educational Curriculum (for the San Joaquin River Parkway Trust)			
Obtained Grant Funding with Water Districts for Habitat Enhancement (projects on conjunctive use and wildlife habitat enhancement, such as production of an educational video; provide technical assistance as partners)			
Implemented Posting of Special Conservation Areas on Canal to Avoid (such as test plots and kangaroo rat habitat)			

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority **Ongoing and Initiated Projects**			
Participate in San Joaquin River Management Plan (program and implementation)	CDFG, CDWR, USBR, USFWS	1990	Ongoing
Participate in development of the Kern County Valley Floor Habitat Conservation Plan. Assisted in the development of a water district strategy	KCWA, Maricopa-Wheeler Ridge Water Storage District, West Kern Water District and others	1994	Ongoing
Participate in San Joaquin River Ecosystem Restoration Coordination (through monitoring meetings of the Central Valley Salmon Technical Subcommittee, formerly San Joaquin River quarterly monitoring group)	NA	1996	Ongoing
Participate in Developing Water Quality and Flow Improvement in the Bay-Delta (through a scientific, adaptive management approach)	San Joaquin River Group	Ongoing	
Developed Plan to Help in Rodent Control by Increasing Burrowing Owls (by installing artificial burrows)	NA	Oct 1998	
Install Raptor Nest Boxes/Perches To Assist in Rodent Control (on the canal and reduce bait use)	NA	Oct 1998	
Experiment with Physical Barriers to Preclude Ground Squirrel Burrowing (on the inside canal banks and to reduce use of chemicals)	NA	Oct 1998	
Research Vegetation Management to Better Control Weeds and Pests and Reduce the Use of All Chemicals for Canal Management (grants from CDPR contributed to tests of native species for erosion and pest control; held public workshop to share findings; trying mowing and natural succession; 5 private landowners will participate in demonstration projects (Fall 1998) including growers and other districts)	CDFG, CDPR, TCFB, UCE, USBR		

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority Ongoing and Initiated Projects			
Developed and Initiated New Canal and Water District Vegetation Management Standards to Reduce Use of Chemicals (includes less blading and grading near levees, using biological controls when available and cooperating with biological control research)	FWUA		
Won the 1997 Innovator's in Pest Management Award from CDPR (for outstanding program in research and public education in using vegetation to reduce use of chemicals)	FWUA, Districts	1996	1999
Provide Monthly Biologist Report to All Water Districts (to increase awareness of biological activities, provide guidance on regulations, biological opinion requirements, grant availabilities and listed species issues and recommendations)	NA	1994	Ongoing
Conduct Preactivity Surveys for Threatened and Endangered Species for Surface Disturbance Construction (on USBR and special District projects and in known special species habitat; flag avoidance buffer zones)	FWUA, Districts	1994	Ongoing
FWUA Is Partner to Districts Conducting Habitat Enhancement Projects	DCTRA, DEID, AEWSD	1997	Ongoing
FWUA Sbmitted to Bureau request for funding and work plan for the Water for Wildlife Program (over 20 district and private wildlife habitat enhancement projects have applied to be covered, pending approval of the Bureau and Service)	Bureau, USFWS	1999	Pending, ongoing
FWUA and NRDC coalition have partnered and initiated a contract to develop a restoration plan for the San Joaquin River.	NRDC, Bureau, State	2000	Ongoing
FWUA and NRDC coalition have partnered and initiated a contract to develop a plan for water supply alternatives for restoration of the San Joaquin River.	NRDC, Bureau, State	2000	Ongoing
The FWUA/NRDC SJRRHRP partnered with the San Joaquin River Trust and CDFG to develop a restoration plan for the Milburn Unit on the SJR	DWR, Bureau	2000	Ongoing

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority Ongoing and Initiated Projects			
The FWUA/NRDC SJRRHRP conducted a solid waste cleanup on the SJR near San Mateo Avenue with River stakeholders and volunteers	NRDC, Bureau, landowners		
FWUA and the NRDC conducted pilot projects to study experimental flow releases on the reestablishment of riparian vegetation and impacts to surface and groundwater on the San Joaquin River between the Friant dam and the Chowchilla bypass	NRDC, Exchange Contractors, Bureau, USFWS	1998	2000
Initiated field scale revegetation trial for weed and pest control in fall of 1999 (about 12 acres).	NA	1999	Ongoing
Conducted experimental plantings for weed and pest control on five grower and water district sites	CDPR	1998	1999
Distribute CDFG Farming for Wildlife to Districts, thru office and special presentations	NA	1996	Ongoing
Designed and initiated a long-term monitoring program for vegetation and water (surface and groundwater) in Reach 2 of the San Joaquin River. This included the installation of 13 groundwater monitoring wells and numerous piezometers in the River channel.	NRDC, Bureau, Reclamation Board, and River landowners	1999	Ongoing
Assisted in the design and implementation of a vegetation management plan to help prevent adverse impacts of riparian restoration on flood flows.	NRDC, Lower San Joaquin Levee District, Exchange Contractors	2000	Ongoing
Contracted for the development of a public outreach and education plan for restoration activities being conducted on the San Joaquin River	NRDC, Bureau, USFWS	1999	Ongoing
Participate in the San Joaquin River Management Program Action Team and Advisory Council.	NA	1994	Ongoing

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority Ongoing and Initiated Projects			
Initiated and coordainted diversion mapping on the San Joaquin River between the Friant Dam and the mouth of the Merced River.	NRDC, CDFG	2000	Ongoing
Restored a portion of the SJR channel above the head of Rank Island that experienced accelerated downcutting in the flood of 1997.	Bureau, SLC	1998	Complete
Initiated refining of the hydrualic and sedimentology model for the San Joaquin River from Friant Dam to Mendota Pool.	NRDC, Bureau, USFWS	1999	Ongoing
Initiated development of a hydraulic and sedimentology model for the San Joaquin River from Mendota Pool to the confluence of the Merced River.	NRDC, Bureau, USFWS	2000	Ongoing
Initiated development and refinement of a roughness model to predict the effects of the reestablishment of riparian vegetation in the San Joaquin River	NRDC, Bureau, USFWS	2000	Ongoing
Initiated studies for the development of a groundwater model for the San Joaquin River	NRDC, Bureau, USFWS	2000	First part completed
Relocated Uncommon *Eryngium spinosepalum or other?* at Lake Woolloomes to avoid loss of population. Relocation was successful. Initiated a taxonomic investigation of the species with agency and university personnel.	NA	1999	Ongoing
The SJRRHRP worked with the City of Firebaugh and drafted an evaluation of opportunities for restoration activities in the Firebaugh area.	NRDC, Bureau, USFWS	1998	1999
Initiated use of California State University Fresno students in pilot projects as field technicians as part of public outreach and education efforts	NRDC, CSUF	2000	Ongoing
Arranged to bank water at a FWUA district conjunctive use facility for later use in creating flows in the San Joaquin Rivver	NRDC, DCTRA	2000	Ongoing

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH December 2000

Projects in Progress	Cooperators/Collaborators	Project Schedule	
		Start	End
Friant Water Users Authority Ongoing and Initiated Projects			
Expanded the Deer Creek wildlife habitat enhancement ponds by over 80 acres. Includes riparian and upland areas.	DCTRA, Bureau, NFWF and others	1999	2000
Initiated public outreach and education for San Joaquin River activities with regional news media	NRDC, Bureau	2000	Ongoing
Provided funds and speaker to support the Working at a Watershed Level public training restoration workshop focusing on the San Joaquin River. Solicited additional donors for workshop support.	NRDC, Bureau	2000	Ongoing

Recovery Programs Implemented
by
Endangered Species Recovery Program

SAN JOAQUIN VALLEY ENDANGERED SPECIES RECOVERY PROGRAM[1] PROJECTS AND ACCOMPLISHMENTS

December 2000

ONGOING RECOVERY PROJECTS

- ***Population censuses for riparian brush rabbits and woodrats***—population monitoring at two sites in Caswell Memorial State Park (CMSP), San Joaquin Co., annually in January, starting in 1997; repeats census conducted in Jan. 1993 at three sites. Each site is trapped for a 7-day period for both species. **Objectives**: estimate population size; obtain tissue biopsies for genetic analyses; determine effects of climatic variation and flood levels on population dynamics. **Products**: annual summary reports; report on 1993 assessment produced for California Dept. of Parks and Recreation. This is an essential recovery activity, monitoring population size and relative fitness, and obtaining information on genetics that are crucial for making decisions on controlled propagation and translocation of individuals.

- ***Population censuses for giant and short-nosed kangaroo rats***—population monitoring on grazed and nongrazed plots (1.44 ha) twice annually since July 1987 on the Elkhorn Plain, San Luis Obispo Co. **Objectives**: determine spatial relationships of individuals, reproduction, recruitment, and survivorship; determine effects of annual climatic variation on populations; determine interactions of giant and short-nosed kangaroo rats; determine effects of livestock grazing on populations of kangaroo rats. **Products**: annual report on rainfall, net primary productivity on grazed and nongrazed plots, and population numbers, survivorship, recruitment, estimated densities and other demographics. Summary reports published by CDFG in 1993, 1995; 15-year summary report to be published after August census, 2001. Study is essential part of recovery actions to delist species; particularly establishing population responses to climatic variation and livestock grazing.

- ***Population censuses for blunt-nosed leopard lizards***—monitoring twice annually since May 1988 (monitoring of permanently marked animals since 1989) on the Elkhorn Plain, San Luis Obispo Co. on grazed and nongrazed plots (8.1 hectares), and continuous monitoring on one grazed plot (9 hectares) at Pixley NWR, Tulare Co. since May 1993. **Objectives**: determine spatial relationships of individuals; determine reproduction, recruitment, and survivorship; determine effects of annual

[1] ESRP

climatic variation on populations. **Products**: annual report on population numbers, net primary plant productivity, prey abundance (grasshoppers and side-blotched lizards), survivorship, recruitment, estimated densities, and other demographics. Summary report published by CDFG in 1993; Refereed publication in 1994 on effects of drought; refereed publication on effects of greater than average rainfall and El Niño on populations to be prepared after the 2001 censuses. Study is essential part of recovery actions to delist species.

- ***Population censuses for coast horned lizards***—continuous monitoring on one grazed plot at Pixley NWR, Tulare Co., since May 1993. **Objectives**: determine spatial relationships of individuals; determine reproduction, recruitment, and survivorship; determine effects of annual climatic variation on populations. **Products**: see blunt-nosed leopard lizard (above). This former candidate species is included in our study at Pixley NWR because it is relatively abundant there, costs for including it are slight, and little is known of its biology. We also include it in studies on the Elkhorn Plain (see blunt-nosed leopard lizards, above) but captures are too few most years to make statistical comparisons.

- ***Population censuses for Tipton and Heermann's kangaroo rats***—continuous monitoring on one 4.4 hectare plot at Pixley NWR, Tulare Co., since Dec. 1993 (decreased from 3-5 days weekly to monthly 5-day censuses, to quarterly starting in 1995). **Objectives**: to monitor population fluctuations in relation to environmental variation and measure annual population turnover, productivity, and recruitment and other demographics. Other specific objectives are to determine population interactions of the two kangaroo rats. **Products**: annual report on demographics, including estimated densities, and monthly precipitation.

- ***Population estimates for California jewelflower, Kern mallow, San Joaquin woolly-threads, and Bakersfield cactus***—counts of rare plants present in permanent belt transects on the Carrizo and Elkhorn Plains (San Luis Obispo Co.), Lokern (Kern Co.), and Sand Ridge (Kern Co.) beginning in 1993. To be conducted at least once every 5 years following seasons of above-average rainfall. **Objectives**: to monitor population sizes to provide information on progress of recovery efforts. **Products**: periodic report on population numbers and estimated densities, Natural Diversity Data Base field forms.

- ***Population estimates for palmate-bracted bird's-beak***—Estimate population size at Alkali Sink Ecological Reserve, Fresno Co. To be conducted at least once every 5 years following seasons of above-average rainfall. **Objectives**: to monitor population sizes to provide information on progress of recovery efforts. **Products**: periodic report on population numbers and estimated densities, Natural Diversity Data Base field forms.
- ***Annual vegetation sampling on Lokern***—vegetation transects and plant productivity sampling at Lokern, Kern Co., in conjunction with habitat management research. **Objectives**: to provide data on vegetation response to

annual precipitation patters and population dynamics of listed plants, especially Kern mallow and listed animals at the site (giant kangaroo rat, blunt-nosed leopard, and San Joaquin antelope squirrel are species featured in research). **Products**: annual report on vegetation composition; final analyses to be included in peer-reviewed publication (see Kern mallow habitat management research)..

- ***Annual vegetation sampling on Elkhorn Plain***—plant productivity and residual dry matter sampling (see giant kangaroo rat population censuses) on the Elkhorn Plain, San Luis Obispo Co. **Objectives**: to provide data on vegetation response to annual precipitation patters and population dynamics of listed animals, particularly blunt-nosed leopard lizards and giant kangaroo rats. **Products**: net primary productivity on grazed and nongrazed plots and giant kangaroo rat precincts to be included in annual report on giant kangaroo rat population censuses and peer-reviewed publication on giant kangaroo rat effects on plants (see giant kangaroo rat population censuses and Kern mallow habitat management research).

- ***Ecology and habitat management of Kern mallow***—annual monitoring on 4 cattle-grazed and 4 nongrazed plots in Lokern, Kern Co., in conjunction with Biological Resource Division of USGS study of listed animals. **Objectives**: to determine whether (1) the reproductive output of Kern mallow is the same on grazed and nongrazed experimental plots, and (2) percent cover and composition of dominant plants change on grazed and nongrazed experimental plots. **Products**: annual report on population responses to vegetation management and environmental variation, peer-reviewed publication on use of grazing as a management tool for Kern mallow.

- ***Ecology and habitat management of giant and short-nosed kangaroo rats***— see remarks under Population Censuses of Giant and Short-nosed Kangaroo Rats and Annual Vegetation Sampling for the Elkhorn Plain, San Luis Obispo Co. Study has been ongoing since July 1987. Effects of livestock grazing are measured on two plots. Reproduction and demography measured by monthly trapping for 3-year period; weekly for 3 month periods during reproduction.

- ***Ecology and habitat management of blunt-nosed leopard lizards***—see remarks under Population Censuses and Annual Vegetation Sampling for Blunt-Nosed Leopard Lizards and Coast Horned Lizards and Annual Vegetation Sampling for the Elkhorn Plain, San Luis Obispo Co. Study has been ongoing since May 1988. Effects of livestock grazing are measured on two plots. Reproduction and demography measured by weekly captures for 2-year period during reproductive season.
- ***Habitat Management and Restoration for riparian brush rabbit and woodrat***—habitat restoration work commenced at Caswell Memorial Park, San Joaquin Co., in 1999. **Objectives**: reduce dangerously high level of downed woody material providing fuel for potential wildfires, remove exotic trees, primarily the tree of heaven, and renew decadent shrubs and other vegetation

providing habitat for these species. **Products**: a report on fuel removal was prepared and delivered to the USBR and USFWS; periodic updates of vegetation monitoring in treated areas. Fuel reduction and removal of exotic plants continues under CDPR. ESRP continues to monitor. In FY97, with Restoration Fund support, this project provided strategies and recommendations for the following items: 1) a fire management plan, 2) methods to monitor and reduce fuel levels, and 3) creation of refugia to act as safe harbors in the event of flooding of the Park. This was accomplished through coordinated efforts between the Endangered Species Recovery Program, the California Department of Parks and Recreation, USBR, USFWS, Flood Control Districts, CDFG, Ripon Fire Department, and private landowners. Fuel reduction in Caswell Memorial State Park, San Joaquin Co. was accomplished in 1999-2000 by the California Conservation Corps (CCC) with funding from the Central Valley Project Conservation Program and supervision by ESRP. Plots were established to monitor succession of plants where dead trees and accumulated downed woody material was removed. Plots will be monitored annually if funding is provided. Project on hold for lack of funding in FY 2001 **Products**: interim and annual reports on biological studies; fire and flood management plan, annual progress reports on vegetation monitoring.

- ***Distribution, habitat relationships, and population status of Kern mallow***—part of grazing studies in the Lokern Region, Kern Co. (with USBLM, NBS/BRD, CDFG, and CNLM). **Objectives**: to periodically look for new populations of this species. **Products**: updated maps and NDDB records for the species when new information is found.

- ***Distribution, habitat relationships, and population status of Fresno kangaroo rats***—periodic attempts to locate and census populations of Fresno kangaroo rats have been on-going since February 1988; with ESRP leading the effort since October 1992. **Objectives**: to locate and assess populations of Fresno kangaroo rats, assess habitat relationships, and obtain tissue samples for genetic studies. All public and private properties where access has been granted have been surveyed one or more times (some several times) between 1992 and 1994 with little success; in Nov. 1992, a single male Fresno kangaroo rat was captured twice on the Alkali Sink Ecological Reserve, Fresno County. No other individuals were captured despite repeated trapping at the Ecological Reserve since 1992. Other opportunities to survey for Fresno kangaroo rats have presented themselves since 1994. In July and August 1999, Endangered Species Recovery Program biologists surveyed the University of California, Merced planning area but no animals were captured. In April and May 2000, biologists trapped parts of the Merced National Wildlife Refuge, including parts of the Eastside Bypass and the Arena Plains, but no animals were captured. Between August and October 2000, biologists from the Endangered Species Recovery Program and Jones & Stokes, Inc. trapped extensively throughout Madera Ranch in western Madera Co., but no Fresno kangaroo rats were captured. Populations of Fresno kangaroo rats have disappeared throughout their range. It is possible that some remain in small

isolated populations or on large tracts of private land to which we have been unable to gain access. We will continue our efforts to locate populations. These efforts will continue as permission to access other parcels is granted. **Products**: report detailing efforts and results of surveys between 1988 and 1996 has been drafted; reports on UC Merced and Madera Ranch surveys have been prepared; summary report to CDFG, who has partly financed these studies, is being prepared; anticipated periodic activity reports (annual, as efforts dictate).

- ***Distribution, habitat relationships, and population status of San Joaquin kit foxes***—on-going efforts to document the historical and current geographic distribution and population numbers of San Joaquin kit foxes. Efforts to date have focused on assembling records not represented in the California NDDB, gathered from biologists and agency personnel, with a special emphasis on the Salinas River and Pajaro River watersheds and the northern portions (eastern and western edges of the San Joaquin Valley) of the species' geographic range. A short-term mark-recapture population census was conducted in western Fresno Co. and eastern San Benito Co. (Panoche Region). More extensive surveys (spotlighting, trapping, track plates) was conducted in western Merced and Stanislaus counties in 1997-2000. Additional surveys were conducted mostly by CDFG and CDWR and others in San Joaquin, Alameda, and Contra Costa counties. **Objectives**: were to refine methods for mark/resight population estimation and to obtain an estimate of the distribution and number of foxes in the Panoche Region and to determine current distribution and relative abundance in the northwestern portion of the geographic range of San Joaquin kit foxes (Contra Costa, Alameda, San Joaquin, Stanislaus, and Merced counties). Future efforts will be to obtain similar information for the matrix of agricultural/natural lands in Tulare and northern Kern counties on the Valley floor, and to conduct a scientifically rigorous population estimate for the Carrizo Plain natural area. **Products**: updated maps and NDDB records for the species completed; project final report completed for Panoche region study; anticipated annual and project final reports for future work.

- ***Distribution, habitat relationships, and population status of Buena Vista Lake shrews***—with permission, we used funds originally allocated for habitat management research on this species at Kern Lake Preserve, Kern Co. We were not granted permission to work at the former preserve by the private land owner. Instead, we search for other possible populations of Buena Vista Lake shrews at remnants of historical wetlands in the southern Tulare Basin. **Objectives**: to locate additional populations of Buena Vista Lake shrews, assess their habitat relationships, and obtain samples for phylogenetic analyses. **Products**: a report to the USBR has been drafted and is being finalized in January 2001. A refereed publication of findings of two new populations of this species and reconfirmation of a fourth (third being the only previously known population at Kern Lake) is being prepared.

- ***Distribution and habitat assessment for riparian brush rabbits and woodrats***—a

periodic, ongoing activity. ESRP repeated earlier (1983-1986) surveys on Stanislaus River, plus all other accessible properties with potential habitat; surveys continue as we gain access to property. **Objectives**: to locate and assess additional populations of these riparian species and to better define their habitats. **Products**: NDDB field forms, distribution maps, reports, refereed publications. To date we have located a new population of riparian brush rabbits on a channel of the San Joaquin River in the Delta region, and woodrats a couple of miles downstream from Caswell MSP and directly across the Stanislaus River from Caswell MSP.

- *Recovery planning for vernal pool communities*—preparing species accounts for 28 vernal pool plants and 9 animals of the Central Valley and coast. Elements of species accounts include taxonomy, historical and current distribution, life history and habitat, reasons for decline and threats to survival, conservation efforts, and recovery strategy. ESRP staff also are writing portions of introductory chapter and ecosystem strategy and prepare maps in GIS. **Objectives**: to prepare draft recovery plan for vernal pool species. **Products**: draft species accounts and recovery strategies for review by the Vernal Pool Recovery Team; final species accounts and recovery strategies; maps of species' distribution, essential habitat, and ecosystem protection framework.

- *Recovery planning for Sierran foothills plants*—ESRP is preparing the entire recovery plan for at least 14 plants of the southern Sierran foothills, including introduction, species accounts, ecosystem recovery strategy, stepdown narrative, and implementation schedule. Elements of species accounts are the same as in vernal pool recovery plan. **Objectives**: to prepare draft recovery plan for foothill plants. **Products**: draft recovery plan for review by the Fish and Wildlife Service.

- *Recovery planning for the San Joaquin kit fox*—we are using population modeling, GIS-based modeling of available potential habitat, and results of studies of use of urban and agricultural areas, population genetics, and population estimates to develop more refined, area-specific recovery strategies for the San Joaquin kit fox. **Objectives**: to refine recovery strategies and identify specific areas and parcels for protection, restoration, and management to support kit foxes and facilitate movement of individual foxes between population centers. **Products**: periodic reports and maps for use in regulatory and conservation decision making; refereed publications (see list for publications already in press).

- *Recovery planning for riparian brush rabbits and woodrats*—implementation of recovery for these species requires development of several detailed plans on habitat restoration and management, captive propagation, translocation, and investigations of population genetics, breeding systems, and husbandry. Periodic meetings of a multi-agency team to refine and implement recovery goals are ongoing. **Objectives**: to implement recovery actions for riparian brush rabbits and woodrats. **Products**: habitat management plans, controlled propagation plan,

genetics management plan, translocation plan, NEPA, CEQA, and other documents as appropriate.

- ***Development and maintenance of GIS databases for the San Joaquin Valley ecosystems***—ESRP continually updates and adds to its GIS databases; primary users are USFWS and USBR, thought we also provide maps and database information to other agencies and conservation organizations when it does not interfere with our ongoing operations. **Products**: maps and database information are provided to agencies upon request.

- ***National Center for Ecological Analysis and Synthesis modeling studies***—in 1997, with financial support from the National Science Foundation through a grant to the National Center for Ecological Analysis and Synthesis (NCEAS) at the Univ. of California, Santa Barbara, a multidisciplinary analysis was initiated on the effects of alternative land management strategies for conserving San Joaquin kit foxes. There are numerous collaborators with ESRP on this project. The principals include Dr. Katherine Ralls (Smithsonian Institution), Dr. Robert Haight, (USFS), Dr. Hugh Possingham (Univ. of Queensland, Australia), Dr. Tony Starfield (Univ. of Minnesota), and Dr. P.J. White (USFWS). The NSF grant covered the expenses of meetings at NCEAS. ESRP's staff time was not funded and no funding was provided to gather data from field studies. Although our research objectives involved complementary modeling of ecological, economic and hydrological parameters, most headway to date has been achieved with the ecological models. We hope to make continuation of these highly productive and collaborative research and modeling activities a recognized part of our service to USBR and USFWS under future annual contracts. **Products**: The first manuscript from this collaborative modeling study, *Designing habitat protection strategies for a core population of the endangered San Joaquin kit fox*, is in press with the journal Conservation Biology. Another significant manuscript that presents methods for determining and evaluating the allocation of a limited budget to the protection of subpopulations of an endangered metapopulation is nearing completion.

- ***San Joaquin kit fox ecology on irrigated farmland***—intensive study between March 1997 and Spring 2000 of a group of kit foxes along the California Aqueduct near Lost Hills, Kern and Kings counties, California, provided important insights on how kit foxes use agricultural land. **Objectives**: to determine crops and cultural practices conducive to use by kit foxes, diet, denning sites and structures, reproduction, survival, movement patterns, and dispersal. The main phase of this study, radiotelemetry of a group of kit foxes and red foxes, is tapering off at the end of 2000. **Products**: a comprehensive report of how kit foxes use agricultural lands in the Lost Hills area is nearing completion. This report will be submitted for publication in a major peer-reviewed journal early in 2001. This study entered an important new phase in November 2000 when installation of artificial kit fox dens was initiated on cultivated lands owned by the

Paramount Farming Company; a so-called *Safe Harbor* project involving Paramount Farming, non-governmental organizations (Environmental Defense, Nature Restoration Trust), the US Fish and Wildlife Service, and the California Dept. of Fish and Game. This Safe Harbor project seeks to lower the elevated mortality rate of kit foxes in cultivated fields that we can attribute to coyotes and the lack of escape cover for kit foxes. The willing cooperation and assistance of the Paramount Farming Company—through the provision of a excavation equipment and staff, as well as they use of their land—may well be a major milestone in the recovery of kit foxes.

- ***Ecological interactions of endangered San Joaquin kit foxes and non-native red foxes***—Howard Clark of ESRP is studying the interactions of San Joaquin kit foxes and red foxes in a Masters of Science research project at California State University, Fresno. **Objectives**: to quantify the movements of radio-collared red foxes and kit foxes in an agricultural landscape and determine the nature of interactions between the species. The non-native red fox may have a significant effect on the recovery of endangered native kit foxes. Red foxes may carry out spatial and exploitative competition with kit foxes. Both species were radio-collared and monitored over a 2-year period. Kit foxes were frequently found in agricultural areas and at times traveled more than 1,700 meters into the farm fields. Relative to habitat availability, both kit foxes and red foxes used the California Aqueduct right-of-way and orchards more than expected and used cotton and barley fields less than expected. The amount of fox use (both species) relative to habitat availability was highest in uncultivated areas. Overlap in home ranges between kit foxes and red foxes and sightings of uncollared red foxes within the ranges of kit foxes demonstrated that some spatial overlap occurred between these two species. This research project should be completed by June 2001. Partners are USBR, CDFG, and California State Univ., Fresno. **Products**: master's thesis, project interim and final reports; refereed publications.

- ***Demography and ecology of urban kit foxes***—investigation was initiated in Bakersfield, Kern Co., in 1997 and is on-going. **Objectives**: are to characterize demographic and ecological attributes of urban kit foxes and develop strategies for conserving this population. Data being collected include survival rates, sources of mortality, reproductive rates, food habits, den locations, habitat use, movements, social interactions, and human interactions. **Products:** annual progress reports, final reports, and journal manuscripts.

- ***Use of Friant-Kern Canal corridor by kit foxes***—this study is located on the USBR's Friant-Kern Canal and livetrapping is centered in metropolitan Bakersfield. **Objectives**: are to survey for kit foxes along the FKC and to determine whether kit foxes use the FKC corridor to fulfill life history requirements. Surveys were initiated in 2000. Also, livetrapping was initiated in 2000, and two foxes were captured and collared along the FKC in Bakersfield and are being monitored. Project is on-going. **Products:** annual progress reports and

final reports.

- ***Population genetics of the San Joaquin kit fox***—we sampled San Joaquin kit foxes in portions of their geographic range and utilized previously collected samples for the Elk Hills (USDOE), Camp Roberts (California Army National Guard, USDD), Panoche Region (ESRP), Lost Hills area (ESRP), Bakersfield (ESRP, private citizens), and Carrizo Plain (Smithsonian Institution). **Objectives**: were to characterize the genetic variation within and between populations of San Joaquin kit foxes, use genetic data to estimate effective population size and movements (dispersal) between populations, and identify populations that might be at risk of excessive inbreeding or small population size and isolation. **Projects**: final report to CDWR, who financed portions of the studies; refereed publications; one of which is in press and others are in preparation. Collaborators include Smithsonian Institution where genetic lab work was preformed, University of Montana, where statistical analyses and interpretations are being performed, CDWR, who financed parts of the study, and CDFG who contributed to field work and collection of genetic samples in the northern part of the geographic range of the kit fox.

- ***Population genetics and biogeography of San Joaquin kangaroo rats***—comprehensive analysis of genetic relationships of Tipton, Fresno and short-nose kangaroo rat populations from throughout their historic ranges. This research project was initiated in 1994 with Prof. James L. Patton of the Univ. of California, Berkeley with financial support from the US Bureau of Reclamation. Prof. Patton produced an interim report in 1998 on this work. No extant population of Fresno kangaroo rats was located for this research. However, tissue samples taken from museum specimens indicated that Fresno kangaroo rats were the most divergent of the three subspecies. This research continues. **Objectives**: to determine the phylogenetic relationships of the three described subspecies of San Joaquin kangaroo rats (*Dipodomys nitratoides*) and the taxonomy of several isolated populations of the species in areas where two or more of the subspecies may occur; to identify unique genetic units of the species' fragmented populations for conservation purposes. **Products**: draft and final reports; refereed publications.

- ***Population genetics of giant kangaroo rats***—we sampled giant kangaroo rat populations throughout their geographic range where they occurred on public lands and private lands where we obtained permission to work in 1992 through 1994. Studies were funded by CDFG and by ESRP money from non-agency sources. **Objectives**: to obtain tissue samples for genetic analyses intra and inter-population variation, and to identify amount of genetic diversity in different populations. **Products**: final report to CDFG, refereed publication on variation in the mitochondrial genome; refereed publication in preparation on variation in microsatellite DNA. Partners in this investigation include the Smithsonian Institution, Pennsylvania State University, and Illinois State University.

- ***Genetic structure and phylogenetic relationships of riparian brush rabbit populations***—this project, conducted at California State University, Stanislaus, was initiated in 1999 and funded in April 2000. Information from the investigations is critical to determining strategy for controlled propagation and translocation of riparian brush rabbits, actions essential to recovery of the species. **Objectives**: to determine relationship of riparian subspecies to the others of the species and amount of inbreeding in riparian population; also to provide tools and refined techniques to identify progeny of parents in controlled propagation facilities (pens larger than 1 acre with dense cover of blackberries, where three females are free roaming) and information to make selection of individuals for founding new populations in restored and protected habitat. **Products**: periodic progress reports, final report, and refereed publications; set of efficacious procedures and primers to amplify microsatellite DNA for genetic analyses.

- ***Genetics of Riparian woodrats***—genetic research is being conducted by Ph.D. student, Marjorie Matocq and UC Berkeley without funds from ESRP sources. (ESRP has provided a few thousand dollars for laboratory supplies and related expenses). **Objectives**: to characterize population genetics of riparian woodrats and determine their phylogenetic relationships to other subspecies of dusky-footed woodrats (*Neotoma fuscipes*). **Products**: project final report. ESRP's role has been to collect samples from riparian woodrats and geographically adjacent populations in the Sierran foothills of Tuolumne and Mariposa counties and the Diablo Range of Merced, San Joaquin, and Alameda counties. The study is but a part of a Ph.D. investigation of the genetics and phylogenetic relationships of dusky-footed woodrats. Ms. Matocq compared the DNA extracted from tissue samples of endangered riparian woodrats with samples from other populations in the Sierra Nevada foothills and coast ranges. Not surprisingly, her preliminary results indicate genetic relationships between riparian woodrats at Caswell Memorial State Park (on the Stanislaus River) and populations of other, non-endangered woodrats in the Sierra foothills. The Caswell population exhibits low levels of both mitochondrial and nuclear genetic diversity when compared to other populations throughout the range. Furthermore, the geographic overlap of two highly distinct mitochondrial types coupled with the nuclear signature found only in other coastal individuals indicates that there may have been historic gene flow across the San Joaquin Valley between forms that in other portions of the range appear to be distinct species. Further investigation of the history of the Caswell population along with that of populations flanking the San Joaquin Valley is warranted. This research continues as Ms. Matocq completes her dissertation research and moves to the Smithsonian Institution on a post-doctoral fellowship in January 2001.

- ***Biological surveys of San Justo Reservoir, San Benito Co., San Felipe Division, and protection of California red-legged frogs***—surveys of USBR property were conducted at San Justo Reservoir, the Pacheco and Coyote Pumping Plants, the

Pacheco, Santa Clara, and Hollister Conduits, in Merced, San Benito, and Santa Clara counties, and other locations in the San Felipe Division. **Objectives**: were to provide a baseline of biota occurring on USBR property and to identify sensitive species that could be impacted by repair of the dam's toe drains. We continue to consult with USBR on this project regarding a threatened population of California red-legged frogs at the base of a dam where repairs to dam components are being conducted. **Products**: include a Supplemental Project Evaluation Report on the Environmental Commitment Plan, a report on results of surveys conducted at Los Banos Creek, a report on surveys conducted at Los Banos Creek and the Delta-Mendota Canal Siphon, a report on construction monitoring at the Los Banos Creek/Delta Mendota Siphon, and a report on construction monitoring for the San Justo toe drain remediation project.

- ***Biological survey of Millerton Reservoir***—surveys for plants, amphibians, and reptiles have been completed on USBR and Department of Parks and Recreation (DPR) lands surrounding Millerton Lake, San Joaquin River, Fresno and Madera counties. Surveys began in January 1998 and were completed in August 2000.In September 2000, a 1978 sighting (one plant) of *Carpenteria californica* was investigated in the field. ESRP biologists found and mapped approximately 10 individual plants. Additional surveys for mammal species are to be performed beginning in fall 2001. **Objectives**: to provide baseline information on occurrence and distribution of targeted biota (higher plants, vertebrates) and sensitive species at Millerton Reservoir on the San Joaquin River for use in future resource management plans. **Products:** submitted include a database prepared for bird surveys that were conducted by CDPR, a draft report on the results of plant surveys, and a draft report on the results of the amphibian and reptile surveys. Final reports will be submitted prior to 2001. Mammals surveys have not begun, though some bat monitoring (recording of echolocation calls) has been completed.

- ***Monitoring mammalian species succession on recently restored riparian habitat at Grayson River Ranch***—located on the Tuolumne River near its confluence with the San Joaquin River, Stanislaus Co, this approximately 160-acre parcel is being restored to riparian communities and seasonally flooded ground to serve as nursery areas for anadromous fishes. The project is funded by CalFed and managed by the Tuolumne River Trust; it is for a 6-year monitoring period with monitoring every 2 years. **Objectives**: to monitor mammalian succession and habitat relationships as restoration of this property proceeds. **Products**: periodic progress reports and a final report.

- ***Developing Database of Bat Calls and Bat Activity at Selected Field Sites***—monitoring of bat calls at selected field sites in central California. **Objectives**: to provide baseline data on occurrence and relative activity of bat species at field sites throughout parts of central California. Sites include Clovis, Fresno Co., Turlock, Stanislaus Co., Elkhorn Plain, San Luis Obispo Co., Millerton Reservoir, Fresno Co., Diablo Range, Merced and Stanislaus counties.,

and other scattered localities. All bat species in California are in decline and several are candidates for listing or species of special concern. **Products**: library of computer-recorded bat calls, library of known-calls of selected species; possible refereed publications. We generally monitor calls at field sites where we are conducting other field work overnight. This project is not funded; equipment was purchased with ESRP funds from sources other than agency grants and contracts.

- ***Developing 1:100,000 base maps of project area***—each map copies the coverage of USBLM's 1:100,000 surface ownership maps, showing cities, roads, canals, topography, agriculturally-developed and natural lands, and, as needed, species distribution records. **Objectives**: to provide easily distributed data for conservation and development planning, showing locations of sensitive species and communities. **Products**: maps with species and community records documented on the map. Such maps have been developed showing distribution records and potential habitat for Fresno kangaroo rats and San Joaquin kit foxes. Other such maps can be produced from ESRP's GIS as needed.

- ***Compilation of on-line literature database on listed and sensitive species of central California***—we have been developing in a computerized textbase database on literature pertaining to the biology of the San Joaquin Valley, with a focus on sensitive species. The personal reprint libraries of Daniel F. Williams and Patrick A. Kelly have been mostly indexed for computerized retrieval; also the Endangered Species Information System for California, developed by the USFWS and USBLM has been converted to a textbase file and is being edited and amended to be more user friendly (most information was originally in short codes to fit in delimited fields and there were numerous spelling errors, making retrieval of much information problematic). Editing is about 60% completed. **Objectives**: to provide a single source of bibliographic information for use in endangered species recovery planning and biological resource management in the San Joaquin Valley. **Products**: computerized bibliographic database. This project is not funded, and was mostly developed with materials and labor paid from non-agency sources.

- ***Established and maintain global positioning system (GPS) public reference station***—maintenance of Trimble Community GPS reference station and distribution of reference files through a public internet site. Currently, this is the only public reference station in the San Joaquin Valley. Users include Federal and State agencies, farmers, and private companies. Equipment donated by Trimble Navigation Ltd. through CTSP grant, assistance with setup and surveys donated by CSU Fresno, Dept. of Survey Engineering. The equipment is located at the Forestry Sciences Laboratory of the USFS's Pacific Southwest Research Station on the campus of California State University, Fresno. **Objectives**: provide GPS data for differential correction of raw GPS signals and improve accuracy of point locations. **Products**: refined locality data, GPS data for public use in correcting point locations.

- *Integration of data on detailed land cover/land into GIS*—integration of and maintenance of detailed land use and land cover data from federal and state data sources. **Objectives**: to facilitate conservation and recovery planning by having up-to-date GIS data on land cover and land uses in the San Joaquin Valley Planning area. **Products**: maps, data on land uses and rates of land conversion, data on land cover types.

- *Integration of detailed elevation and topographic data into GIS*—preparation of a 1:24,000 digital elevation model for various mapping and modeling projects. **Objectives**: to incorporate topographic information into GIS for mapping, modeling, and decision making. **Products**: maps, reports, and publications incorporating elevation/topography.

- *Updates to GIS data for Recovery Plan for Upland Species of the San Joaquin Valley*—ongoing maintenance and updates for GIS data used to develop the plan. **Objectives**: to provide up-to-date data on species occurrences, land cover and uses, and land ownership for ongoing recovery implementation. **Products**: new items include integration with the California Natural Diversity Database and the development of an intranet based bibliographic database for all occurrence records used in the plan.

- *GIS support and data analysis for Vernal Pool Recovery Plan*—GIS support for data analysis.

- *Developing GIS support for recovery criteria for the Foothill Plants Recovery Plan*—GIS support for recovery criteria.

- *Mapping topographic roughness categorization of San Joaquin kit fox habitats*—extending USDOE terrain and habitat studies range-wide using GIS and digital elevation model. An example of the use of topography in population modeling.

- *Mapping public land ownership for San Joaquin Valley*—integration and update of GIS data from Federal, State, and County agencies to update public land maps from the SJV Upland Recovery Plan.

- *GIS and database support for DOI Land Retirement Demonstration Project*—restoration project on farmland retired to ease drainage problems in the San Joaquin Valley; Program is a DOI team consisting of USBLM, USBR, and USFWS.

- *Study of history and rates of agricultural and urban conversion of natural communities on the San Joaquin Valley floor*—in this "unfunded study" we have assembled data from county agricultural departments, other historical records, and aerial photos. As time and resources permit, we are ground truthing identified

natural lands and classifying their plant communities, and collating and interpreting information.

- ***Controlled propagation of riparian brush rabbits***—planning for this project has been ongoing since 1998. Funding to build pens for controlled propagation was provided in Fiscal Year 2000 but related funding for planning and field work has been frozen. **Objectives**: to establish confined populations in 1 to 1.5-acre enclosures of natural vegetation serving as habitat for brush rabbits for purposes of producing offspring that can be translocated to restored and protected sites within the species historical geographic range. **Products**: progeny for translocation; periodic interim and final reports. The controlled propagation facility is located on CDWR property under control of the CDFG. Both agencies are cooperating in this endeavor. No additional funding has been allocated for overseeing construction, moving animals to the facility, or monitoring those animals, so the project may have to be suspended.

- ***Land Retirement Demonstration Project***—biological monitoring of the effects of agricultural land retirement in addition to designing, implementing and monitoring habitat restoration experiments. Retirement of irrigated farmland characterized by high selenium levels in shallow groundwater, poor drainage, and poor productivity has been recommended as a method to reduce the volume of agricultural irrigation drain water produced on fields on the west side of the San Joaquin Valley, California. A Land Retirement Demonstration Project has been initiated by the Department of Interior CVPIA Land Retirement Team in Fresno, Kings and Tulare counties. **Objectives**: are to monitor the effects of land retirement and test various habitat restoration strategies in a scientifically rigorous manner prior to retirement of thousands of acres of land under the CVPIA Land Retirement Program. Other objectives are to monitor succession of the natural community through natural dispersal and to develop and test methods for reestablishing target species that cannot recolonize the parcels naturally because of isolation. The Demonstration Project will expand to 15,000 acres and include extensive biotic and physical monitoring. ESRP is responsible for conducting the biological monitoring, collection of biological contaminant samples, and habitat restoration research. Biotic monitoring surveys include small mammal trapping, avian surveys, herpetological and invertebrate pitfall trapping, spotlight surveys, track stations and winter raptor surveys. An 800-acre research experiment has been designed and established at the western Fresno county project site. Experimental treatments include reintroduction of native plant species by seeding and planting seedlings, and creation of microtopography by forming mounds and berms. Control plots were also established to see how retired lands would respond without active restoration. In the Fall of 2001, a companion study will be established at a second site in the Tulare basin. Partners are USBR, USBLM, USFWS, CDFG. CDWR also has contributed some personnel on a short-term basis. The project started in winter 1998 and is scheduled to continue through spring 2003. **Products**: annual progress reports; final reports, refereed publications; restored natural communities,

perhaps with listed species as members.

- ***Study of history and rates of agricultural and urban conversion of natural communities on the San Joaquin Valley floor***—in this "unfunded study" we have assembled data from county agricultural departments, other historical records, and aerial photos. As time and resources permit, we are ground truthing identified natural lands and classifying their plant communities, collating and interpreting information. **Objectives**: to provide a composite history of extent and distribution of natural communities in the San Joaquin Valley and document their conversion by humans. **Products**: a report and refereed publication summarizing the extent, locations, and qualities of existing natural communities in the San Joaquin Valley lowlands, and the development activities and rates that have been the primary factors in their reduction.

COMPLETED PROJECTS

- *Annual vegetation sampling at Lemoore Naval Air Station*—vegetation transects on each treatment grid, sampled according to California Native Plant Society protocol. **Objectives**: to determine plant species composition, overall cover, and response to treatments since December 1994. Plant productivity sampling on each treatment grid. **Products**: summary of vegetation composition, productivity, and changes in response to treatment to be included in annual and final reports (see Fresno kangaroo rat population census).

- *Habitat management research for Fresno and Tipton kangaroo rats*—continuous monitoring on 15 0.81-hectare plots on Naval Air Station Lemoore , Fresno Co., between December 1994 and July 1999. **Objectives**: to determine if prescribed burning is beneficial in maintaining habitat for kangaroo rats, and demographic parameters relative to environmental variation with annual vegetation sampling at Naval Air Station, Lemoore; and measure annual population turnover, productivity, and recruitment and other demographics. **Products**: semiannual progress report and annual report on population responses to vegetation management and environmental variation. Final report on monitoring and a habitat management plan were submitted to the U.S. Navy in January 2000. This highly vulnerable population of kangaroo rats is the focus of a great deal of attention by the US Navy and the federal and state regulatory agencies. The US Fish and Wildlife Service has asked the Endangered Species Recovery Program to develop a population augmentation plan in the event that may be necessary (through translocation and introduction of animals from other populations).

- *Kern mallow genetic samples*—collected specimens in 1999 to be used for systematic study funded by U.S. Fish and Wildlife Service. **Objectives**: to clarify the systematic status of Kern mallow and related species and to determine the phylogeography of this complex for purposes of recovery. **Products**: pressed specimens and detailed location information sent to Dr. Bruce Baldwin at University of California, Berkeley, in 2000.

- *Land Acquisition evaluations for 3 plant specialty preserves*—two Land Acquisition Evaluations and one Conceptual Area Plan were prepared for CDFG between May 1998 and September 1999. They included supporting documentation for four potential plant reserves in Kern Co. according to California Department of Fish and Game LAE guidelines. **Objectives**: to provide information for decision making on which parcels to preserve for conservation of candidate and listed plant species. **Products**: The two LAE's were for Comanche Point and Kern Bluff and the CAP was for Kern Lake. Each area was proposed for a CDFG Ecological Reserve. All three plans were accepted by CDFG and presented to the Wildlife Conservation Board for their consideration in 1999.

- ***Seed collection of palmate-bracted bird's-beak***—we collected approximately 7,000 seeds from Alkali Sink Ecological Reserve (Fresno Co.) in 1998 and deposited them in long-term storage at Rancho Santa Ana Botanic Garden. **Objectives**: to preserve genetic diversity of this endangered population should it be extirpated or seriously reduced in size. **Products**: cleaned seeds sent to seed banking facility, permit report to the California Department of Fish and Game.

- ***Keck's checkerbloom seed collection***—we collected approximately 700 seeds from the Piedra population (Fresno Co.) in 1998 and 1999 and deposited them in long-term storage at Rancho Santa Ana Botanic Garden. **Objectives**: to preserve genetic diversity of this endangered population should it be extirpated or seriously reduced in size. **Products**: seeds sent to seed banking facility, report to the U.S. Bureau of Reclamation.

- ***Keck's checkerbloom survey***—Surveyed potential habitats on public land (USBR, USBLM) and private land where permission was granted in the vicinity of *Piedra, Fresno Co.*, in 1998. We rediscovered populations not observed since 1939 on nearby property. Products: report to the U.S. Bureau of Reclamation, CNDDB occurrence forms.

- ***Effect of mulch on species composition in Lokern, Kern Co.***—we compared plant species composition on plots from which mulch had been removed and control plots. Work was conducted on Center for Natural Land Management property during 1996 and 1997. **Objectives**: to determine effects of different amounts of mulch on annual plant diversity and specifically on the endangered Kern mallow. **Products**: presentation at San Joaquin Valley Natural Communities Conference in 1998.

- ***Effect of sheep grazing on Kern mallow***—we monitored 86 plots on Center for Natural Land Management property, Lokern, Kern Co., to evaluate effects of sheep grazing on Kern mallow during 1994 and 1995. **Objectives**: to determine if sheep grazing is a useful too to promote population size and seed production by Kern mallow. Funded by USBLM. **Products**: reports to CNLM and USBLM in 1994 and 1996.

- ***Literature review of effects of roads on San Joaquin kit foxes***—we reviewed literature and data on the effects of roads on kit foxes; project was initiated and completed in 2000. **Objectives**: were to identify actual and potential effects of roads on kit foxes, identify potential mitigation strategies, and develop recommendations for further addressing this issue. **Products**: A final report was completed and distributed in 2000.

- ***Kit fox use of Highway Crossings in Santa Nella Area***—we conducted a 3-year evaluation of kit fox movements and an analysis of kit fox use of crossing structures in the Santa Nella Area, Merced Co., using spotlighting, tracking plates,

camera stations, and kit fox trapping and radio-telemetry. **Objectives**: were to determine presence of kit foxes in the Santa Nella area and their use of crossing structures on California highways 152 and 33. **Products**: a 30-page draft report entitled "Analysis of kit fox movements and their use of crossing structures near the State Route 152/33 interchange, Merced County, California" has been prepared and submitted to CDT for review. A final draft will be submitted prior to 2001.

- ***Kit foxes in the Panoche Region in western Fresno and eastern San Benito counties***—study took place with permission on private lands. **Objectives**: to develop quantitative estimates between spotlight survey sightings and population size, estimate population and habitat sizes, and monitor movement between natural and agricultural land. Study was curtailed there because of radio telemetry interference and other factors and a new study started at Lost Hills--Kit Fox Ecology on Irrigated Farmland. **Products**: final report on trapping and radio-collaring foxes; NDDB species occurrence forms; tissue samples for genetic analyses.

- ***Survey and habitat assessment for Doyen's dune weevil***—surveys and habitat assessments were conducted for Doyen's dune weevils (DDW) in spring of 1997 through spring of 2000 on the only site where they are known to occur, near Kettleman City, Fresno Co. Additional sites that potentially harbor DDW were surveyed and assessed once permission from landowners was obtained. **Objectives**: were to determine if the species still was extant, characterize habitat, assess current population level, and search for new populations. We found that DDW persisted on the site where they were previously known to occur, but in reduced numbers, and they were not present at other localities searched. Habitat at the known site has undergone extreme degradation resulting in decreased numbers of DDW and a new plant that hosts the weevil was identified. **Products**: include an interim report submitted in August 1997 and a final report submitted in August 1998. Annual updates of our more recent findings have been provided to USBR through memoranda.

- ***Habitat and population assessment for giant kangaroo rats in the USBLM's Hollister Resource District***—we inspected sites with potential habitat for giant kangaroo rats in western Fresno and eastern San Benito counties between June 1992 and June 1993. **Objectives**: to estimate total population size and assess population status and distribution of giant kangaroo rats in colonies in the northern portion of their geographic range, and to obtain tissues samples for genetic analyses. **Products**: tissues samples for genetic analyses; project final report published by CDFG in 1995.

- ***Community and habitat relationships of giant kangaroo rats in the Carrizo Plain Natural Area***—we investigated habitat relationships and relative abundance of giant kangaroo rats on 120 500- x 10-meter belt transects. Transects were

chosen in a stratified random manner from quarter-sections previously characterized by relative abundance of giant kangaroo rat burrows by California Energy Commission surveys. Funding for this study was provided by CDFG. **Objectives**: to determine environmental and biotic community features associated with giant kangaroo rats and to characterize relative habitat quality of different areas. **Products**: project final report prepared for CDFG; refereed publication in preparation. Results indicated giant kangaroo rats are most abundant on gently sloping ground with sandy loam soils supporting annual grasslands, with no more than scattered shrubs.

- ***Wetland delineations and biological surveys along State Route 49 in Mariposa County***—we performed wetlands delineations and biological surveys, focusing on sensitive resources, for a 15 mile stretch of State Route 49 in Madera Co., during 1998. **Objectives**: were to determine presence of listed and sensitive species and wetlands that should be avoided in highway construction activities. **Products**: a 65-page document (plus appendices) entitled "Modified Natural Environmental Study Report for surveys conducted along Highway 49, Mariposa County" was produced in January 1999 and accepted by CDT.

- ***Biological Assessment for sensitive species along Highway 41, Kings County***—we surveyed a 4.5 mile stretch of Highway 41 from Jackson Avenue to the Highway 198 overpass, Kings Co., in late summer 1999. **Objectives**: to assess the presence of sensitive species in and adjacent to the CDT Right-Of-Way. **Products**: a 28-page final document entitled "Biological Assessment for Sensitive Species along Highway 41, Kings County" was submitted in July 2000.

- ***Wetland delineations and biological surveys along State Route 165 in Merced County***—we conducted wetlands delineations and biological surveys along a 12 mile stretch of Highway 165. **Objectives**: to assess the presence of sensitive species in and adjacent to the CDT right-of-way. **Products**: a 179-page document (plus appendices) entitled "Modified Natural Environmental Study Report for surveys conducted along State Route 165, Merced County, California" was produced in September 2000 and accepted by CDT.

- ***Surveys for giant garter snakes at the Mendota Dam***—we conducted surveys for giant garter snakes following standard protocols for a construction project near Mendota Dam along the San Joaquin River, Fresno Co. **Objectives**: to assess the presence of the threatened giant garter snake. **Products**: a final report to USBR was prepared and delivered.

- ***Digitized natural communities distribution in California***—digitized communities coverage from data of Küchler (1977); estimated historical extent of each natural community within the San Joaquin Valley study area. **Objectives**: estimate percentage loss of each community type using updated digital coverage of reaming natural areas. As time permits, we are ground truthing and revising coverage of

current natural areas. **Products**: Historical and current data on natural communities in GIS format.

- ***Identified potential habitat for listed and candidate species in the USBR's Friant Service Area***—from aerial photos we evaluated over 1,400 parcels for habitat and occurrence of sensitive species in the USBR's Friant Service Area. We then ground truthed identified parcels and conducted sensitive species surveys on all parcels where we were granted access. **Objectives**: to determine distribution and habitats of sensitive species within the Friant Service Area in accordance with the biological opinion for long-term water contract renewals. **Products**: maps and reports; GIS database; CNDDB field forms.

- ***Developed San Joaquin Valley Critical Needs Plan***—we identified and developed an action plan to conserve 14 species within the Central Valley Project area considered to be dangerously jeopardized and in need of immediate actions to prevent extinction. **Objectives**: to prevent further population declines and potential extinction of species in the San Joaquin Valley as required in the biological opinion for long-term water contract renewals for the USBR's Friant Service Area. **Products**: a Critical Needs Plan was developed and submitted to USBR and USFWS.

- ***Developed Recovery Plan for Upland Species San Joaquin Valley***—we developed background information and expertise for development of recovery actions for 34 species included in Plan and 30 others to consider. **Objectives**: develop recovery plans for listed and candidate species of upland communities of the San Joaquin Valley region. **Products**: we completed and delivered the draft Recovery Plan to USFWS for intra-agency review in 1987 and the plan was finalized in September 1998.

- ***Assessed population status of Fresno kangaroo rats on federal (FAA, USBR) and state (Alkali Sink and Kerman Ecological Reserves) properties***—to develop and implement a critical-needs plan for this species, under terms of the Friant B.O.

- ***GIS services for the Recovery Plan for Gabbro soil plants of the Central Sierra Nevada foothills***—assisted USFWS in data analysis and prepared a set of map figures for the plan.

- ***Developed detailed maps of distribution records for listed Vertebrate species***—assembled data and developed distribution, population size [when possible] and size of habitat islands for viability analyses and other recovery efforts.

- ***Wrote brief review papers of poorly-known taxa in San Joaquin Valley***—these were of species to consider for recovery efforts; revisions ongoing as necessary.

- ***Developed background information and expertise for recovery planning***—to develop recovery actions for the total of 34 species in the comprehensive recovery plan and 30 other species to consider.

- ***Conducted viability analyses and draft analyses for selected species***—completed for San Joaquin kit fox and blunt-nosed leopard lizard, drafts for 3 listed kangaroo rats.

- ***Prepared Landsat 7 data for habitat mapping***—preparation of low lost public domain remote sensing data for upland habitat mapping. Data is being made available for download and viewing by DOI agencies

OUTREACH AND COLLABORATIVE EFFORTS

- *Habitat assessment and population status survey for oil nestraw*—objective was to train others and to search for additional populations on NPRs and western Kern County. Surveys were completed by DOE and Occidental Petroleum on NPR-1.

- *Developed survey guidelines for Bakersfield cactus, California jewelflower, Hoover's woolly-star, Kern mallow, San Joaquin woolly-threads*—at request of CDFG.

- *Assisted USFWS with rare-plant conservation strategies*—for Kern County Valley Floor Habitat Conservation Plan. Developed strategies to conserve rare plants on both public and private land; many ESA regulations do not apply to plants on private lands.

- *Assisted interagency team with design and implementation of habitat management studies for giant and short-nosed kangaroo rats in the Lokern Area, Kern Co.*—the team, headed by USGS/BRD also consists of representatives from ESRP, USBLM, and CSU Bakersfield. We participated in study design, conduct the plant studies portion of the project, and contribute field biologists for populations censuses of animals. The study has been ongoing since 1997.

- *Assisted with implementation of habitat management studies of Tipton kangaroo rats and blunt-nosed leopard lizards on Kern NWR Complex*—we assisted USFWS in this study by doing the field censuses in 1995. The study was initiated in 1994 to determine if cattle grazing was beneficial to these species. A wildfire compromised results in 1994 and lack of funding necessitated that ESRP to assist in 1995. The study was dropped after that because of lack of funding to (USFWS Kern Refuge Complex.

- *Assisted with population assessment of Tipton kangaroo rats on Allensworth Management Area*—we assisted the CDFG in their habitat management and population assessment studies by providing field biologists for training CDFG workers and to participate in population censuses.

- *Developed survey guidelines for riparian brush rabbit and riparian woodrat for CDFG*—at the request of CDFG in 1993 These were revised in 2000.

- *Habitat restoration for riparian brush rabbits at San Joaquin River NWR* —provide input on creating areas protected from flooding for brush rabbits to refuge from high water, in preparation for additional habitat restoration and translocation of brush rabbits to the Refuge. This activity is ongoing.

- *Surveyed and assessed habitat for riparian mammals for the first phase of the Kaweah River Corridor Enhancement Study*—a multipurpose, cooperative

demonstration project. ESRP contributed by surveying for riparian mammals and assessing habitat and making recommendations for restoration.

- ***Survey and habitat assessment for upland species in Westlands Water District***—to help resolve drainage issues. ESRP, at the request of USBR, conducted field work to assist Westlands WD.

- ***Assisted with status survey for Arburua Ranch jewelflower***—USFWS funded ESRP to conduct field surveys for this species; CDWR already was conducting surveys, so we assisted them; the species was not found to be jeopardized.

- ***Assisted in biological surveys of the Delta-Mendota Canal and San Luis Canal for USBR***—ESRP did focused surveys on both canals to provide baseline information on occurrence of sensitive species. These data were to be used in interagency consultation and developing management recommendations.

- ***Discussions with the Metropolitan Water District of Southern California***—in April 1994, a representative of Metropolitan Water District (MWD) met with ESRP and USBR staff in Fresno to share information regarding respective conservation missions in the San Joaquin Valley. Our objectives were to define roles and objectives and to devise conservation strategies regionally to deal with conflicting interests. MWD was exploring a commitment to large-scale ecosystem conservation efforts in the San Joaquin Valley. Nothing more came of this meeting.

- ***Special expertise on sensitive and listed species biology provided to CDWR***—for various CDWR projects including their HCP for San Joaquin Valley operations and Kern Fan.

- ***Contributed to the Biological Framework for Natural Lands and Endangered Species in Southern San Joaquin Valley***—developed list of potential specialty reserves, wrote major sections of a white paper or framework document, and participated in several meetings of the Committee. The Committee was in cooperative effort of several state and federal agencies, academics, and individuals whose objectives were to develop conservation strategies for San Joaquin Valley natural communities and sensitive species as an interim measure until recovery plans were approved.

- ***Participated in the San Joaquin Valley Interagency Team***—to create a consortium of local, state and federal agencies and the general public to develop coordinated and cooperative regional strategies to sustain natural and human communities and economies–team disbanded after county supervisors elected not to participate.

- ***Developed cooperative agreement with California Natural Diversity Data Base***—for data sharing and cooperation between CNDDB and ESRP. ESRP

sorted CNDDB records from field forms and digitized field localities and computerized other data, then provided those compilations to CNDDB. CNDDB provides periodic updates of its data bases to ESRP.

- ***Provide technical assistance to USFWS***—we frequently provide species and conservation expertise to USFWS, almost on a daily basis. We also less frequently check on issues in the field for Service and frequently develop maps or provide GIS coverages for use by agency personnel. This is an ongoing activity.

- ***Contributed biological expertise, data gathering and analyses for Central Valley Project Biological Assessment and ESA consultation***—we provided maps and GIS coverages, species accounts, and other information and reviewed components of the information in the assessments for both USBR and USFWS.

- ***Provided technical assistance to USBR South Central California Area Office GIS program***—ESRP provided technical support and gave GIS data to assist in the establishment of new GIS program at USBR Fresno Office.

- ***Prepared maps for western snowy plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Recovery Plan***—prepared a set of 163 detailed maps for USFWS to be used in conjunction with the plan.

- ***Serving on Alternatives Subcommittee, Kern County Valley Floor Habitat Conservation Plan (Ellen Cypher)***—provide input on plant conservation issues.

- ***USBLM Central California Resource Advisory Council (Ellen Cypher)***—term began September 1995, ends August 2001; provide input on conservation issues.

- ***Advised Southern Sierra Foothill/San Joaquin Valley Land Trusts Coalition***—provided detailed input on conservation issues.

- ***Consult on Carrizo Plain Natural Area biological and habitat management issues***—provide input on conservation issues and grazing management. This is an ongoing, periodic activity.

- ***Served on Elk Hills Endangered Species Advisory Committee***—provided input on plant conservation issues until Naval Petroleum Reserve #1 was sold to Occidental Petroleum in 1998.

- ***Developed and maintain ESRP web site***—web site chosen site of the day by New Scientist and awards from other organizations; web site mostly used by students of all levels.

- ***Provided technical assistance to USEPA, CEPA, and CDFG***—on pesticide regulations, species distributions and natural histories, and pesticide application

practices, and collected tissue samples of San Joaquin kit foxes for use in pesticide studies by CDFG and other agencies. We have given detailed input on distributions of listed kangaroo rats, riparian brush rabbits, blunt-nosed leopard lizards, and riparian woodrats and have been consulted in detail over designing bait stations (rodenticides) for use in areas occupied by listed species. Collection of tissues from San Joaquin kit foxes that die or are killed by vehicles is ongoing.

- ***Served on Technical Committee for San Joaquin Valley Drainage Implementation Program***—between June 1997 and March 1998, ESRP staff members served on the interagency Technical Committee which reviewed the status of recommendations in the San Joaquin Valley Drainage Program 1990 Management Plan. **Products**: a series of technical reports was produced in this important effort. ESRP staff were primarily involved with a chapter on the biological consequences of land retirement for wildlife.

- ***Organized multi-agency effort to protect and restore riparian habitat on the Kings River, Fresno Co.***—Enlisted CDT, Fresno County, and USCOE in implementing a restoration project for habitat for riparian brush rabbits. USBR and Fresno Co. will provide contiguous parcels of lands they own (separately).

- ***Gave field orientation to new CDFG Region 4 botanist and USFWS botanist regarding southern San Joaquin Valley and Carrizo Plain plant issues and natural areas***—gave field tour of Sand Ridge, Lokern, and Carrizo Plain to introduce new agency staff to listed plants and issues.

- ***Assisted USBR in drafting and reviewing Interim Operations and Maintenance Plan***—ESRP provided species distribution information and maps and information on species life histories, suggested management and avoidance measures, and reviewed drafts of the document.

- ***School presentations and student involvement***—provide numerous presentations to K-12 schools and colleges in Fresno, Kern and Stanislaus counties; an ongoing activity.

- ***Judged science fair projects and sponsored awards***—several ESRP staff members judged science projects at the Central California Regional Science, Mathematics & Engineering Fair in Fresno in 1997, 1998, 1999 and 2000, and Kern County Science Fair in 2000. ESRP also sponsored a special award, an ecology or conservation biology textbook, for the student project that had the most relevance for conservation science

- ***Provided on-site orientation and advice to California Department of Fish and Game and landowner on Bakersfield cactus conservation***—regarding an important Bakersfield cactus population identified in one of the Land Acquisition Evaluations.

- ***Provided input to California Native Plant Society on status of plants to be included in the 6th edition of the Inventory of Rare and Endangered Plants of California***—attended interagency meeting of Sierra-San Joaquin botanists to discuss which plants should be retained on CNPS Lists 1B, 2, or 4; moved from one list to another; or dropped from the CNPS list of rare plants.

- ***Presentations to professional organizations and at universities***—ESRP staff have given more than 77 presentations at scientific meetings and in university seminars and symposia about the program and results of research projects

- ***Students and interns supported by ESRP***—support includes hiring of undergraduate interns, graduate students, and partially or wholly supporting the research of graduate students, or providing them with data or research material. Included are: Thomas Angel, CSUS, Ellen Bean, UMN; Howard Clark, CSUF; Gwynne Corrigan, UCSC; Roberta Fargo, CSUF; Sara Good, PSU; Laurissa Hamilton, UCD; Christine Van Horn Job, CPSUSLO; Connie Lee, CSUS; Rhianna Lee, CSUS; Cristina Lopez, CSUF; Jill Lujan, CSUF; Marjorie Matocq, UCB; Patrick Medve, EHS; Patrick Morrison, FCC & CSUF; Sean Mullins; CSUS; Scott Phillips, CSUF: Robert Robertson, UCB; Michael Schwartz, UM; Elaine Sheehan; NUIC; Justine Smith, CSUF; Ahmed Soliman, CSUF; Richard Ybarra, CSUF; Alicia Villegas, CSUF.

- ***Postdoctoral researchers supported by ESRP***—ESRP supported the postdoctoral research of Dr. Sabine Loew at the Smithsonian Institution on giant kangaroo rat genetics; and a postdoctoral appointment of Dr. Ross Goldingay to ESRP to assist with kangaroo rat conservation and developing conservation strategies for recovery planning; Dr. Goldingay is now at Southern Cross University in Australia.

LIST OF ACRONYMS

AEWSD, Arvin-Edison Water Storage District
CEC, California Energy Commission
CDFG, California Department of Fish and Game
CDWR, California Department of Water Resources
CDT, California Department of Transportation
CNLM, Center for Natural Lands Management
CPSUSLO, California Polytechnic State Univ., San Luis Obispo
CSUF, California State Univ., Fresno
CSUS, California State Univ., Stanislaus
CVPCP, Central Valley Project Conservation Program
CVPIA Central Valley Project Improvement Act
CWA, California Waterfowl Association
D&M, Dames and Moore
DCLTRA, Deer Creek Lower Tule River Authority
DEID, Delano-Earlimart Irrigation District
DOI, Department of the Interior
EDF, Environmental Defense Fund
EG&G, EG&G Measurements
EHS, Edison High School, Fresno
ESRP, San Joaquin Valley Endangered Species Recovery Program
FWUA, Friant Water Users Authority
ISU, Illinois State Univ. (Sabine Loew)
JSA, Jones & Stokes Associates
NSF, National Science Foundation
NUIC, National University Ireland, Cork
PCFFA, Pacific Coast Federation of Fisherman's Associations
PRBO, Point Reyes Bird Observatory
SERCAL, Society for Ecological Restoration-California Chapter
SI, Smithsonian Institution (K. Ralls, R. Fleischer)
TCFB, Tulare County Farm Bureau
TNC, The Nature Conservancy
TWS-SJ, The Wildlife Society-San Joaquin Chapter
UA, Univ. Adelaide, Australia
UCB, Univ. California, Berkeley
UCD, Univ. California, Davis
UCCE, Univ. California, Coop. Extension
UCR, Univ. California, Riverside
UCSB, Univ. California, Santa Barbara
UCSC, Univ. California, Santa Cruz
UM, Univ. Montana
UMN, Univ. Minnesota
USBLM, U.S. Bureau of Land Management
USBR, U.S. Bureau of Reclamation
USCOE, U.S. Army Corps of Engineers
USDA, U.S. Dept. of Agriculture
USDOE, U.S. Department of Energy
USFS, U.S. Forest Service
USFWS, U.S. Fish and Wildlife Service
USGS/BRD, U.S. Geological Survey, Biological Resources Division
USNRCS, U.S. Natural Resources Conservation Service (formerly Soil Conservation Service)
WWD, Westlands Water District

TABLE OF ESRP ACCOMPLISHMENTS, ONGOING AND INITIATED PROJECTS

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000 (Acronyms are defined at the end of the table)

Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Ongoing and Initiated Projects			
Population Censuses of Riparian Brush Rabbits and Woodrats (since 1997, annual census in January at Caswell MSP at two sites for 7 days each; previous census in 1993 using same protocols.)	CDPR*, CDFG*, CVPCP*	Jan 1993	ongoing
Population Censuses of Giant and Short-Nosed Kangaroo Rats on the Elkhorn Plain, San Luis Obispo Co. (since 1987; censuses annually on grazed and nongrazed plots in for 6 consecutive days in April and August.)	CDFG*, USBR*, USBLM, TNC	Jul 1987	ongoing
Population Censuses of Blunt-Nosed Leopard Lizards and Coast Horned Lizards, Elkhorn Plain, San Luis Obispo Co., and Pixley NWR, Tulare County (10-day censuses in spring [generally May to early June] and summer [August] on 8-acre grazed and nongrazed plots on the Elkhorn Plain and one 9-hectare plot at Pixley NW since Jan 1993.)	CDFG*, USBLM*, TNC*	Jun 1988	ongoing
Population Censuses of Tipton and Tulare kangaroo rats at Pixley NWR, Tulare Co. (quarterly censuses on one 4.4-hectare plot.)	USFWS	Jan 1993	ongoing
Periodic Population Assessments of Bakersfield Cactus, California Jewelflower, Kern Mallow, San Joaquin Woolly-threads (at Carrizo and Elkhorn Plains, San Luis Obispo Co., and Lokern, and Sand Ridge, Kern County. Assessments were conducted in 1993. Project is on-going. Additional assessments will be conducted as soon as environmental conditions and staffing levels permit.)	CNLM, USBLM, USFWS	1993	ongoing
Population Estimates of Palmate-Bracted Bird's Beak at Alkali Sink Ecological Reserve, Fresno Co. (conducted once every 5 years following seasons of above-average rainfall)	CDFG	1998	ongoing
Measuring Net Primary Productivity of Annual Plants, Elkhorn Plain, San Luis Obispo Co. (productivity measured in late spring on grazed and nongrazed plots on and off of giant kangaroo rat burrow systems. Objectives are to determine amount of forage eaten by cattle at the end of the green season and the differences in productivity on and off giant kangaroo rat burrow systems)	CDFG, USBLM, TNC	1988	ongoing
Measuring Net Primary Productivity of Annual Plants, Lokern, Kern Co. (vegetation transects and plant productivity sampling in conjunction with habitat management research. Objectives are to provide data on vegetation response to annual precipitation patters and population dynamics of listed plants, especially Kern mallow and listed animals at the site)	CDFG, USBLM, USGS/BRD, CDWR, USBR*, CNLM	Feb 1997	ongoing
Ecology and Habitat Management for Kern Mallow (to determine if livestock grazing is beneficial for Kern mallow, the effects of competition with exotic annual grasses, the effects of mulch on germination and growth, and search for new populations at Lokern and CNLM lands; data were collected on study plots in 1997, 1998, 1999, and 2000. Study is on-going)	CDFG, USBLM, USGS/BRD, CDWR, USBR*, CNLM	Feb 1997	ongoing

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Ongoing and Initiated Projects			
Ecology and Habitat Management for Giant and Short-Nosed Kangaroo Rats (on Elkhorn Plain, San Luis Obispo Co.; populations responses measured on grazed and nongrazed plots biannually; reproduction and demography measured by monthly trapping for 3-5 days for 3-year period.)	CDFG, USBLM, TNC	Jul 1987	ongoing
Ecology and Habitat Management for blunt-nosed leopard lizards (on Elkhorn Plain, San Luis Obispo Co.; populations responses measured on grazed and nongrazed plots biannually; reproductive and demographic parameters measured by weekly captures during 2-year period)	CDFG, USBLM, TNC	Jun 1988	ongoing
Habitat Management and Restoration for Riparian Brush Rabbits and Riparian Woodrats (developed fire and flood management plan; implemented fuel reduction and vegetation renewal with CCC labor from CVPCP; CDPR killing and removing nonnative trees; implementing fire protection. Monitoring is ongoing.	CDFG*, CDPR*, USFS*, USBR*, CVPCP*	1997	ongoing
Distribution and Population Status of Kern Mallow (objectives are to periodically look for new populations of this species. Products include updated maps and NDDB records for the species when new information is found)	USBLM, NBS/BRD, CDFG, CNLM	Feb 1997	ongoing
Distribution and Population status of Fresno Kangaroo Rats (various searches prior to Feb 1988 with ESRP leading since 1992; all public and permitted private lands surveyed ≥once; additional private land with permission; surveyed about 5,000 acres in western Madera Co. under contract to Jones & Stokes Associates. No Fresno kangaroo rats captured since Oct. 1992)	CDFG*, USBR*, JSA*	1988 (Jul 1992, USBR)	ongoing
Distribution (Historic and Current) and Population Assessment of San Joaquin kit fox (with emphasis on the northern portions of the range, parts of San Benito and Monterey Counties; and a rigorous population estimate for the Carrizo Plain Natural Area has been completed by K. Ralls et. al.; northern range study field work completed, report in preparation)	CDFG, CDWR*, USBLM, SI, UMN	Jan. 1997	ongoing
Distribution and Habitat Assessment for Buena Vista Lake Shrews (draft report prepared and in revision, 12/00; two new populations found at Kern Fan and Coles Levee Preserve)	CVPCP*, USBR, CDFG, USFWS	May 1998	Sep 2000

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Ongoing and Initiated Projects			
Distribution and Habitat Assessment for Riparian Brush Rabbits and Woodrats (a periodic, ongoing activity; repeated earlier (1983-1986) surveys on Stanislaus River, plus all other accessible properties with potential habitat; surveys continue as we gain access to property. Over 40 parcels evaluated for locating controlled propagation facility. Additional populations of both species have been located during these efforts.)	CDFG*, USCOE, CDPR, USFWS, private property owners	Jan 1997	ongoing
Vernal Pool Recovery Plan Development (writing species accounts and recovery objectives for 28 vernal pool plants and 9 animals of the Central Valley and coast. Initial drafts of species accounts and conservation strategies were completed in 1997. After technical review, drafts were revised and updated in 2000)	USFWS*	1997	ongoing
Sierran Foothill Plants Recovery Plan Development (preparing entire recovery plan for at least 14 plants of the southern Sierran foothills)	USFWS*	2000	ongoing
Recovery Planning for the San Joaquin Kit Fox (population modeling, GIS-based modeling of available potential habitat, and results of studies of use of urban and agricultural areas, population genetics, and population estimates to develop more refined, area-specific recovery strategies for the San Joaquin kit fox)	USFWS*	2000	ongoing
Recovery Planning for the Riparian Brush Rabbit and Riparian Woodrat (interagency effort to implement recovery; includes developing plans and permits to carry out controlled propagation and translocation, restore and manage habitat; protect habitat from complete flooding and wildfire)	USFWS, CDFG*, CDPR, USBR*, USCOE	1998	ongoing
Developed Geographic Information Systems Capability for San Joaquin Valley Ecosystems (assembled, integrated and mapped numerous layers of information to help develop conservation strategy for recovery; ongoing effort to keep databases current)	CDFG, USBR*, USFWS*	1994	ongoing
Modeling Alternate Farmland-Retirement Strategies for Restoring San Joaquin Valley Ecosystems (multidisciplinary analysis including modeling economics, San Joaquin kit fox population viability, and drainage problem reduction)	NSF*, UCB, UCD, UCR, UCSB UCSC, UMN, SI	Feb 1997	ongoing
Ecology of Kit Foxes on Irrigated Farmland (to determine crops and cultural practices conducive to use by kit foxes, diet, denning sites and structures, reproduction, survival, movement patterns, and dispersal; artificial dens installed in Paramont Farms farmland under safe harbor agreement between USFWS, ESRP, and Paramont with assistance of Environmental Defense)	CDFG*, CDWR, USBR*, Environmental Defense*, Nature Restoration Trust*, Paramont Farms	Mar 1997	ongoing

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Ongoing and Initiated Projects			
Ecological Interactions of Kit Foxes and Red Foxes (a component of the work on kit foxes on farmland, this masters's degree study by Howard Clark looks at the potential adverse interactions between nonnative red foxes and kit foxes–red foxes may have a significant negative impact on kit fox survival and hence complicate recovery of kit foxes)	CDFG*, USBR*, CDWR, private landowners	1998	2001
Ecology of Urban Kit Foxes (to determine population size, diet, movements, denning structures, reproduction, sources of mortality, and survival of foxes in metropolitan Bakersfield; Data collection was initiated in 1997. Demographic and ecological data have been collected continuously since 1997, and will continue for 2-3 years. Project is on-going)	CDFG*, USBR (ESRP)*, USBLM*, CSU Humboldt	May 1997	ongoing
Use of Friant-Kern Canal Corridor by Kit Foxes (to survey for kit foxes along the FKC and to determine if kit foxes use the FKC corridor to fulfill life history requirements)	USBR*	2000	ongoing
Population Genetics of the San Joaquin Kit Fox (to determine number of recognizable populations and their degree of isolation, effective population movements, and barriers to interpopulation movements, and to develop a rapid, definitive DNA test to discriminate fox species from scat. Project field and lab work completed, though some populations were not sampled because of lack of captures. Draft final report and in press manuscript; data analysis and interpretation for some aspects of study in progress)	CDWR*, CDFG*, USBR*, SI* (K. Ralls and R. Fleischer), USDOE	Jan 1998	ongoing
Population Genetics and Biogeography of San Joaquin Kangaroo Rats (to determine the phylogenetic relationships of the three described subspecies of San Joaquin kangaroo rats [*Dipodomys nitratoides*] and the taxonomy of several isolated populations of the species in areas where two or more of the subspecies may occur; to identify unique genetic units of the species' fragmented populations for conservation purposes)	USBR*, UCB*, CDFG	1994	ongoing
Population Genetics of Giant Kangaroo Rats using Mitochondrial and Microsatellite DNA (an extension of studies using mitochondrial DNA to determine number and degree of isolation of populations, effective population size, effective interpopulation dispersal; mtDNA paper published; msDNA in prep.)	ESRP*[1], SI* (K. Ralls, R. Fleischer), ISU (Sabine Loew)	Jun 1993	Sep 2001

[1] Funds ESRP raised from sources other than state and federal agencies

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Ongoing and Initiated Projects			
Genetic Structure and Phylogenetic Relationships of Riparian Brush Rabbit Populations (geographic variation of genetic of populations; developing techniques and primers to amplify microsatellites for genetic analysis; objectives to be able to identify individual relationships among rabbits produced in controlled propagation and to measure phylogenetic relationships of isolated popuations of riparian brush rabbits and other subspecies nearby; field and lab work in progress)	USBR; CSUS*	Apr 2000	Sep 2001
Genetics of Riparian Woodrats (determine relationship of riparian subspecies to the others of the species; determine amount of inbreeding in riparian population; provide data for planning and implementing translocations establishing new populations)	UCB*, USBR*	1998	ongoing
Biological Survey of San Justo Reservoir, San Benito Co., San Felipe Division (surveys of USBR property at San Justo Reservoir, the Pacheco and Coyote Pumping Plants, the Pacheco, Santa Clara, and Hollister Conduits, and other locations in the San Felipe Division. We continue to consult with USBR on this project regarding a threatened population of California red-legged frogs at the base of a dam where repairs to dam components are being conducted.).	USBR*	May 1997	ongoing
Biological Survey of Millerton Reservoir (surveys for plants, amphibians, and reptiles have been completed on USBR and CDPR lands surrounding Millerton Lake for baselline information for Resource Management Plan and other environmental planning. Additional surveys for mammal species are to be performed beginning in fall 2001. Final reports will be submitted prior to 2001.)	USBR*, CDPR*	Jan 1998	ongoing
Monitoring Mammalian Species Succession on Recently Restored Riparian Habitat at Grayson River Ranch (periodic population monitoring on riparian and wetland communities restored by the Tuolumne River Trust on private land)	CalFed*, Tuolumne River Trust, private landowner	Oct 2000	Oct 2006
Developing Database of Bat Calls and Bat Activity at Selected Field Sites (all bat species in California are in decline and several are candidates for listing or species of special concern; our work will provide a baseline of species abundance and activity for future reference at selected sites)	ESRP[2]	Aug 1998	ongoing

[2] Equipment purchased by ESRP with funds from non-governmental sources

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		Start	End
Ongoing and Initiated Projects			
Developing 1:100,000 base maps of project area (each map copies the coverage of USBLM's 1:100,000 surface ownership maps, showing cities, roads, canals, topography, agriculturally-developed and natural lands, and, as needed, species distribution records, including documentation. Maps can be created in this format showing any of the available coverages as well as species occurrence records).	CDFG, USBR*, USFWS*	1994	ongoing
Compiling On-Line Literature Database (for listed and sensitive species of central California; converted Endangered Species Information System to PC textbase database and added to existing on-line literature databases; converted other databses to system; compilation of literature is an ongoing task)	USBR, USFWS, USBLM	Jul 1992	ongoing
Established and Maintain Global Positioning System (GPS) Public Reference Station (maintenance of Trimble Community GPS reference station and distribution of reference files through a public internet site. Currently the only known public reference station in the San Joaquin Valley. Users include federal and state agencies, farmers and private companies. Equipment donated by Trimble Navigation Ltd. through CTSP grant, assistance with setup and surveys donated by CSU Fresno, Dept. of Survey Engineering; facility located at USFS Forestry Science Lab in Fresno)	Trimble Navigation Ltd.* ESRI*, CTSP, USFS, CSUF	Mar 1998	ongoing
Integration of Data on Detailed Land Cover/Land Use into GIS (integration of and maintenance of detailed land use and land cover data from federal and state data sources)	USBR*, USFWS	July 1998	ongoing
Integration of Detailed Elevation and Topographic Data into GIS (preparation of a 1:24,000 digital elevation model for various mapping and modeling projects)	USBR*, USFWS	Mar 2000	July 2000
Updates to GIS data for Recovery Plan for Upland Species of the San Joaquin Valley (ongoing maintenance and updates for GIS data used to develop the plan. New items include integration with the California Natural Diversity Database and the development of an intranet based bibliographic database for all occurrence records used in the plan.)	USFWS*, USBLM	Nov 1995	ongoing
GIS Support and Data Analysis for Vernal Pool Recovery Plan (developing database and GIS coverages and maps for use in vernal pool recovery planning)	USFWS*	July 2000	ongoing
Developing GIS Support for Recovery Criteria for the Foothill Plants Recovery Plan (mapping plant communities, their sizes, and linkages for recovery planning)	USFWS*	Sep 2000	ongoing

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		Start	End
Ongoing and Initiated Projects			
Mapping Topographic Ruggedness for San Joaquin Kit Fox Habitat (extending USDOE terrain and habitat studies range-wide using GIS and digital elevation model)	USDOE, USFWS	Oct 2000	ongoing
Mapping Public Land Ownership for San Joaquin Valley (integration and update of GIS data from federal, state, and county agencies to update public land maps from the SJV Upland Recovery Plan)	USBR, USFWS, USBLM	Nov 1998	ongoing
GIS and Database Support for DOI Land Retirement Demonstration Project (GIS and database support for restoration project)	USBR, USBLM, USFWS	July 1998	ongoing
Study of History and Rates of Agricultural and Urban Conversion of Natural Communities on the San Joaquin Valley floor (in this "unfunded study" we have assembled data from county agricultural departments, other historical records, and aerial photos. As time and resources permit, we are ground truthing identified natural lands and classifying their plant communities, collating and interpreting information.)		1994	ongoing
Habitat Management for Riparian Brush Rabbit and Riparian Woodrat (this project provided strategies and recommendations for the following items: 1) a fire management plan, 2) methods to monitor and reduce fuel levels, and 3) creation of refugia to act as safe harbors in the event of flooding of the Park. Fuel reduction in Caswell Memorial State Park, San Joaquin Co. was accomplished in 1999-2000 by the California Conservation Corps (CCC) with funding from the CVPCP and supervision by ESRP. Plots were established to monitor succession of plants where dead trees and accumulated downed woody material was removed. Plots will be monitored annuallyif funding is provided.)	CDPR, CDFG, USBR*, USFWS, CCC	1997	ongoing
Controlled Propagation of Riparian Brush Rabbits (to establish confined populations in 1 to 1.5-acre enclosures of natural vegetation serving as habitat for brush rabbits for purposes of producing offspring that can be translocated to restored and protected sites within the species historical geographic range. Planning for this project has been ongoing since 1998. Funding to build pens for controlled propagation was provided in Fiscal Year 2000.)	CDFG*, CDPR, CDWR, USBR*, USFWS	1998	ongoing

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		Start	End
Ongoing and Initiated Projects			
Land Retirement Demonstration Program (biological monitoring of the effects of agricultural land retirement in addition to designing, implementing, and monitoring habitat restoration experiments; objectives are to monitor the effects of land retirement and test various habitat restoration strategies in a scientifically rigorous manner prior to retirement of thousands of acres of land under the CVPIA Land Retirement Program. Other objectives are to monitor succession of the natural community through natural dispersal and to develop and test methods for reestablishing target species that cannot recolonize the parcels naturally because of isolation.)	USBR*, USBLM, USFWS, CDWR	1998	2003
Study of History and Rates of Agricultural and Urban Conversion of Natural Communities on the San Joaquin Valley Floor (in this "unfunded study" we have assembled data from county agricultural departments, other historical records, and aerial photos. We are ground truthing identified natural lands and classifying their plant communities, collating and interpreting information to provide a composite history of extent and distribution of natural communities in the San Joaquin Valley and document their conversion by humans.)		1995	ongoing

TABLE OF ESRP ACCOMPLISHMENTS, ONGOING AND INITIATED PROJECTS

TABLE OF SCCAO ACCOMPLISHMENTS THROUGH DECEMBER 2000 (Acronyms are defined at the end of the table)

Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Inactive and Proposed Projects			
Periodic Population Monitoring of Giant Kangaroo Rats Range-wide (active burrow systems were counted on 60 500 by 10-meter belt transects spread over public lands withing range of species. The plant community was measured on a 100-m transect on each plot using the California Native Plant Society's community description protocol. Two mulch samples were taken on each plot to measure existing standing crop. No monitoring has been conducted since establishing plots due to lack of funding. Repeated estimates from transects are needed for delisting species.)	CDFG*, USBLM	1995	on hold
Study of Root Hosts for Palmate-Bracted Bird's-Beak (palmate-bracted bird's-beak is a hemiparasite, which requires connections to the roots of other plants for survival and reproduction. Objectives are to determine which plants serve as root hosts for palmate-bracted bird's-beak at Alkali Sink Ecological Reserve, Fresno Co. A nearest-neighbor analysis was conducted in 1999 at Alkali Sink Ecological Reserve, Fresno Co., suggesting that either rusty molly (*Kochia californica*) or seepweed (*Suaeda moquinii*) is a likely root host. Study is unfunded.)	CDFG, CSUF	1999	pending
Population Expansion of Palmate-Bracted Bird's-Beak in the San Joaquin Valley (to increase population size and viability of palmate-bracted bird's beak on only public property in the San Joaquin Valley to contribute to recovery criteria. ESRP/CDFG have applied to USFWS for funds to attempt expansion of the palmate-bracted bird's-beak population within Alkali Sink and to Kerman Ecological reserves in Fresno Co.	CDFG, USFWS	proposed 2001	pending
Management of habitats for Vasek's Clarkia (surveys and control of competitors for this species from the Transverse Range in Kern Co. We projected to start in Spring 1997 but have yet to obtain permission from private landower's to work on their properties; we continue to work on access for essential recovery tasks.)	USBR*	1997	on hold
Seed Banking for Vasek's Clarkia (no progress. Access to Tejon Ranch denied)	CVPCP*[3], USBR	Apr 1998	on hold
Designed Habitat Management Studies for California Jewelflower, San Joaquin Woolly-threads, and Hoover's Woolly-star (preliminary data were collected in 1993. Not funded after 1993.)	USBLM, USGS/BRD	1993	on hold

[3] Funding from CVPCP for seed banking

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Inactive and Proposed Projects			
Management of habitats for Bakersfield smallscale and Buena Vista Lake shrew (determine through adaptive management, habitat management protocols to maintain populations of wetland-dependent smallscale and shrews at historical Kern Lake, Kern Co., and to aid planning for habitat restoration and relocation to the Kern Fan area. We were unable to obtain access to private land at Kern Lake. We periodicallly seek access. Funds to initiate this project were diverted to surveying other potential habitat for Buena Vista Lake shrews.)	CVPCP	May 1998	on hold
Demography of Palmate-Bracted Bird's Beak in the San Joaquin Valley (study focused on Alkali Sink Ecological Reserve; Demographic data were collected in 1998. No data were collected in 1999 due to a lack of manpower. Additional demographic data were collected in 2000. Project is on-going)	USBR*, CDFG	Apr 1998	ongoing

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Completed Projects			
Annual Vegetation Sampling at Lemoore Naval Air Station (vegetation transects sampled according to California Native Plant Society protocol to determine plant species composition, overall cover, and response to grazing, burning, and no treatment. Plant productivity sampling on each livetrapping grid [for kangaroo rats])	USN*, USBR, USBLM	1994	1999
Habitat Management and Population Ecology for Fresno/Tipton Kangaroo Rats (to determine if prescribed burning is beneficial in maintaining habitat for kangaroo rats, demographic parameters relative to environmental variation with annual vegetation sampling at Lemoore Naval Air Station; habitat management plan submitted to US Navy, Jan. 2000)	USN*, USBR, USBLM, CVPCP*	1994 quarterly	2000
Kern Mallow Genetic Samples (collected specimens in 1999 to be used for systematic study funded by U.S. Fish and Wildlife Service)	USFWS	1999	1999
Land Acquisition Evaluations for 3 Plant Speciality Reserves (two Land Acquisition Evaluations and one Conceptual Area Plan was prepared for CDFG between May 1998 and September 1999)	CDFG*[4]	May 1998	May 1999
Seed Banking of Palmate-Bracted Bird's-Beak (collected approximately 7,000 seeds from Alkali Sink Ecological Reserve, Fresno Co., deposited them in long-term storage at Rancho Santa Ana Botanic Garden.)	CDFG, RSABG	1998	1998
Seed Banking Surveys for Keck's Checkerbloom (seeds were collected in 1998 and 1999. The seeds were deposited at the Rancho Santa Ana Botanic Garden.	CVPCP*, USBR	Apr 1998	May 1999
Surveys for Keck's Checkerbloom (surveyed USBR property and rediscovered population thought to be extinct; assisted USBLM with surveys and two small populations were found on private lands which has since been acquired by the Sierra Foothill Conservancy. This species was listed in 2000 which precluded seed collection on public land without a permit. Permission was not granted to collect seed from populations on private lands.)	CVPCP*, USBR, private land owners	Apr 1998	May 1999
Effect of Mulch on Species Composition in Lokern, Kern Co. (compared plant species composition on plots from which mulch had been removed and control plots)	CNLM, USBR	1996	1997
Effect of Sheep Grazing on Kern mallow (monitored 86 plots on Center for Natural Land Management property, Lokern, Kern Co., to evaluate effects of sheep grazing on Kern mallow)	CNLM, USBLM*	1994	1995

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Completed Projects			
Developed Literature Review of Effects of Highways on San Joaquin Kit Foxes (completed and filed final report with CDT--Cypher, B. L. 2000. Effects of roads on San Joaquin kit foxes: a review and synthesis of existing data. Endangered Species Recovery Program, Fresno, California. 59 pp.)	CDT*	Jan 200	Sep 2000
Kit Fox Use of Highway Crossing in Santa Nella Area (to determine if and how much kit foxes use culverts and other undercrossings to cross busy, multilane highways. We conducted a 3 year evaluation of kit fox movements and an analysis of kit fox use of crossing structures in the Santa Nella Area using spotlighting, tracking plates, camera stations, and kit fox trapping and radio-telemetry. A draft report has been prepared and submitted to CDT for review. A final draft will be submitted prior to 2001)	CDT*, USBR	Jun 1997	2000
Kit Fox in the Panoche Region in Western Fresno and Eastern San Benito Counties (to develop quantitative estimates between spotlight survey sightings and population size, estimate population and habitat sizes, and monitor movement between natural and agricultural land. Study was curtailed here because of radio telemetry interference and other factors and a new study started at Lost Hills–Kit Fox Ecology on Irrigated Farmland)	USBR*, private landowners	1995	1996
Survey and Habitat Assessment for Doyen's Dune Weevil (conducted for Doyens dune weevils (DDW) on the only site where they are known to occur. Additional sites that potentially harbor DDW were surveyed and assessed once permission from landowners was obtained)	CVPCP*, USBR, CDT, private landowners	Apr 1997	May 2000
Habitat and Population Assessment for Giant Kangaroo Rats in USBLM's Hollister Resource Area (located and counted active burrow systems in all colonies of giant kangaroo rats in Fresno and San Benito counties, assessed habitat; CDFG final report published.)	CDFG*	Jul 1993	Jun 1994
Community and Habitat Relationships of Giant Kangaroo Rats on Carrizo Plain Natural Area (sampled giant kangaroo rat burrow systems to inventory and determine community and habitat relationships, CDFG Report 1994; manuscript for refereed publ. drafted)	CDFG*	Jul 1992	Jun 1993
Wetland Delineations and Biological Surveys along State Route 49 in Madera County (a report for surveys conducted along Highway 49, Mariposa County" was produced in January 1999 and accepted by CDT)	CDT*[4]	Apr 1998	Jan 1999

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Completed Projects			
Biological Assessment for sensitive species along Highway 41, Kings County (we surveyed a 4.5 mile stretch of Highway 41 from Jackson Avenue to the Highway 198 overpass in late summer 1999 to assess the presence of sensitive species in and adjacent to the CDT Right-Of-Way. A final report was submitted in July 2000.)	CDT*	Jun 1999	Jul 2000
Wetland Delineations and Biological Surveys along State Route 165 in Merced County (we conducted wetlands delineations and biological surveys, focusing on sensitive resources, along a 12 mile stretch of Highway 165. A 179 page document (plus appendices) entitled "Modified Natural Environmental Study Report for surveys conducted along State Route 165, Merced County, California" was produced in September 2000 and accepted by CDT)	CDT*	Jun 1999	Sep 2000
Surveys for Giant Garter Snakes at the Mendota dam (surveys for giant garter snakes following standard protocols for a construction project near Mendota Dam along the San Joaquin River, Fresno Co.)	USBR	2000	2000
Digitized Küchler Natural Communities of California (estimated historical extent of each, extent of conversion to agriculture and urban use, percentage loss of each community and ground-truthed estimates of existing natural lands by communities)	USBR	1997	1997
Identified Potential Habitat for Listed and Candidate Species (in USBR's Friant Service Area, evaluated habitat on 1,400 parcels and assessed USBR properties)	USBR	1992	1995
Developed Critical Needs Plan for San Joaquin Valley Region (for 13 San Joaquin Valley endemic species for the USFWS)	USBR	1992	1996
Developed Recovery Plan for Upland Species of the San Joaquin Valley (developed background information and expertise for development of recovery actions for 34 species included in Plan and 30 others considered; completed and delivered the draft Recovery Plan to USFWS for intra-agency review; plan finalized Sep 1998)	USBR, USFWS, CDFG, USBLM	Jul 1992	Sep 1998
Data Analysis and Map Development for Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada Foothills (assisted USFWS in data analysis and prepared a set of map figures for the plan)	USFWS*	Apr 1998	Jan 1999
Population Assessment of Fresno Kangaroo Rats (To develop and implement a Critical Needs Plan for this species on federal and state lands under terms of the Friant Biological Opinion)	USBR, FAA, CDFG	1991	1994

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Completed Projects			
Developed Detailed Maps of Distribution Records for Listed Vertebrate Species (developed information on distribution, population size [when possible] and size of habitat islands for viability analyses and other recovery efforts)	USBR	Aug 1992	Sep 1997, revisions ongoing
Brief Review Papers of Poorly-Known Taxa (developed to consider for recovery efforts; revisions ongoing as necessary)	USBR	Aug 1992	Dec 1993
Background Information and Expertise for Recovery (to develop recovery actions for the total of 34 species in the comprehensive recovery plan and 30 other species to consider)	USBR	Jul 1992	Sep 1996
Viability Analyses and Draft Analyses for Selected Species (completed for San Joaquin kit fox and blunt-nosed leopard lizard, drafts for 3 listed kangaroo rats)	USBR	1993	1998
Prepared Landsat 7 Data for Habitat Mapping (preparation of low lost public domain remote sensing data for upland habitat mapping. Data is being made available for download and viewing by DOI agencies).	USFWS	May 2000	Nov 2000

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Outreach and other Collaborative Efforts			
Habitat Assessment and Population Status Survey for Oil Nestraw (trained others and to search for additional populations on NPRs and western Kern County; surveys were completed by DOE and Occidental Petroleum on NPR-1.)	USBLM, USBR, USDOE, CSUF	1996	1996
Developed Survey Guidelines for Bakersfield Cactus, California Jewelflower, Hoover's Woolly-star, Kern Mallow, San Joaquin Woolly-threads (at request of CDFG)	CDFG	1994	1994
Assisted USFWS with Rare Pant Conservation Strategies (for Kern County Valley Floor Habitat Conservation Plan)	USFWS		1995
Assisted in Designed and Implementation of Habitat Management Studies for Giant and Short-nosed Kangaroo Rats (lead by USGS/BRD, project implemented by USBLM USGS/BRD)	USBLM, USGS/BRD	1998	ongoing
Assisted in Implementing Habitat Management Studies of Tipton Kangaroo Rats (on Kern NWR Complex; Kern NWR Co.–Tipton kangaroo rat project at Pixley NWR delayed for lack of funds and time)	USFWS	1995	1995
Assisted with Population Assessment of Tipton Kangaroo Rats (on parcels in the Allensworth Management Area; CDFG initiated and continues to assess populations)	USBR, CDFG	1996	1996
Developed Survey Guidelines for Riparian Brush Rabbit and Riparian Woodrat (at request of CDFG; revised 2000)	CDFG	1993	1993
Habitat Restoration for Riparian Brush Rabbits at San Joaquin River NWR (to provide input on creating areas protected from flooding for brush rabbits to refuge from high water, in preparation for additional habitat restoration and translocation of brush rabbits to the Refuge. This activity is ongoing.)	USFWS, USBR	2000	ongoing
Survey and Habitat Input for First Phase of Kaweah River Corridor Enhancement Study (a cooperative effort for a multi-purpose demonstration project)	USBR	1992	1993
Survey and Habitat Assessment for Upland Species in Westlands Water District (to help resolve drainage issues)	USBR, WWD	1996	1996

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		Start	End
Outreach and other Collaborative Efforts			
Assisted with Status Survey for Arburua Ranch Jewelflower (CDWR conducted surveys)	USFWS*, CDWR*, USBR, USBLM	Apr 1998	Jul 1999
Biological Survey of Delta-Mendota Canal and San Luis Canal (focused surveys on both canals to provide baseline information on occurrence of sensitive species. These data were to be used in interagency consultation and developing management recommendations.)	USBR	Jan 1998	Sep 1998
Discussions with The Metropolitan Water District of Southern California (to define roles and objectives and to devise conservation strategies regionally to deal with conflicting interests)	MWD	1995	1995
Biological Special Species Expertise Provided to CDWR (for various CDWR projects including their HCP for San Joaquin Valley operations and Kern Fan)	USBR, CDWR		
Contributed to the Biological Framework for Natural Lands and Endangered Species in Southern San Joaquin Valley (by writing some sections, providing maps and reviewing and editing drafts)	USBR, USBLM, USFWS, CDFG, CDWR, CSUS, CEC, TNC, D&M, EG&G, CNLM	Feb 1991	1993
Participated in the San Joaquin Valley Interagency Team (to create a consortium of local, state and federal agencies and the general public to develop coordinated and cooperative regional strategies to sustain natural and human communities and economies–team disbanded after county supervisors elected not to participate)	USBR, USBLM, USFWS, CDFG, CDWR, USNRCS	1993	1995
Developed Cooperative Agreement with California Natural Diversity Data Base (for data sharing and cooperation)	CDFG	1994	1994
Provide Technical Assistance to USFWS (to provide species and conservation expertise independent of biological opinions and recovery plan)	USFWS*	Oct 1996	ongoing
Contributed Biological Expertise, Data Gathering and Analyses for Central Valley Project Biological Assessment and ESA Consultation (we provided maps and GIS coverages, species accounts, and other information and reviewed components of the information in the assessments for both USBR and USFWS.)	USBR, USFWS	1997	ongoing
Technical Assistance to USBR South Central California Area Office GIS program (technical support and GIS data provided to assist in the establishment of new GIS program at USBR Fresno Office)	USBR	Dec 1998	ongoing

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Outreach and other Collaborative Efforts			
Prepared Maps for Western Snowy Plover (*Charadrius alexandrinus nivosus*) Pacific Coast Population Recovery Plan (prepared a set of 163 detailed maps to be used in conjunction with the plan)	USFWS	June 2000	draft copies in review
Serving on Alternatives Subcommittee, Kern County Valley Floor Habitat Conservation Plan (provide input on plant conservation issues and endangered species matters)	Kern Co.		
USBLM Central California Resource Advisory Council (term began September 1995, ends August 2001; provide input on conservation issues)	USBLM	1995	2001
Southern Sierra Foothill/San Joaquin Valley Land Trusts Coalition (provide detailed input on conservation issues)			
Carrizo Plain Natural Area—provide input on conservation issues and grazing management. This is an ongoing, periodic activity.	USBLM, USFWS, TNC, CDFG	1992	ongoing
Elk Hills Endangered Species Advisory Committee (provided input on plant conservation issues until Naval Petroleum Reserve #1 was sold to Occidental Petroleum in 1998)	USDOE, USFWS, USBLM	1992	1998
Developed and Maintain ESRP Web Site (web site chosen site of the day by New Scientist and awards from other organizations; web site mostly used by school students)	ESRP	1997	ongoing
Provided Technical Assistance to USEPA, CEPA, and CDFG (on pesticide regulations, species distributions and natural histories, pesticide application practices, and collected tissue samples of San Joaquin kit foxes for use in pesticide studies by CDFG and other agencies. Collection of tissues from San Joaquin kit foxes that die or are killed by vehicles is ongoing.)	CEPA, CDFG, USEPA	Jul 1992	ongoing
Served on Technical Committee for San Joaquin Valley Drainage Implementation Program (ESRP staff members served on the interagency Technical Committee which reviewed the status of recommendations in the San Joaquin Valley Drainage Program 1990 Management Plan. **Products**: a series of technical reports was produced in this important effort. ESRP staff were primarily involved with a chapter on the biological consequences of land retirement for wildlife.)	San Joaquin Valley Drainage Program	1997	1998

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		Start	End
Outreach and other Collaborative Efforts			
Organized Multiagency Effort to Protect and Restore Riparian Habitat on the Kings River, Fresno Co. (enlisted in implementing a restoration project for habitat for riparian brush rabbits. USBR and Fresno Co. will provide neighboring parcels of lands already owned.)	CDT, USCOE, Fresno Co.,	1993	1996
Gave Field Orientation to New CDFG Region 4 Botanist and USFWS Botanist Regarding Southern San Joaquin Valley and Carrizo Plain Plant Issues and Natural Areas (gave field tour of Sand Ridge, Lokern, and Carrizo Plain to introduce new agency staff to listed plants and issues)	CDFG, USFWS	1998	1998
Assisted USBR in Drafting and Reviewing Interim Operations and Maintenance Plan (provided background information and accounts of species, developed maps, reviewed document)	USBR		
Made School Presentations (provide numerous presentations to K-12 schools and colleges in Fresno, Kern and Stanislaus counties; an ongoing activity)	Public Schools	1993	ongoing
Judged Science Fair Projects and Sponsored Awards (several ESRP staff members judged science projects at the Central California Regional Science, Mathematics & Engineering Fair in Fresno in 1997, 1998, 1999 and 2000, and Kern County Science Fair in 2000. ESRP also sponsored a special award, an ecology or conservation biology textbook, for the student project that had the most relevance for conservation science)	Public Schools	1997	ongoing
Provided On-Site Orientation and Advice to California Department of Fish and Game and Landowner on Bakersfield Cactus Conservation (regarding an important Bakersfield cactus population identified in one of the Land Acquisition Evaluations)	CDFG, private landowner		
Provided input to California Native Plant Society on status of plants to be included in the 6th edition of the Inventory of Rare and Endangered Plants of California (regarding an important Bakersfield cactus population identified in one of the Land Acquisition Evaluations)	CNPS	1999	1999
Presentations to Professional Organizations and at Universities (ESRP staff have given more than 77 presentations at scientific meetings and in university seminars and symposia about the program and findings from research projects)	Scientific Societies, Universities, Workshops, Symposia	1993	ongoing

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Project	Cooperators/Collaborators	Project Schedule	
		Start	End
Outreach and other Collaborative Efforts			
Students and Interns Supported by ESRP (support includes hiring of undergraduate interns, graduate students, and partially or wholly supporting the research of graduate students, or provided them with data or research material. Included are: Thomas Angel, CSUS; Ellen Bean, UMN; Howard Clark, CSUF; Gwynne Corrigan, UCSC; Roberta Fargo, CSUF; Sara Good, PSU; Laurissa Hamilton, UCD; Christine Van Horn Job, CPSUSLO; Connie Lee, CSUS; Rhianna Lee, CSUS; Cristina Lopez, CSUF; Jill Lujan, CSUF; Marjorie Matocq, UCB; Patrick Medve, EHS; Patrick Morrison, FCC & CSUF; Sean Mullins, CSUS; Scott Phillips, CSUF: Robert Robertson,UCB; Michael Schwartz, UM; Elaine Sheehan; NUIC; Justine Smith, CSUF; Ahmed Soliman, CSUF; Richard Ybarra, CSUF; Alicia Villegas, CSUF)	Universities and Colleges	1993	ongoing
Postdoctoral Researchers Supported by ESRP (supported the postdoctoral research of Dr. Sabine Loew at the Smithsonian Institution on giant kangaroo rat genetics; and a postdoctoral appointment of Dr. Ross Goldingay to ESRP to assist with kangaroo rat conservation and developing conservation strategies for recovery planning; Dr. Goldingay is now at Southern Cross University in Australia)	ESRP	1995	1997
Projects Funded by Cooperators and Collaborators (ESRP has received over $2,502,900 from sources other than USBR or the CVPCP and CVPIA funds for research and planning on listed and sensitive species. This total represents 52 grants and contracts with 18 different agencies, companies, and foundations. ESRP also has obtained major equipment and software grants for GIS, have received annual grants to participate in the ESRI's GIS Users Conference, and received donations of equipment and supplies from several companies and individuals.)	various agencies, nongovernmental organizations, and private companies and individuals	1992	ongoing

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Refereed Publications

Title	Authors	Journal	Vol	Pages
Fleas (Siphonaptera) infesting giant kangaroo rats (*Dipodomys ingens*) on the Elkhorn and Carrizo plains, San Luis Obispo County, California	Tabor, S.P., D.F. Williams, D.J. Germano, and R.E. Thomas	Jour. Medical Entomology	30	291-294.
Recovery of endangered kangaroo rats in the San Joaquin Valley, California	Williams, D.F., and D.J. Germano	1992 Trans. Western Sec. Wildl. Soc	28	93-106
Recovery of the blunt-nosed leopard lizards: past efforts, present knowledge, and future opportunities	Germano, D.J., and D.F. Williams	1992 Trans. Western Sec. Wildl. Soc	28	38-47
Field Evaluation of using passive integrated transponder (PIT) tags to permanently mark lizards	Germano, D.J., and D.F. Williams	Herpetologic al Review	24	54-56
Taxonomy, *in* Biology of the family Heteromyidae (H.H. Genoways and J.H. Brown, eds.)	Williams, D.F., H.H. Genoways, and J. K. Braun	Amer. Soc. Mammalogist s, Spec. Publ	10	38-196
The effect of drought on blunt-nosed leopard lizards (*Gambelia sila*)	Germano, D.J., D.F. Williams, and W. Tordoff III	Northwest Naturalist	75	36-48
Gambelia sila (blunt-nosed leopard lizard). Cannibalism	Germano, D.J., and D.F. Williams	Herp. Review	25	26-27
Evaluation of methods for marking kangaroo rats (*Dipodomys*; Heteromyidae).	Williams, D.F., W. Tordoff III, and D.J. Germano	Spec. Publ. Mus. SW Biol.,	3	36599
The kangaroo rats of California: endemism and conservation of keystone species	Goldingay, R.L., P.A. Kelly, and D.F. Williams.	Pacific Conserv. Biology	3	47-60
Population structure of *Dipodomys ingens* (Heteromyidae): the role of spatial heterogeneity in maintaining genetic diversity	Good, S., D.F. Williams, K. Ralls, and R.C. Fleischer	Evolution	51	1296-1310
Utility of ten-day censuses to estimate population size of blunt-nosed leopard lizards	Germano, D.G., D.F. Williams, and L.R. Saslaw	California Fish& Game	83	144-152

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Title	Authors	Journal	Vol	Pages
Perognathus alticola	Williams, D.F.	Smithsonian Book of North American Mammals	1999	494-495
Perognathus flavescens	Williams, D.F.	Smithsonian Book of North American Mammals	1999	498-499
Chaetodipus californicus	Williams, D.F.	Smithsonian Book of North American Mammals	1999	508-509
Dipodomys ingens	Williams, D.F.	Smithsonian Book of North American Mammals	1999	531-532
Recovery plan for upland species of the San Joaquin Valley, California	Williams, D..F., E. A. Cypher, P. A. Kelly, N. Norvell, S.E Phillips, C.D. Johnson, G.W. Colliver, and K.J. Miller	U.S. Fish and Wildlife Service	1998	1-319
An animal track casting method using dolomite, sand, and spray adhesive	Clark, H.O.	California Fish and Game	1999	138-139
Factors influencing populations of endangered San Joaquin kit foxes	Cypher, B. L., P. A. Kelly, and D. F. Williams	Proceedings of the North American Swift Fox Symposium	in press	

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Title	Authors	Journal	Vol	Pages
Endangered kit foxes in urban environments: implications for foxes and humans	Cypher, B. L.	Proceedings of the 4th Internat. Symposium on Urban Wildlife Conservation	in press	
Designing habitat protection strategies for a core population of the endangered San Joaquin kit fox	Haight, R. G., B. L. Cypher, P. A. Kelly, S. Phillips, H. Possingham, K. Ralls, A. Starfield, P. J. White, and D. F. Williams	Conservation Biology	in press.	
Genetic variation and substructure of San Joaquin Kit Fox populations	Schwartz, M.K.,, K Ralls, D.F. Williams, and R.C. Fleischer	Molecular Ecology	in press	
Response of San Joaquin kit fox (Canidae) to oil-gas well fire	Clark, H.O.	Southwestern Naturalist	in review	

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Acronyms

AEWSD, Arvin-Edison Water Storage District
CEC, California Energy Commission
CDFG, California Department of Fish and Game
CDWR, California Department of Water Resources
CDT, California Department of Transportation
CNLM, Center for Natural Lands Management
CPSUSLO, California Polytechnic State Univ., San Luis Obispo
CSUF, California State Univ., Fresno
CSUS, California State Univ., Stanislaus
CVPCP, Central Valley Project Conservation Program
CVPIA Central Valley Project Improvement Act
CWA, California Waterfowl Association
D&M, Dames and Moore
DCLTRA, Deer Creek Lower Tule River Authority
DEID, Delano-Earlimart Irrigation District
DOI, Department of the Interior
EDF, Environmental Defense Fund
EG&G, EG&G Measurements
EHS, Edison High School, Fresno
ESRP, San Joaquin Valley Endangered Species Recovery Program
FWUA, Friant Water Users Authority
ISU, Illinois State Univ. (Sabine Loew)
JSA, Jones & Stokes Associates
NSF, National Science Foundation
NUIC, National University Ireland, Cork
PCFFA, Pacific Coast Federation of Fisherman's Associations
PRBO, Point Reyes Bird Observatory
SERCAL, Society for Ecological Restoration-California Chapter
SI, Smithsonian Institution (K. Ralls, R. Fleischer)
TCFB, Tulare County Farm Bureau
TNC, The Nature Conservancy
TWS-SJ, The Wildlife Society-San Joaquin Chapter
UA, Univ. Adelaide, Australia
UCB, Univ. California, Berkeley
UCD, Univ. California, Davis
UCCE, Univ. California, Coop. Extension
UCR, Univ. California, Riverside
UCSB, Univ. California, Santa Barbara
UCSC, Univ. California, Santa Cruz
UM, Univ. Montana
UMN, Univ. Minnesota
USBLM, U.S. Bureau of Land Management
USBR, U.S. Bureau of Reclamation
USCOE, U.S. Army Corps of Engineers
USDA, U.S. Dept. of Agriculture
USDOE, U.S. Department of Energy
USFS, U.S. Forest Service
USFWS, U.S. Fish and Wildlife Service
USGS/BRD, U.S. Geological Survey, Biological Resources Division
USNRCS, U.S. Natural Resources Conservation Service (formerly Soil Conservation Service)
WWD, Westlands Water District

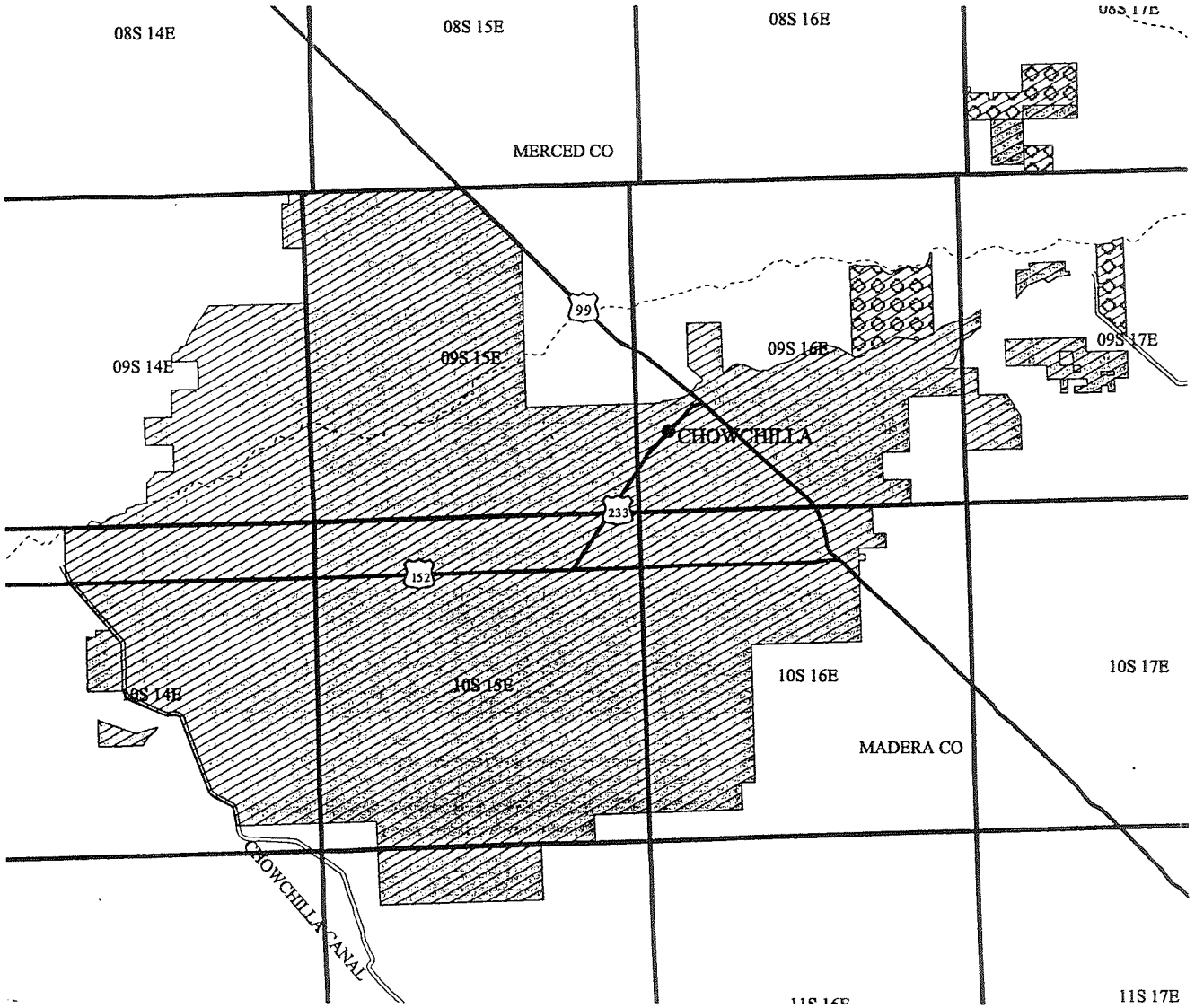
Appendix D

CVP Water District
Boundary Changes since 1991

- Friant Division
- Cross Valley Division

FRIANT DIVISION

CVP Water District Boundary Changes



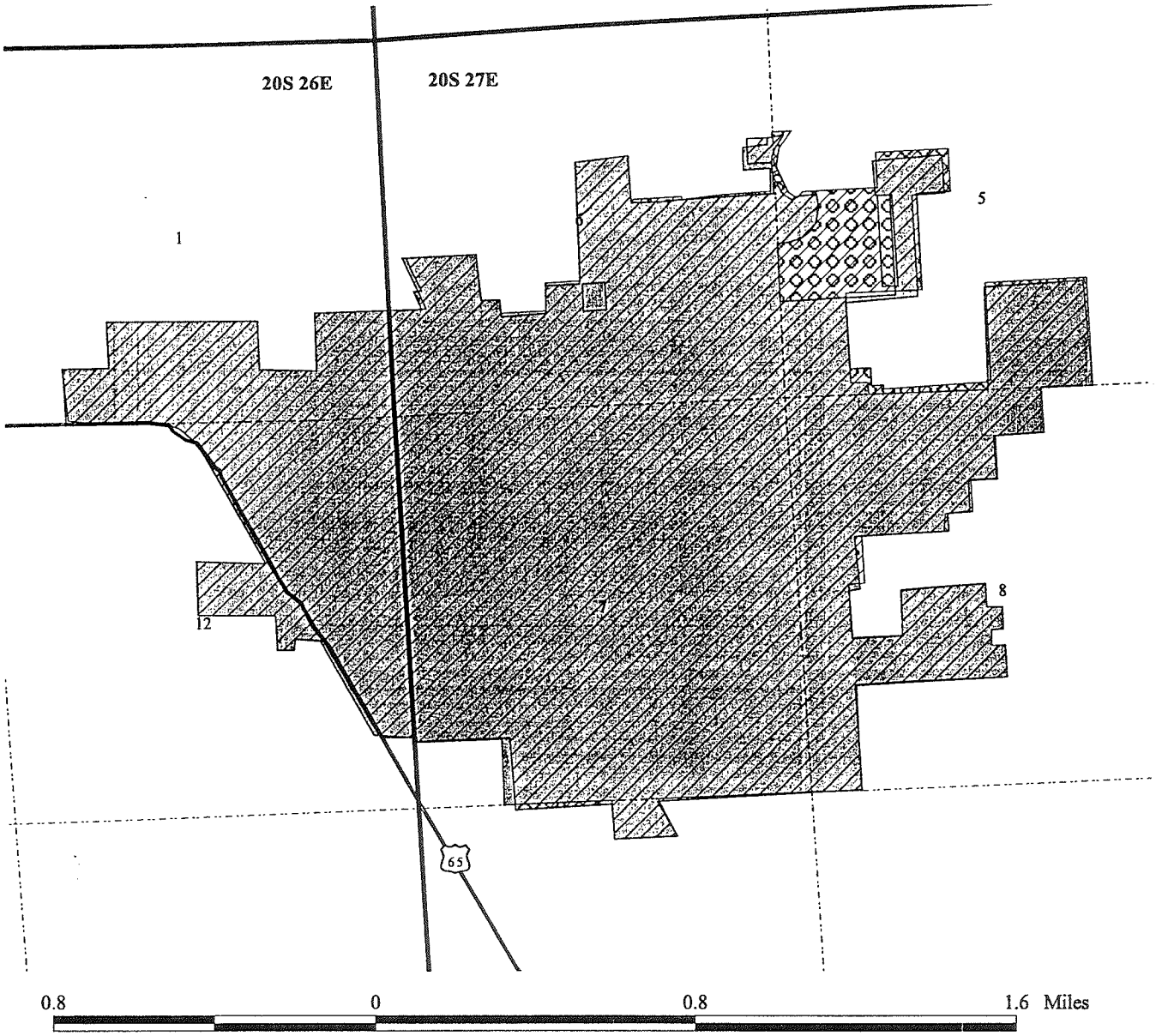
Chowchilla Water District

- Cities
- County Boundaries
- Canals
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Chowchilla WD prior to CVPIA

N
W E
S

1/8/01

CVP Water District Boundary Changes



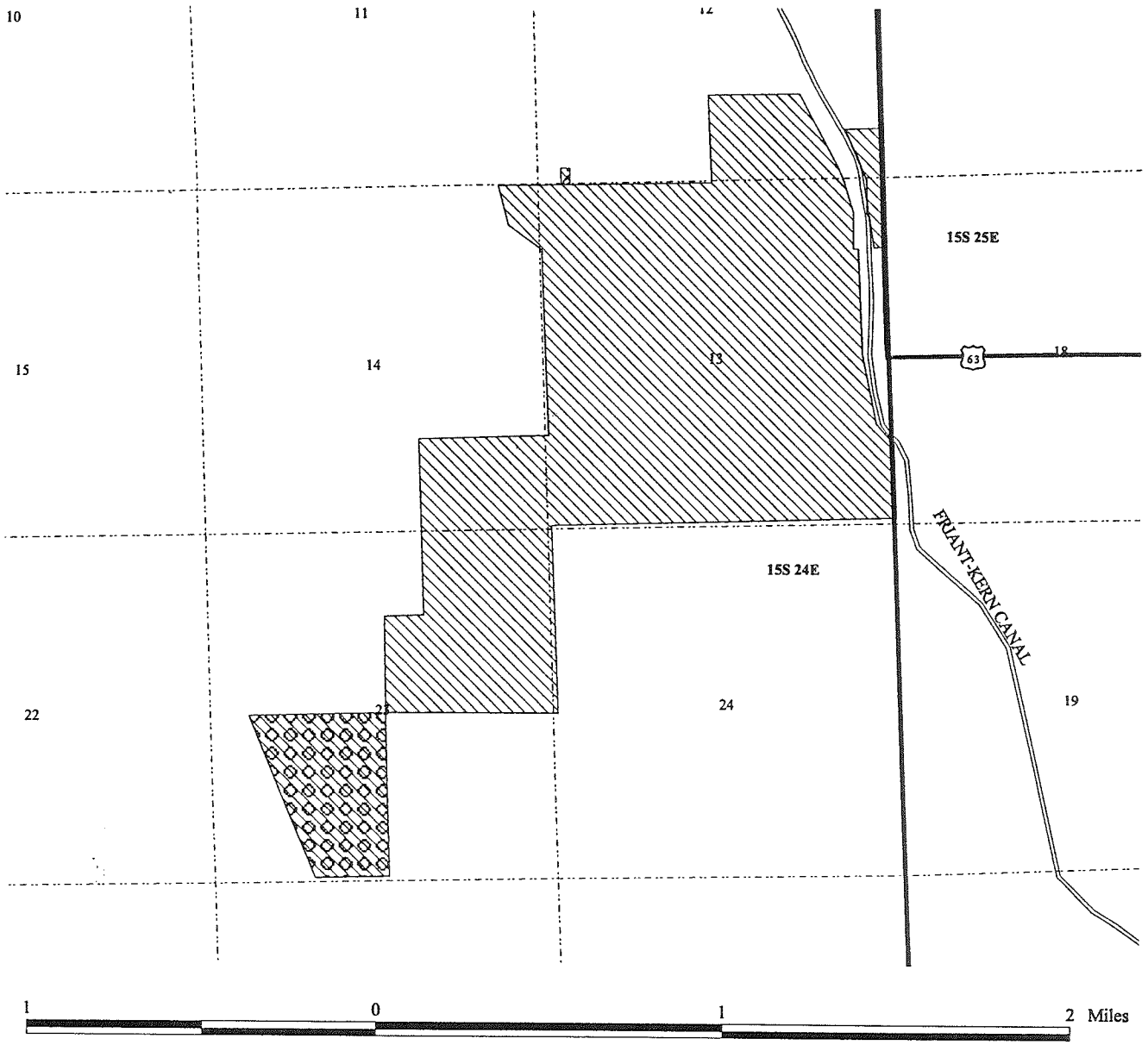
City of Lindsay WSA

- Sections
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

N
W
E
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



City of Orange Cove

- Sections
- Canals
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

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W
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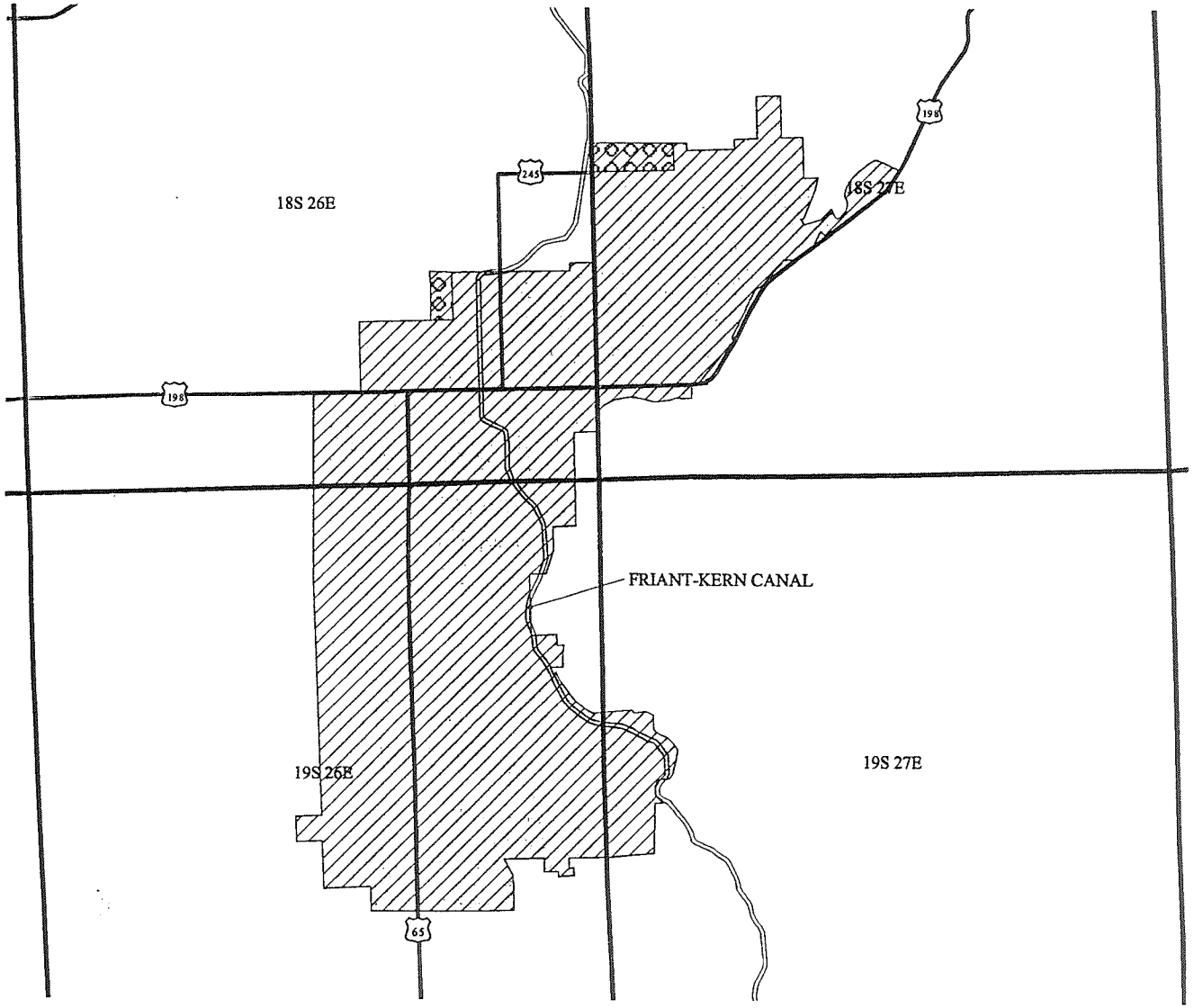
S

1/5/01

CVP Water District Boundary Changes



Exeter ID

- Canals
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

4 0 4 8 Miles

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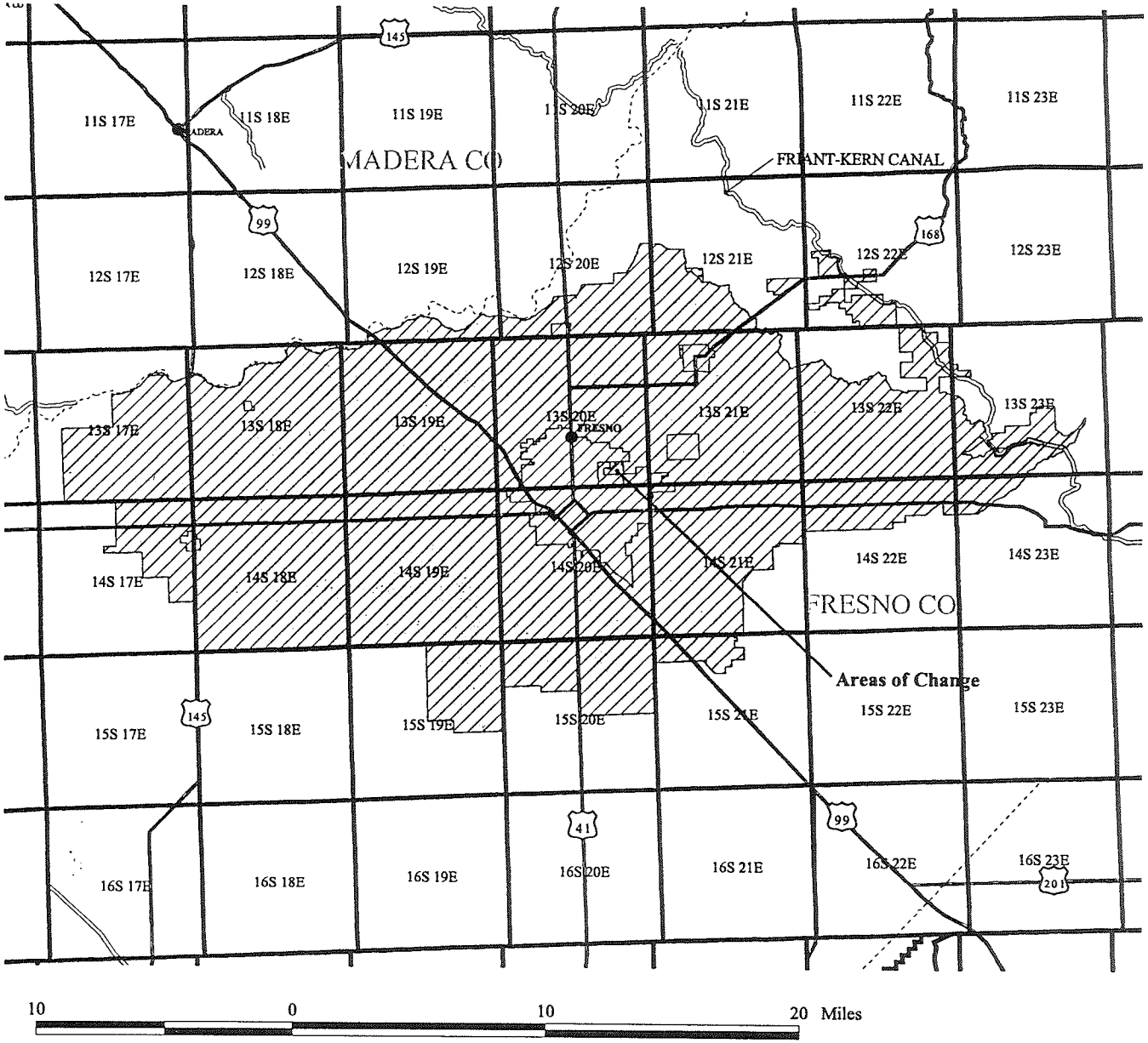
1/8/01
J:\projects\Westcontracted_old.apr

CVP Water District Boundary Changes



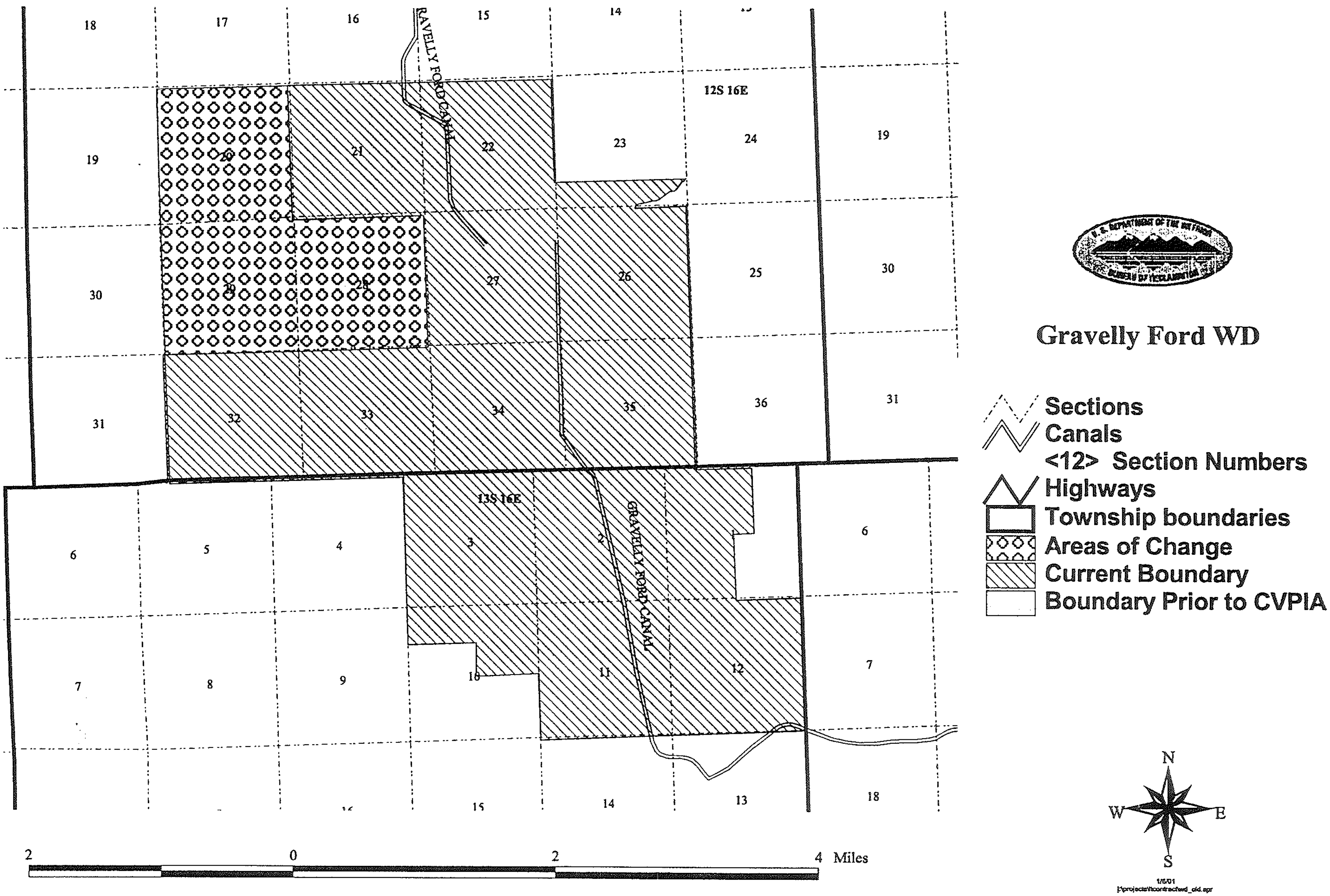
Fresno Irrigation District

- Cities
- Canals
- County Boundaries
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

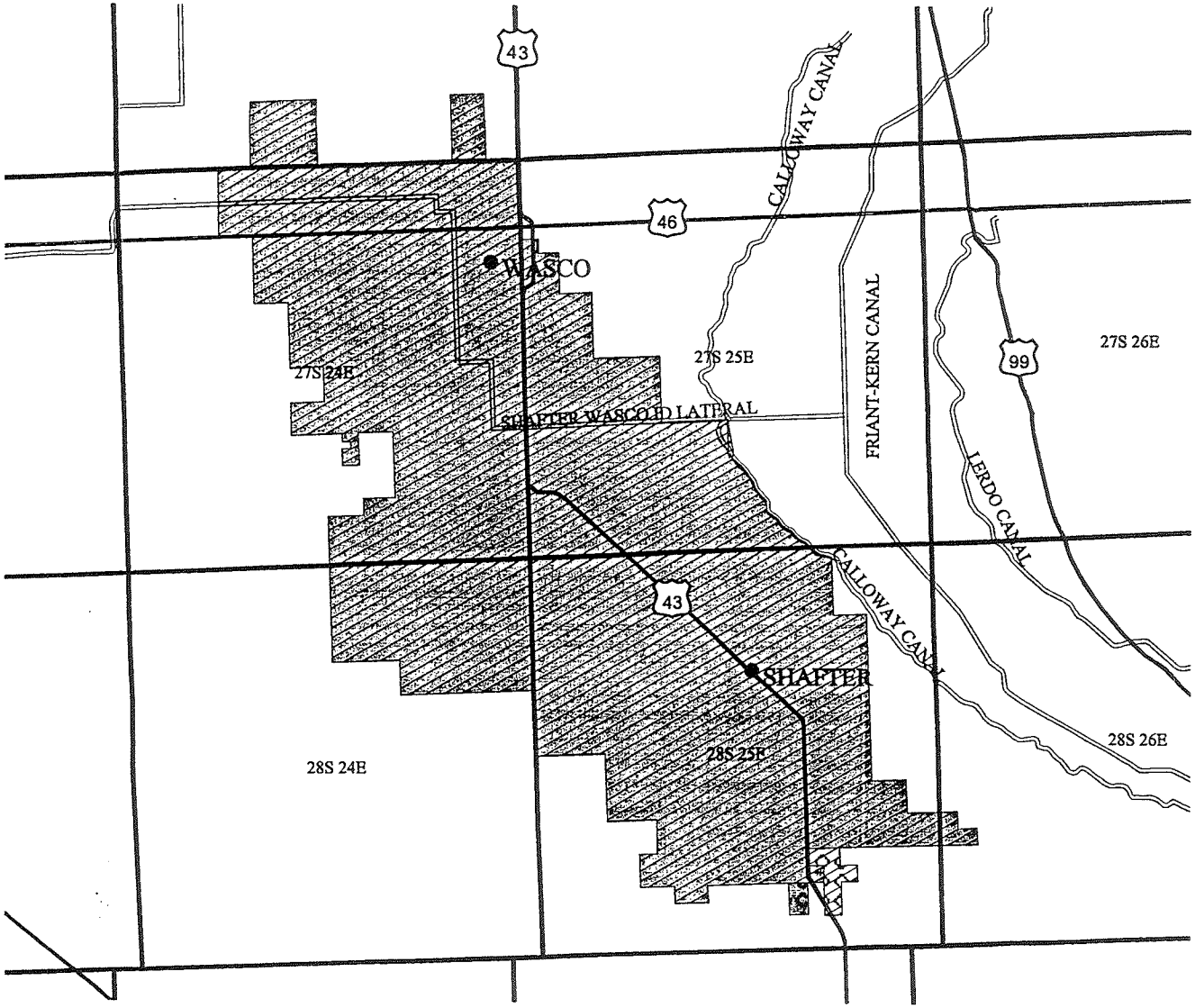
N
W E
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



CVP Water District Boundary Changes



Shafter-Wasco ID

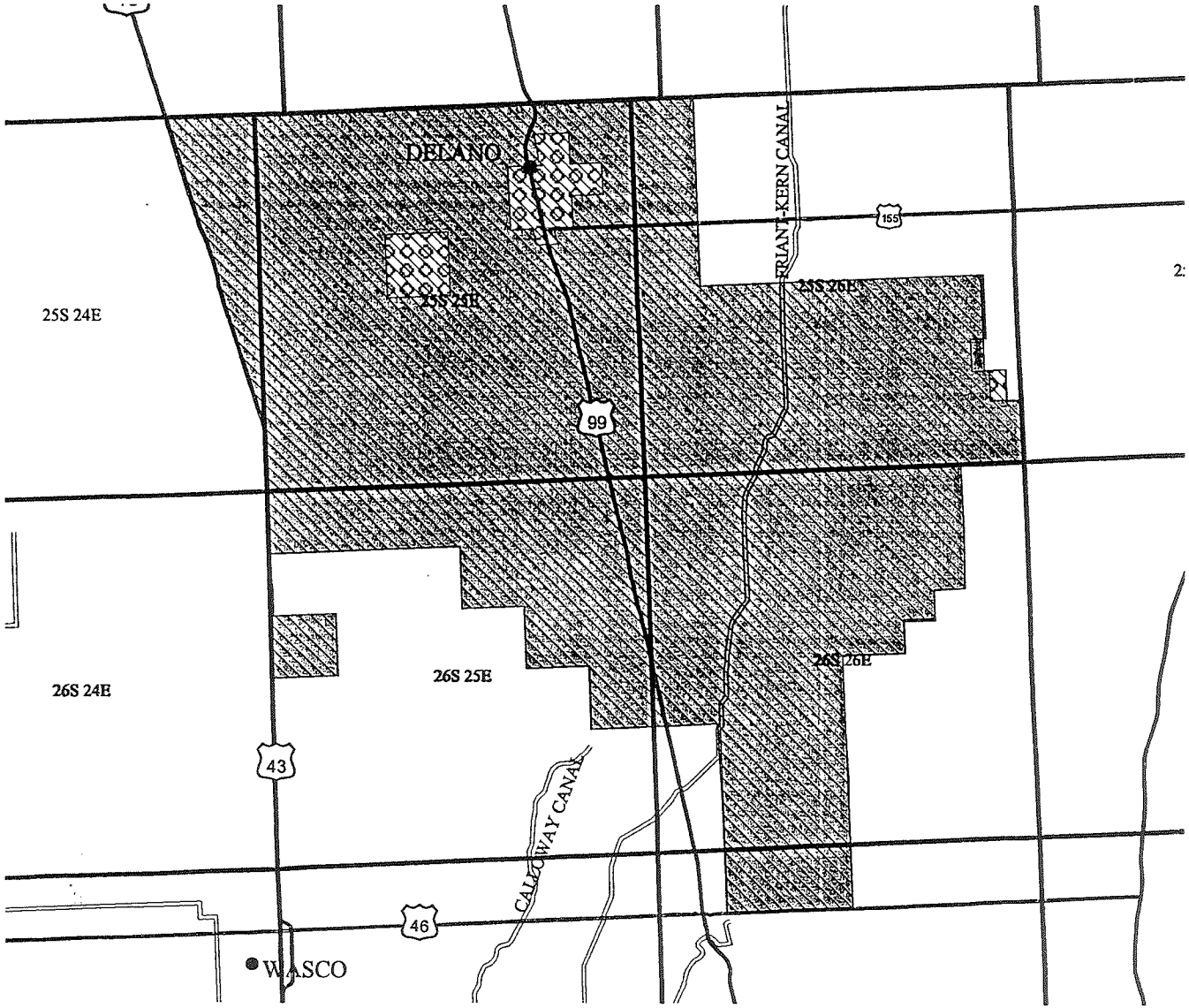
- Cities
- Canals
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

6 0 6 12 Miles

N W E S

1/8/01
J:\projects\contracted_old.apr

CVP Water District Boundary Changes



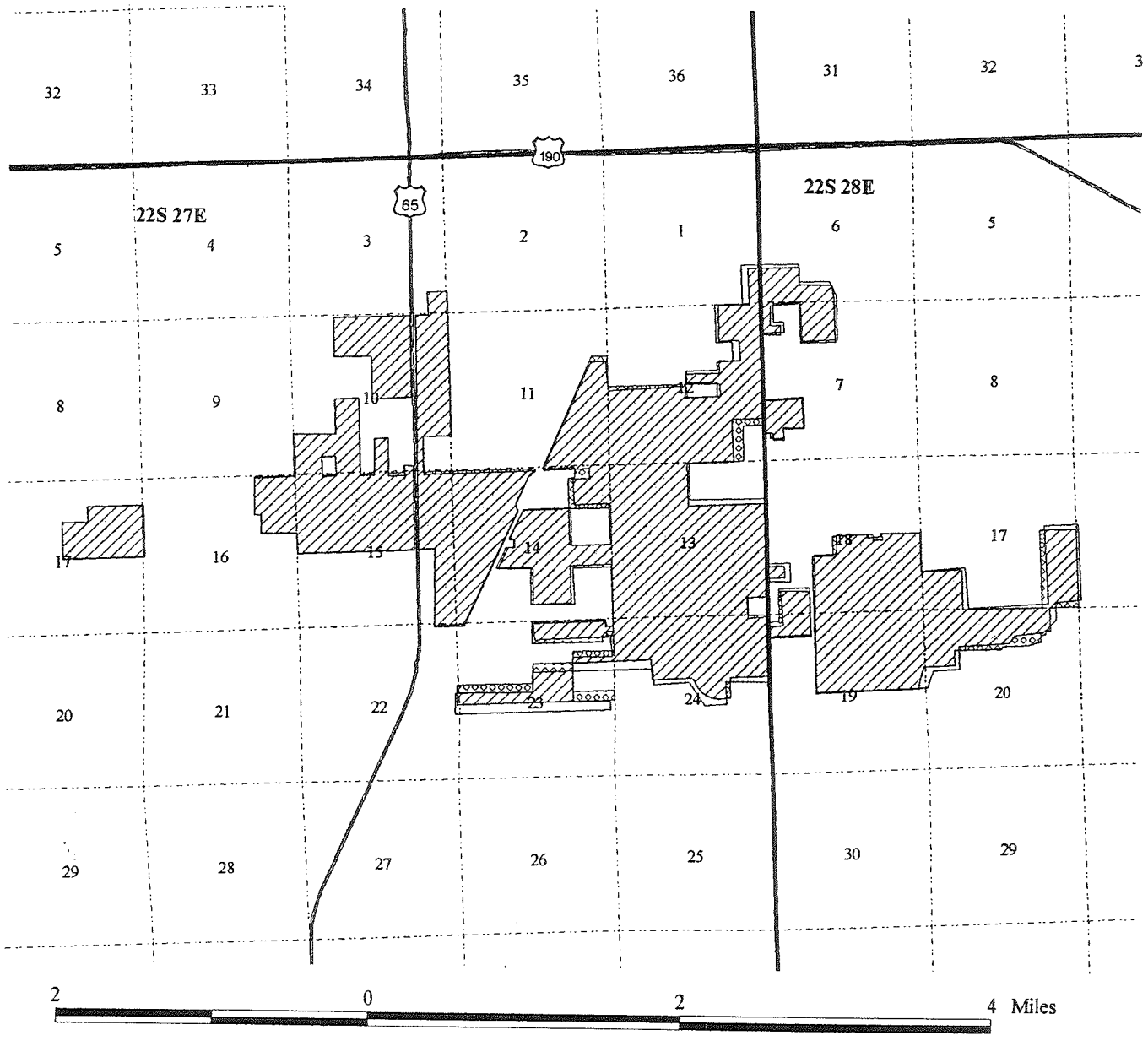
Southern San Joaquin MUD

- Cities
- Canals
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

N
W
E
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Tea Pot Dome WD

- Canals
- Sections
- <12> Section Numbers
- Highways
- Township boundaries
- Areaas of Change
- Current Boundary
- Boundary Prior to CVPIA

N
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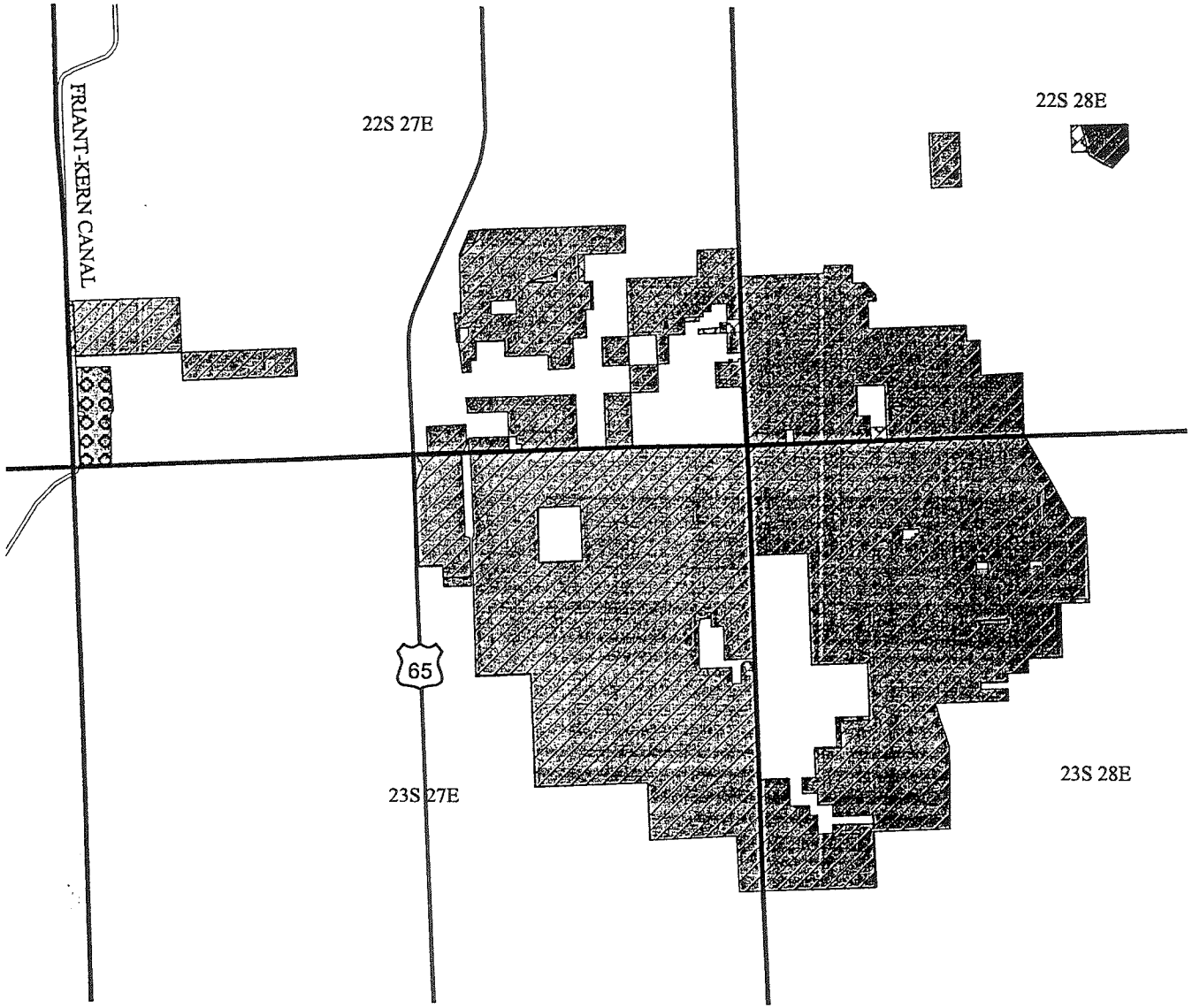
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



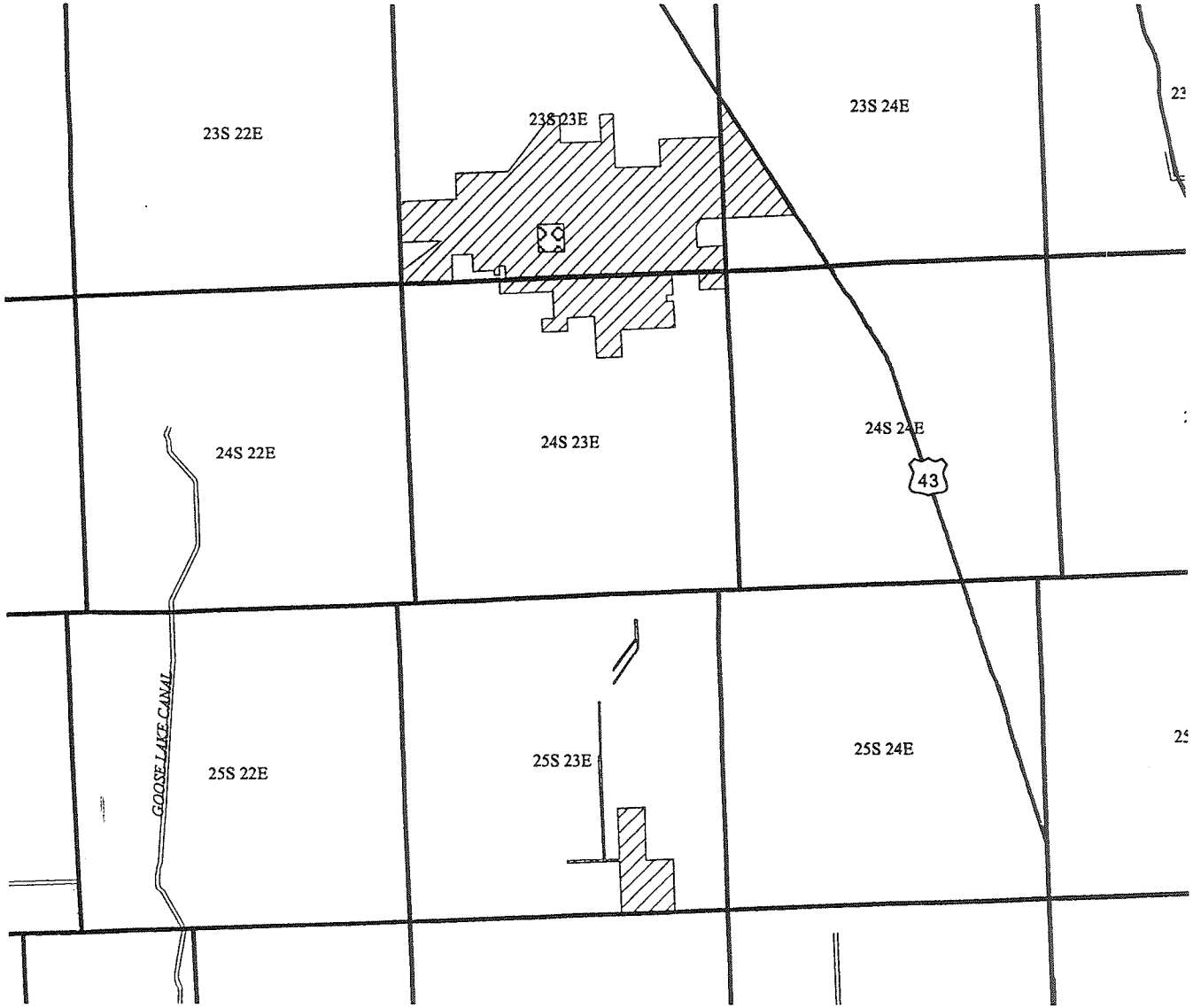
Terra Bella ID

- Canals
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

N
W E
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



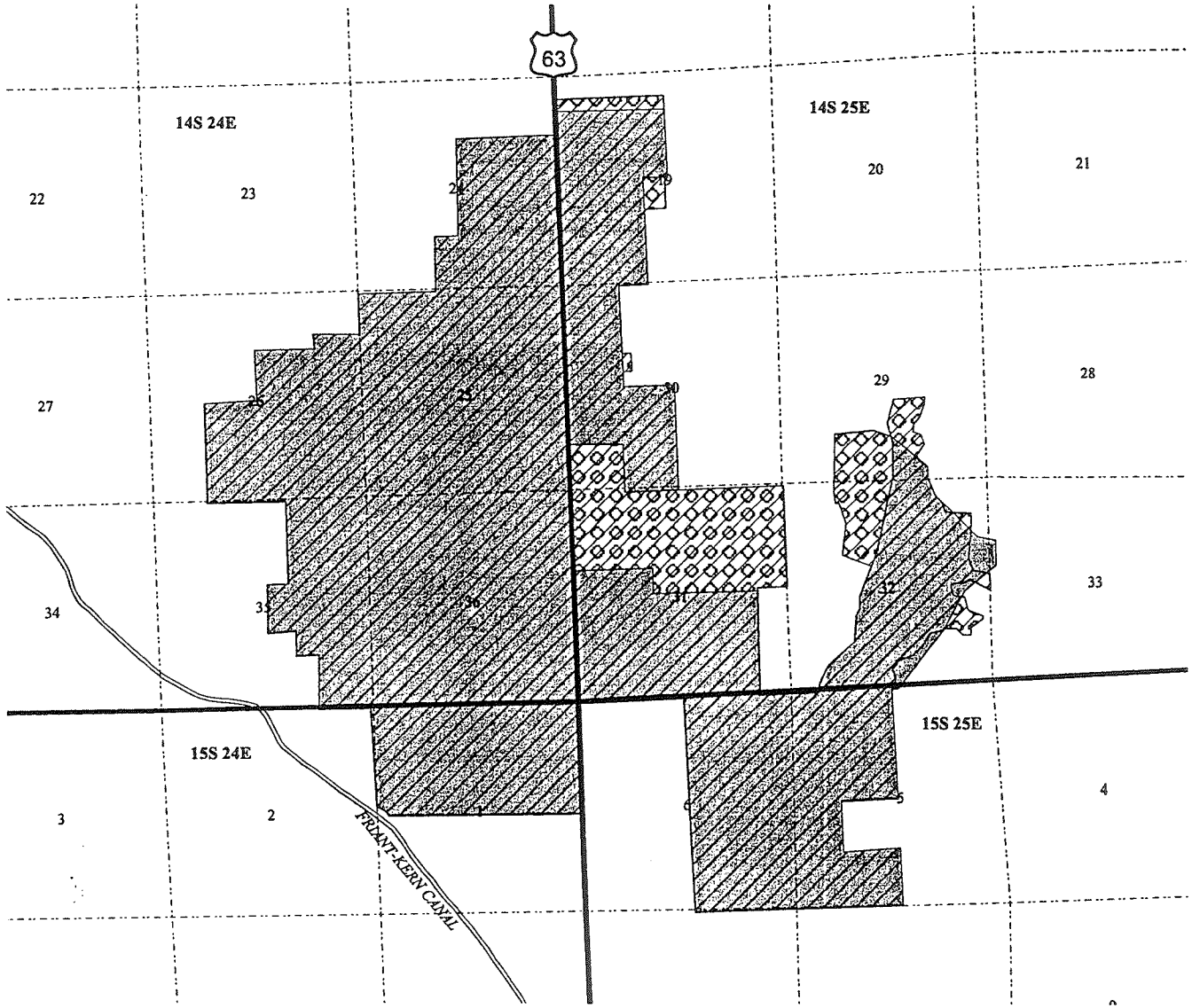
Alpaugh ID

- Canals
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

N
W
E
S

Southern San Joaquin MUD

CVP Water District Boundary Changes



Hills Valley ID

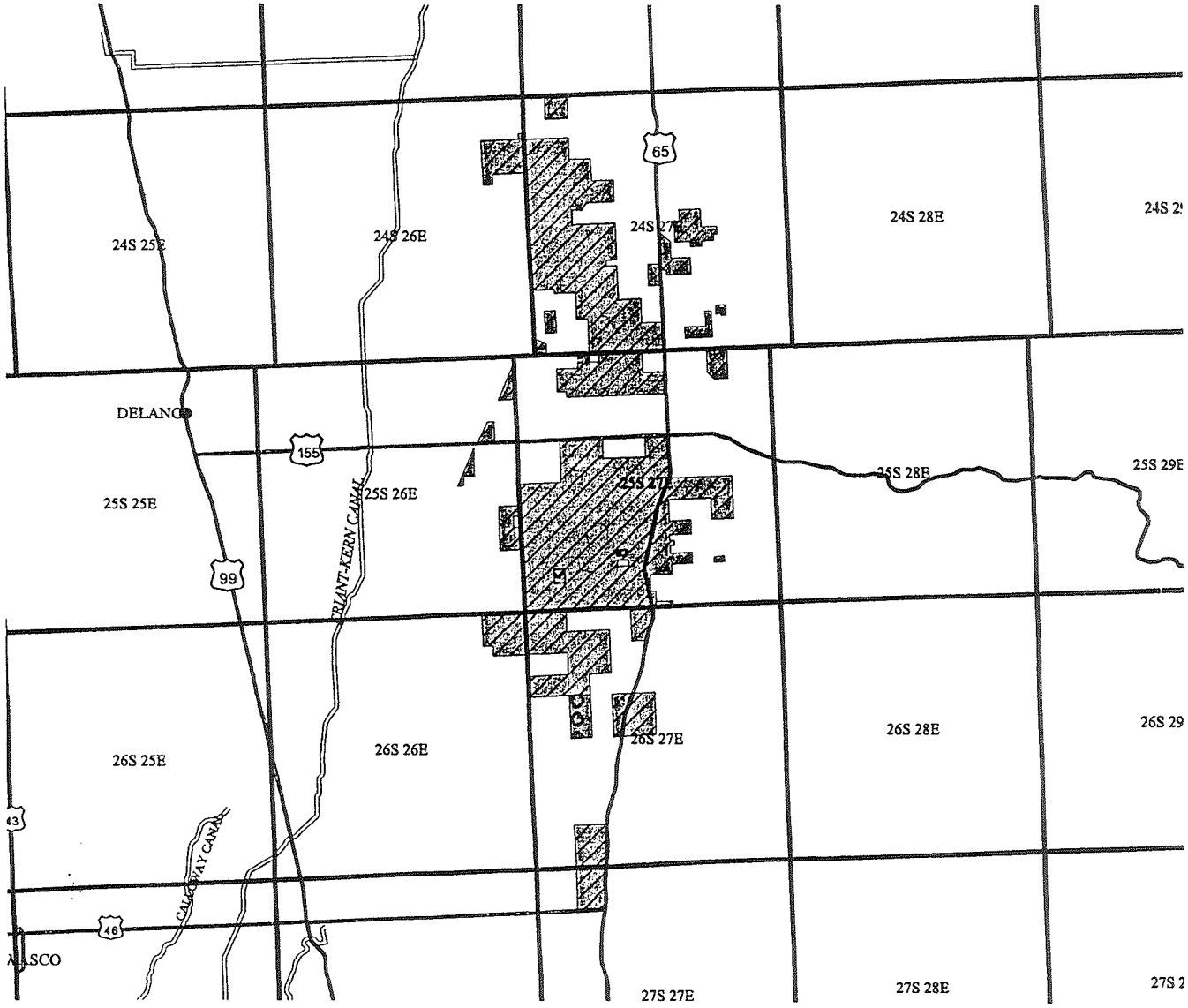
- Canals
- Sections
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

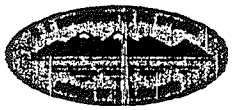
N
W
E
S

2 0 2 4 Miles

Southern San Joaquin MUD

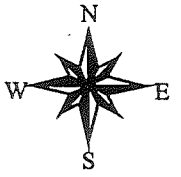
CVP Water District Boundary Changes





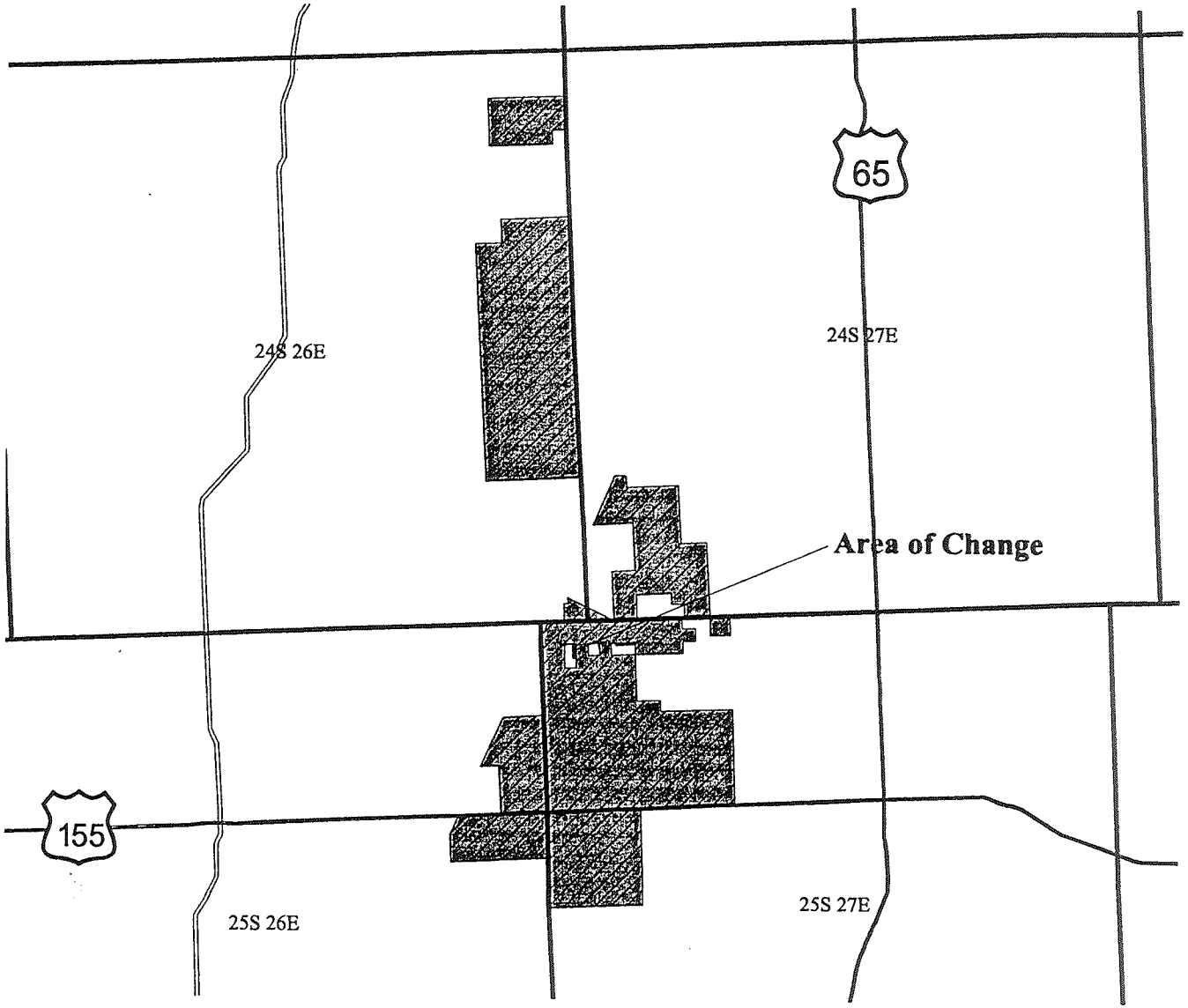
Kern Tulare WD

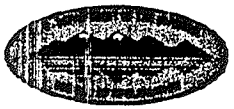
- Cities
- Canals
- Highways
- Township boundaries
- Current Boundary
- Areas of Change
- Boundary Prior to CVPIA



Southern San Joaquin MUD

CVP Water District Boundary Changes





Rag Gulch WD

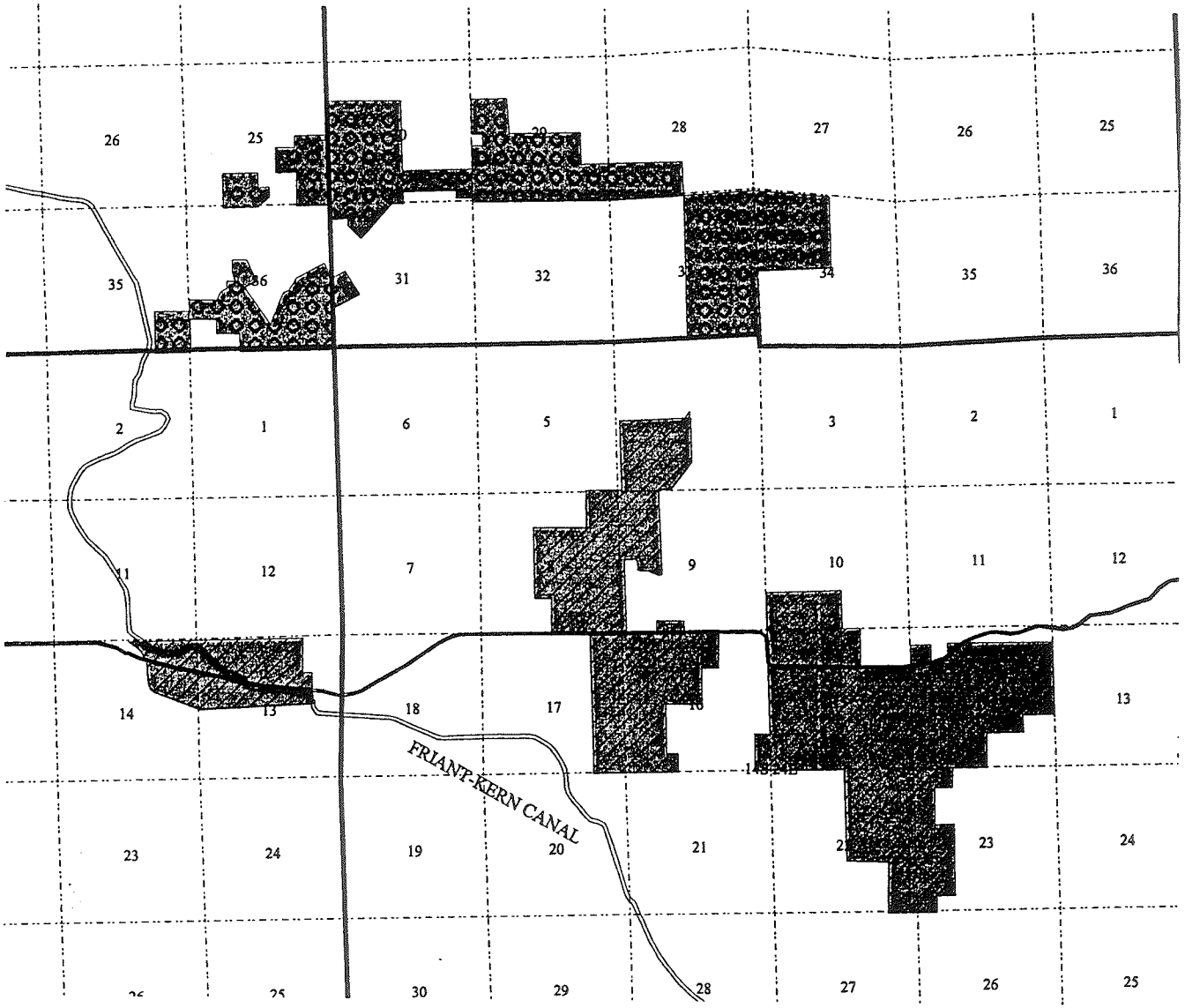
Canals
Highways
Township boundaries
Current Boundary
Boundary Prior to CVPIA

2 0 2 4 Miles

N
W E
S

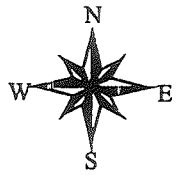
Southern San Joaquin MUD

CVP Water District Boundary Changes



Tri Valley WD

- Canals
- Sections
- <12> Section Numbers
- Highways
- Township boundaries
- Areas of Change
- Current Boundary
- Boundary Prior to CVPIA

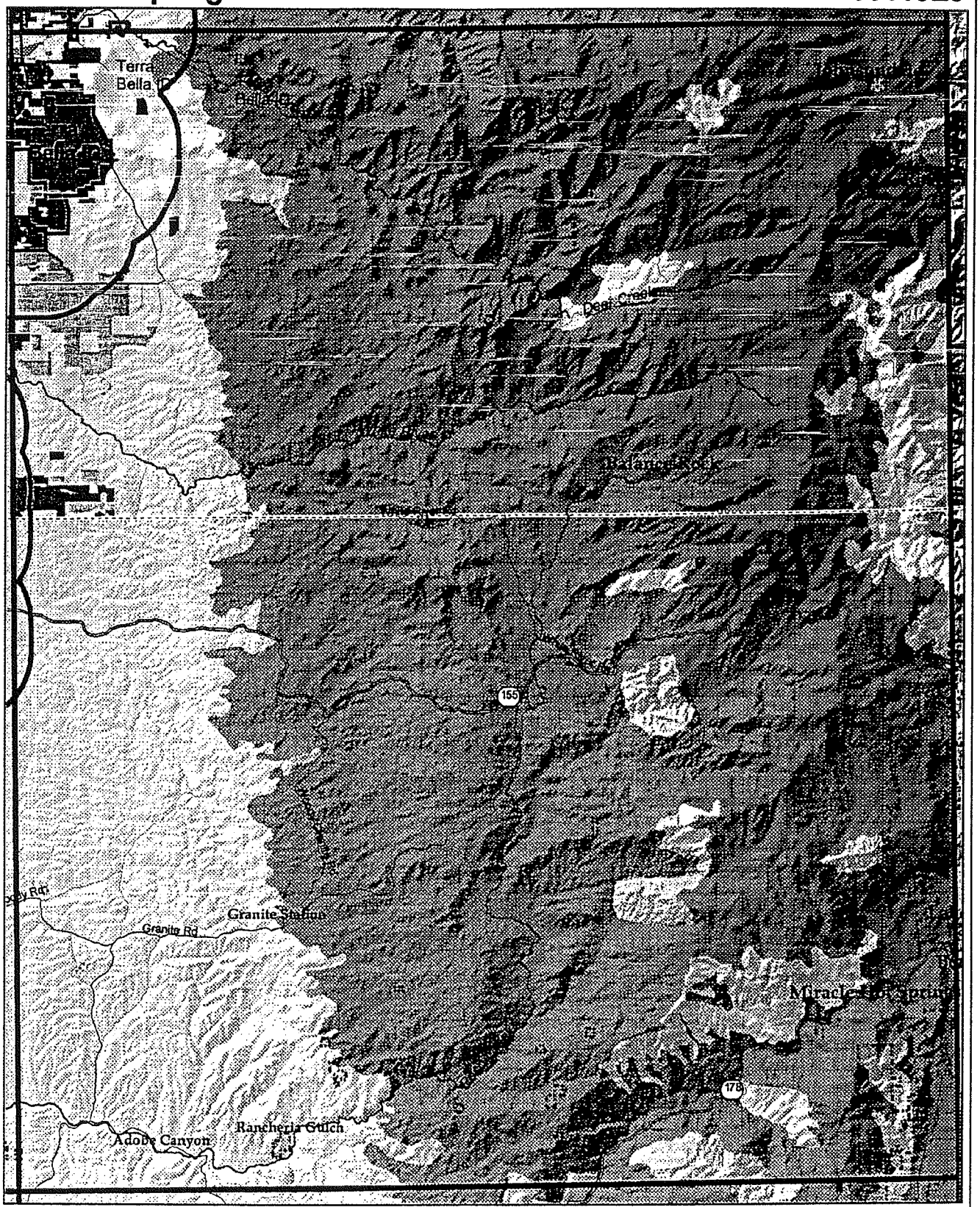


2 0 2 4 Miles

Southern San Joaquin MUD

Fountain Springs

35118E5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vinyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

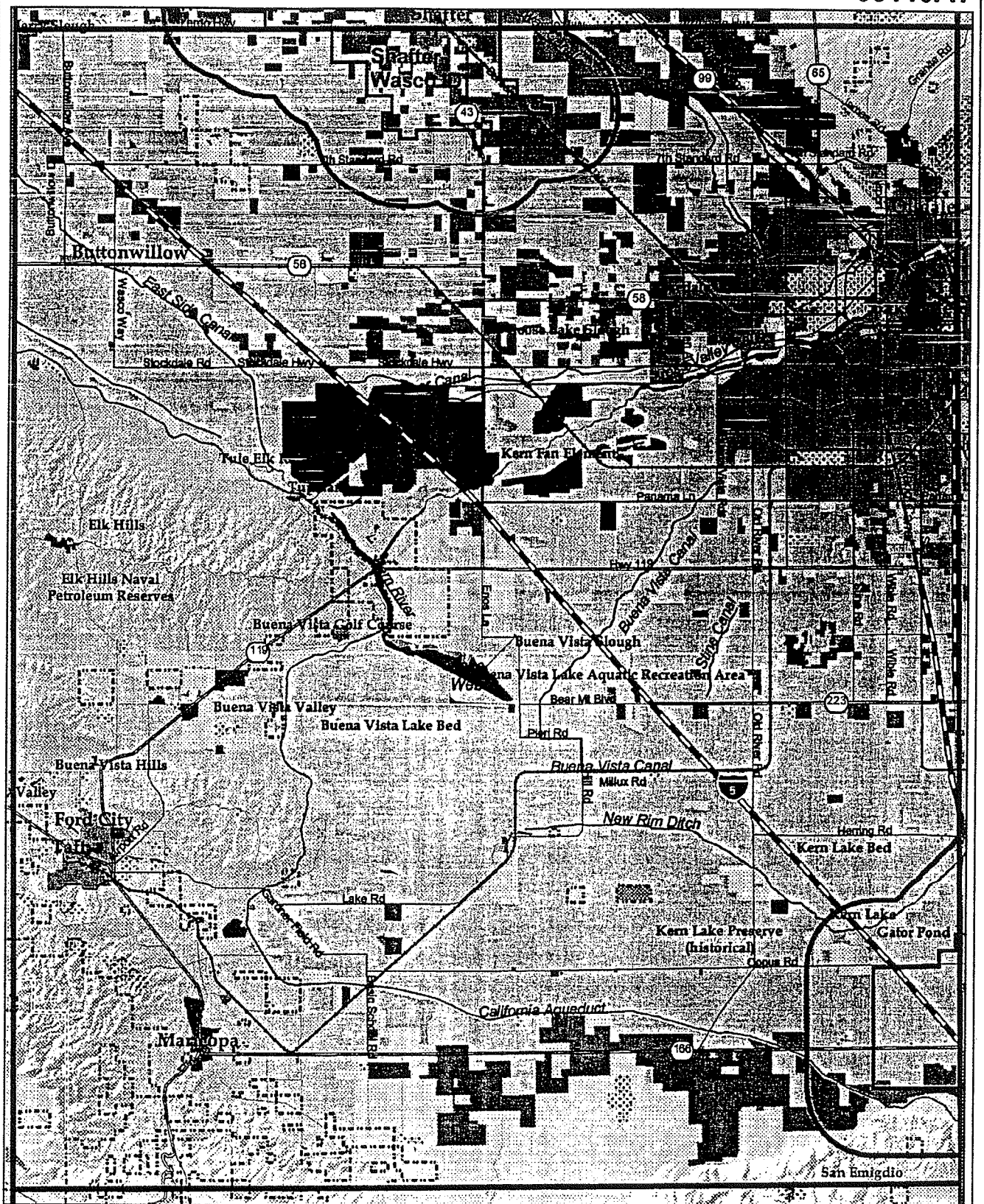
1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Taft

35119A1



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vinyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Appendix E

Land Use Maps
for
Friant and Cross Valley Contract
Service Areas

GIS Land Use Data and Analysis: Sources and Methods

provided by:
Endangered Species Recovery Program, CSU Stanislaus Foundation, Fresno, CA, on behalf of the Bureau of Reclamation.

List of Data Sources

California Department of Water Resource land use data
Abbreviation: DWR
Dates of data: (1993 - 1998)
More information on data at:
http://dplasp.water.ca.gov/landwateruse/landuse/ludataindex.htm
How it was used:
Primary data source

UCSB GAP analysis land cover data
Abbreviation: GAP
Dates of data: (1980 - 1995)
More information on data at:
http://www.biogeog.ucsb.edu/projects/gap/gap_home.html
How it was used:
Used to to further classify non-developed lands of the DWR data and fill in areas outside of DWR surveys

USGS 1:250,000 Land use/land cover data
Abbreviation: LULC
Dates of data: (1977 - 1980)
More information on data at:
http://edcwww.cr.usgs.gov/glis/hyper/guide/1_250_lulc
How it was used:
Urban areas from this coverage where added to DWR data since it included many transportation corridors and industrial (oil) areas not included in the DWR data and to fill in urban values outside of the DWR surveys. The data was also used to further classify urban areas of the DWR, GAP, and FMMP data

California Dept. of Conservation Farmland Mapping and Monitoring Program
Abbreviation: FMMP
Dates of data: (1998)
More information on data at:
http://www.consrv.ca.gov/dlrp/FMMP/
How it was used:
Urban areas from this coverage where added to DWR data to include newer urban uses and fill in land cover values outside of the DWR data survey areas.

U. S. Fish and Wildlife Service National Wetlands Inventory

Abbreviation: NWI
Dates of data: (1998)
More information on data at:
http://www.nwi.fws.gov/
How it was used:
Used to to further classify non developed lands of the DWR data

Dataset Construction

The following steps were taken with each data set:

-Data was obtained for the project area
-Data was mosaiced and dissolved by land use code
-Data was projected to a common map projection
-Land use values where reclassified to USGS land use codes
(see table below)
-Data source and year attributes where added to the data

Land use was assigned in the following steps:

A spatial union was done with the DWR and GAP data to show both the DWR and GAP classification for the entire project area and classified with the following rules:

-Where DWR data was available, the DWR code was assigned
-Where DWR data was not available, the GAP code was assigned
-Where DWR data was the generic "Native Vegetation", the GAP code was assigned if it was an undeveloped category (rangeland, forested land, wetland, or barren). Otherwise, the DWR data retained a code of 30 (unspecified rangeland).

The resulting data set is designated: dwr_gap_i

A spatial union was done with the FMMP and LULC data to show lands classified as urban for the project area and classified with the following rules:

-Where LULC and FMMP were both classified as urban, the LULC code was used since it has more detailed classification codes.
-Where the LULC data was classified as urban and the FMMP data was not, the data was classified using the LULC urban code
-Where the FMMP data was classified as urban and the LULC data was not, the data was classified using the FMMP generic code of 10 (unspecified urban)
-Lands not classified as urban in either set were removed

The resulting data set is designated: lulc_fmmp_urban_i

A spatial union was done with the above data sets (dwr_gap_i and lulc_fmmp_urban_i) to add and enhance urban classifications in the study area, with the following rules:

-Where the DWR data land use code was the generic "Urban" and LULC data was also urban, the LULC code was used to further classify the DWR data.
-Where the LULC data was classified as urban and the DWR data was not, the data was classified using the LULC urban code
-Where the FMMP data was classified as urban and the DWR data was not, the data was classified using the FMMP generic code of 10 (unspecified urban)

The resulting data set is designated: dwr_plus_urban

A spatial union was done with the above data set and the NWI data to enhance wetland classification in the study area, with the following rules:

-Where the dwr_plus_urban data was a non-developed category (not urban or farmland) and the NWI data was for a wetland, the NWI code was used to further classify wetland areas.

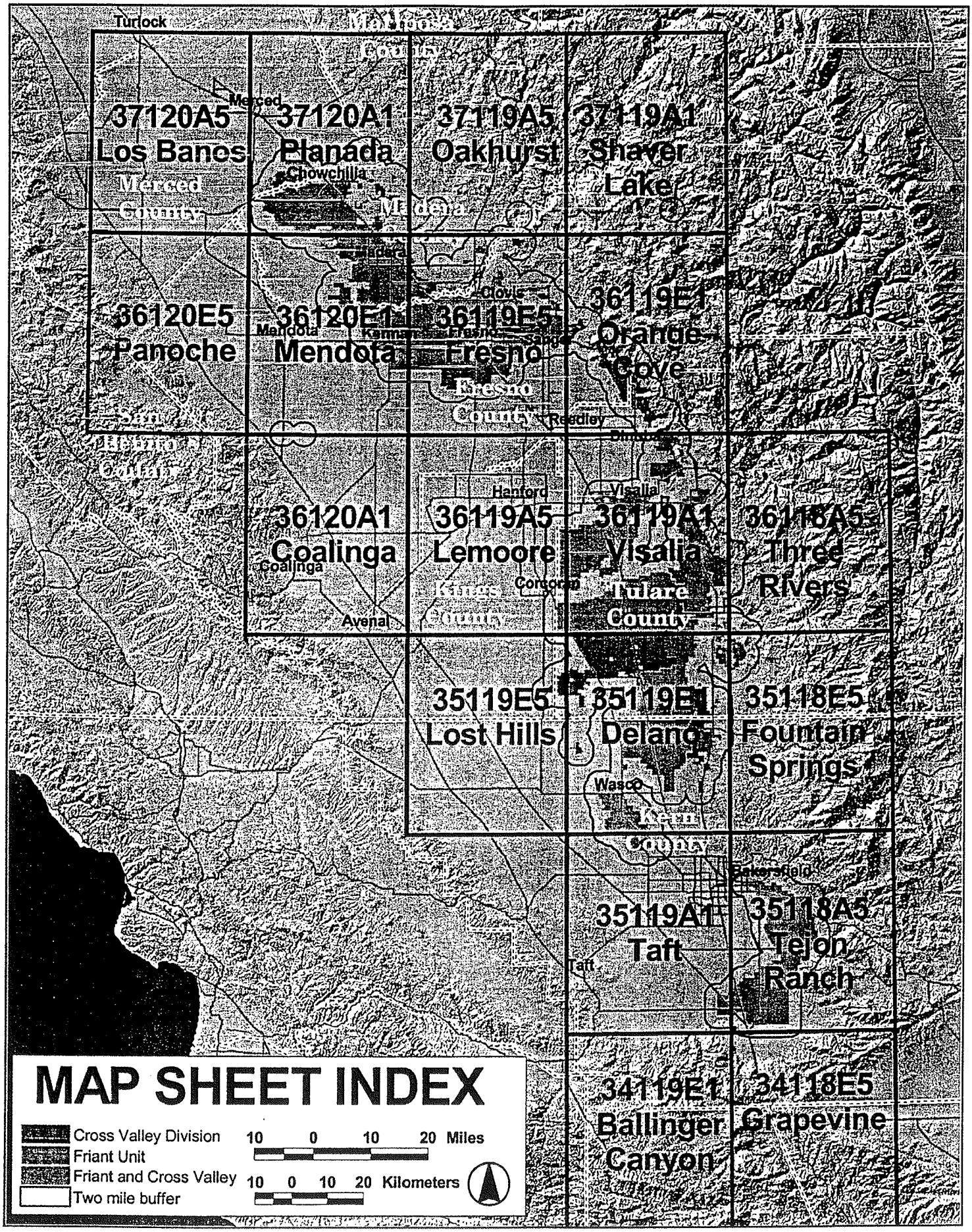
USGS Land use and land cover classification system for use with remote sensor data (Anderson, et al., 1976)

Level I	Level II
1. Urban or Built-up Land	1. Residential 2. Commercial and Services 3. Industrial 4. Transportation, Communications and Utilities 5. Industrial and Commercial Complexes 6. Mixed Urban or Built-up Land 7. Other Built-up Land
2. Agricultural Land	1. Cropland and Pasture 2. Orchards, Groves, Vineyards, Nurseries and Ornamental Horticultural areas 3. Confined Feeding Operations 4. Other Agricultural Land
3. Rangeland	1. Herbaceous Rangeland 2. Shrub and Brush Rangeland 3. Mixed Rangeland

4. Forest Land	1. Deciduous Forest Land 2. Evergreen Forest Land 3. Mixed Forest Land
5. Water	1. Streams and Canals 2. Lakes 3. Reservoirs 4. Bays and Estuaries
6. Wetland	1. Forested Wetlands 2. Nonforested Wetlands
7. Barren Land	1. Dry Salt Flats 2. Beaches 3. Sandy Areas other than Beaches 4. Bare Exposed Rock 5. Strip Mines, Quarries, and Gravel Pits 6. Transitional Areas 7. Mixed Barren Land
8. Tundra	(outside of species' ranges)
9. Perennial Snow or Ice	(outside of species' ranges)

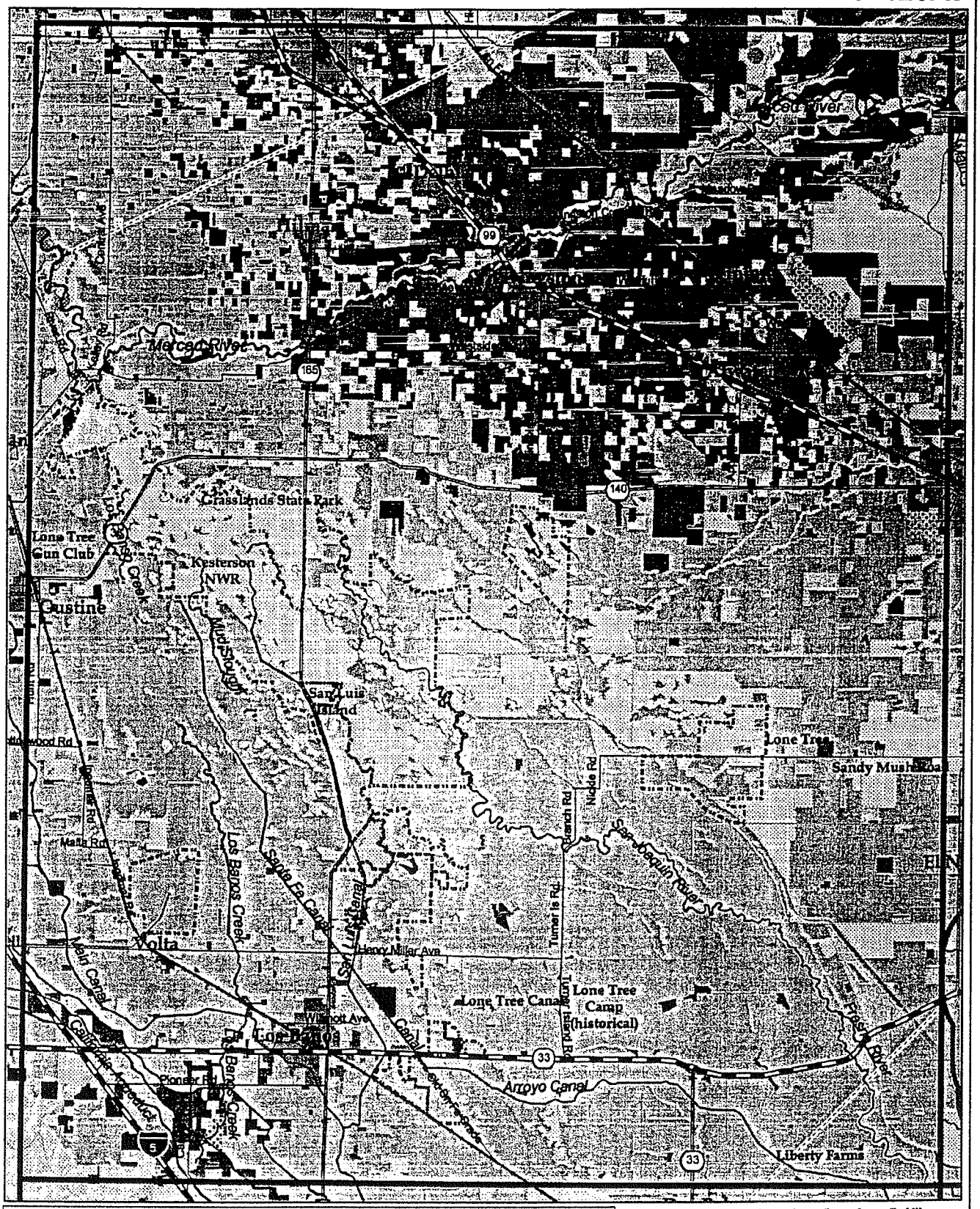
References

Anderson, J. R., Hardy, E. E., Roach, J. T. and Witmer, R. E. 1976. "A Land Use and Land Cover Classification System for Use with Remote Sensor Data." U.S. Geological Survey, Professional Paper 964, p. 28, Reston, VA.


Turlock
Merced
37120A5
Los Banos
37120A1
Planada
Chowchilla
37119A5
Oakhurst
37119A1
Shaver
Lake
Merced
County
Madera
36120E5
Panoche
36120E1
Mendota
Mendota
Kerman
Fresno
36119E5
Fresno
Sanger
Clovis
36119E1
Orange
Cove
Reedley
Dinuba
Hanford
Visalia
36120A1
Coalinga
Coalinga
36119A5
Lemoore
Concord
36119A1
Visalia
Tulare
County
36118A5
Three
Rivers
Avenal
35119E5
Lost Hills
35119E1
Delano
35118E5
Fountain
Springs
Wasco
Kern
County
Bakersfield
35119A1
Taft
Taft
35118A5
Tejon
Ranch
34119E1
Ballinger
Canyon
34118E5
Grapevine
MAP SHEET INDEX
Cross Valley Division
Friant Unit
Friant and Cross Valley
Two mile buffer
10 0 10 20 Miles
10 0 10 20 Kilometers

Los Banos

37120A5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vinyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

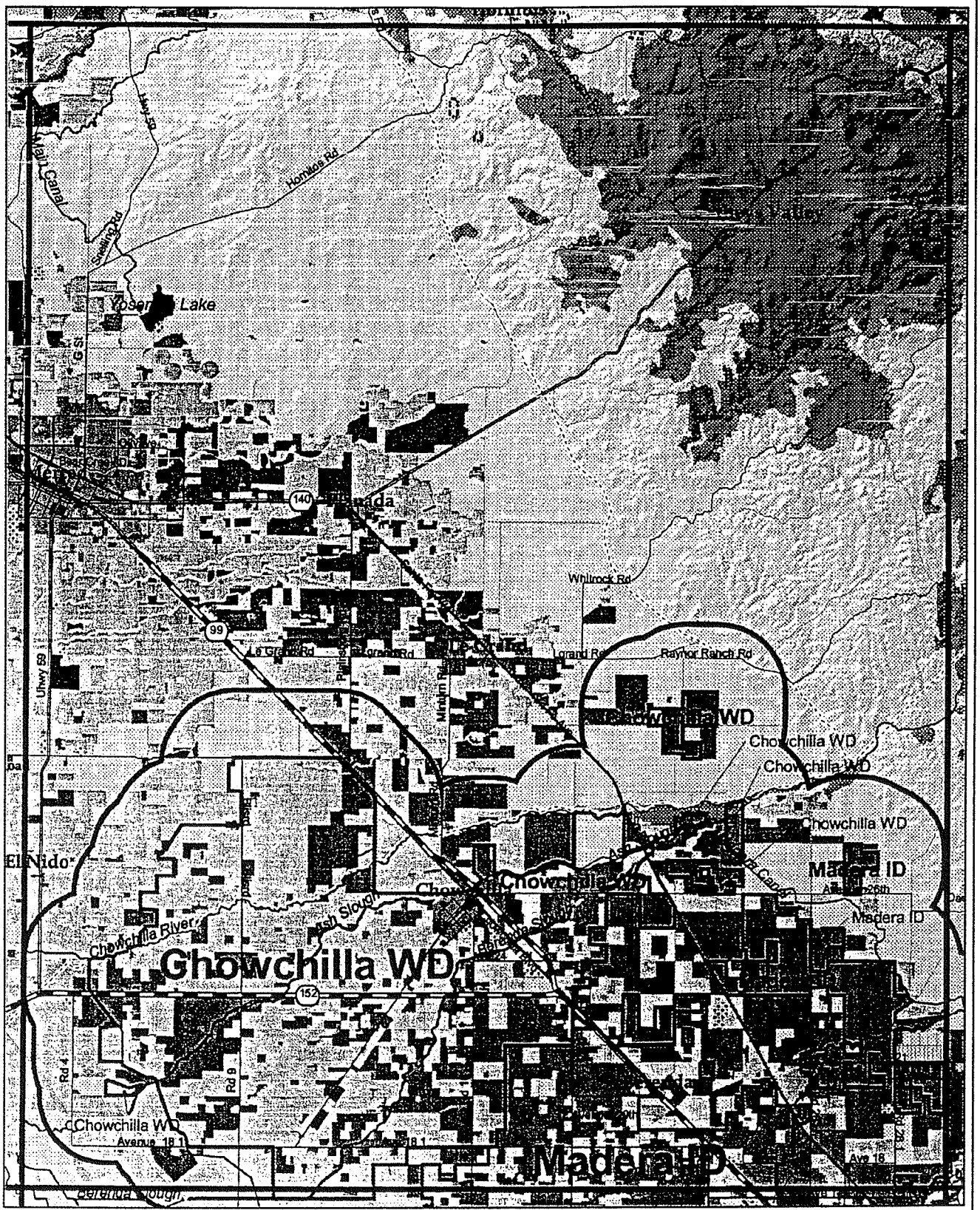
1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Planada

37120A1



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

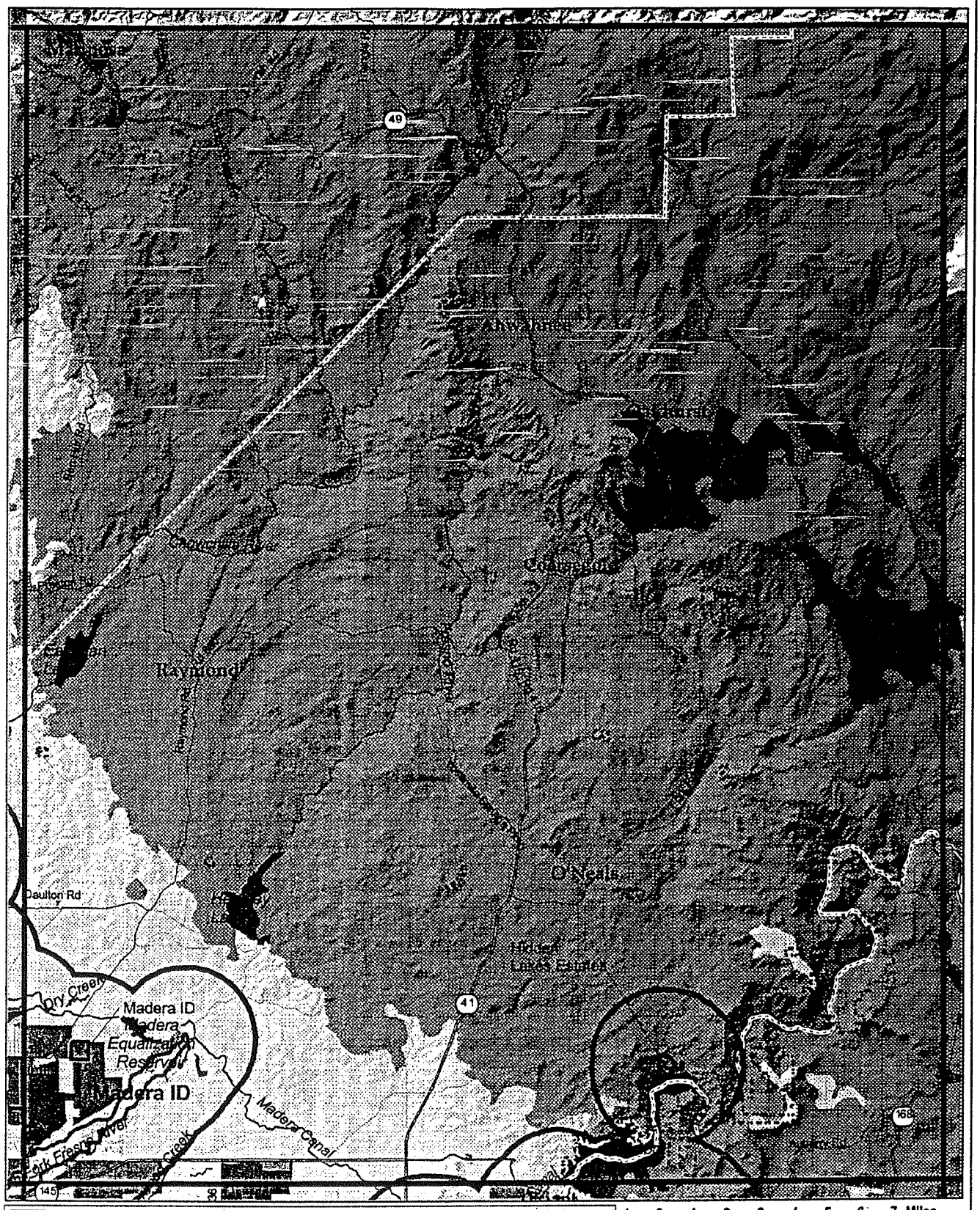
Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vineyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

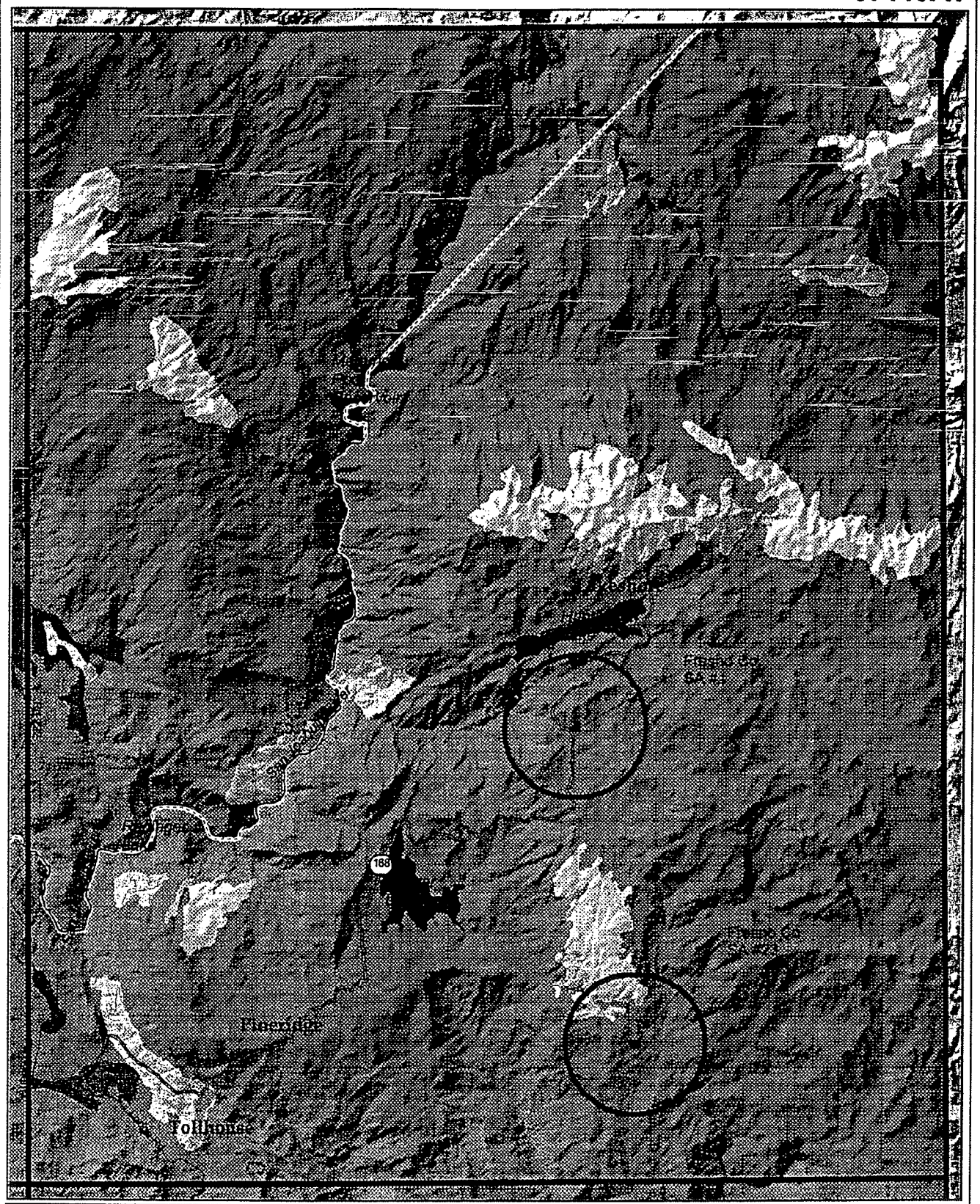
Oakhurst

37119A5



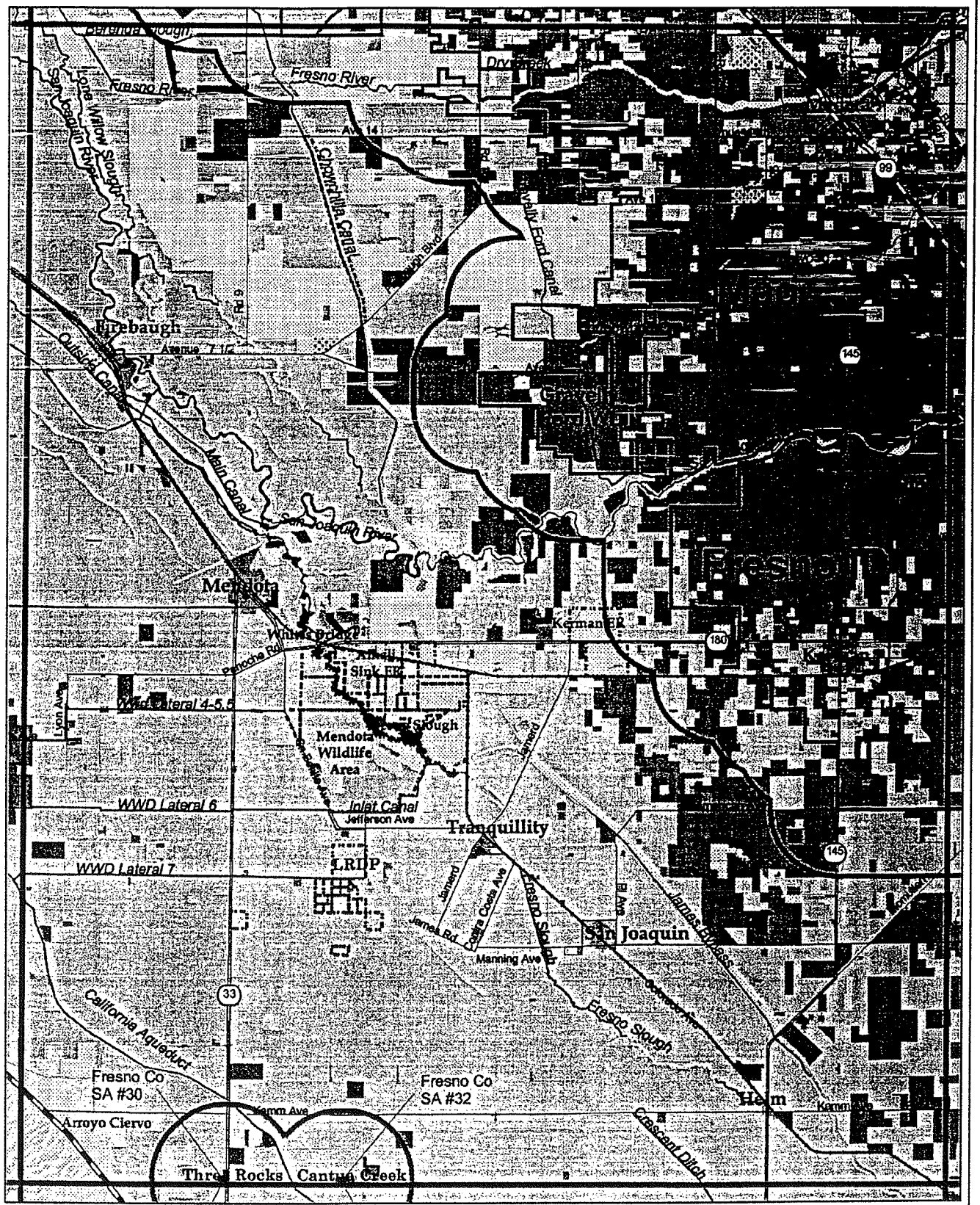
Shaver Lake

37119A1



Mendota

36120E1



Fresno

36119E5

Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vinyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

1 0 1 2 3 4 5 6 7 Miles

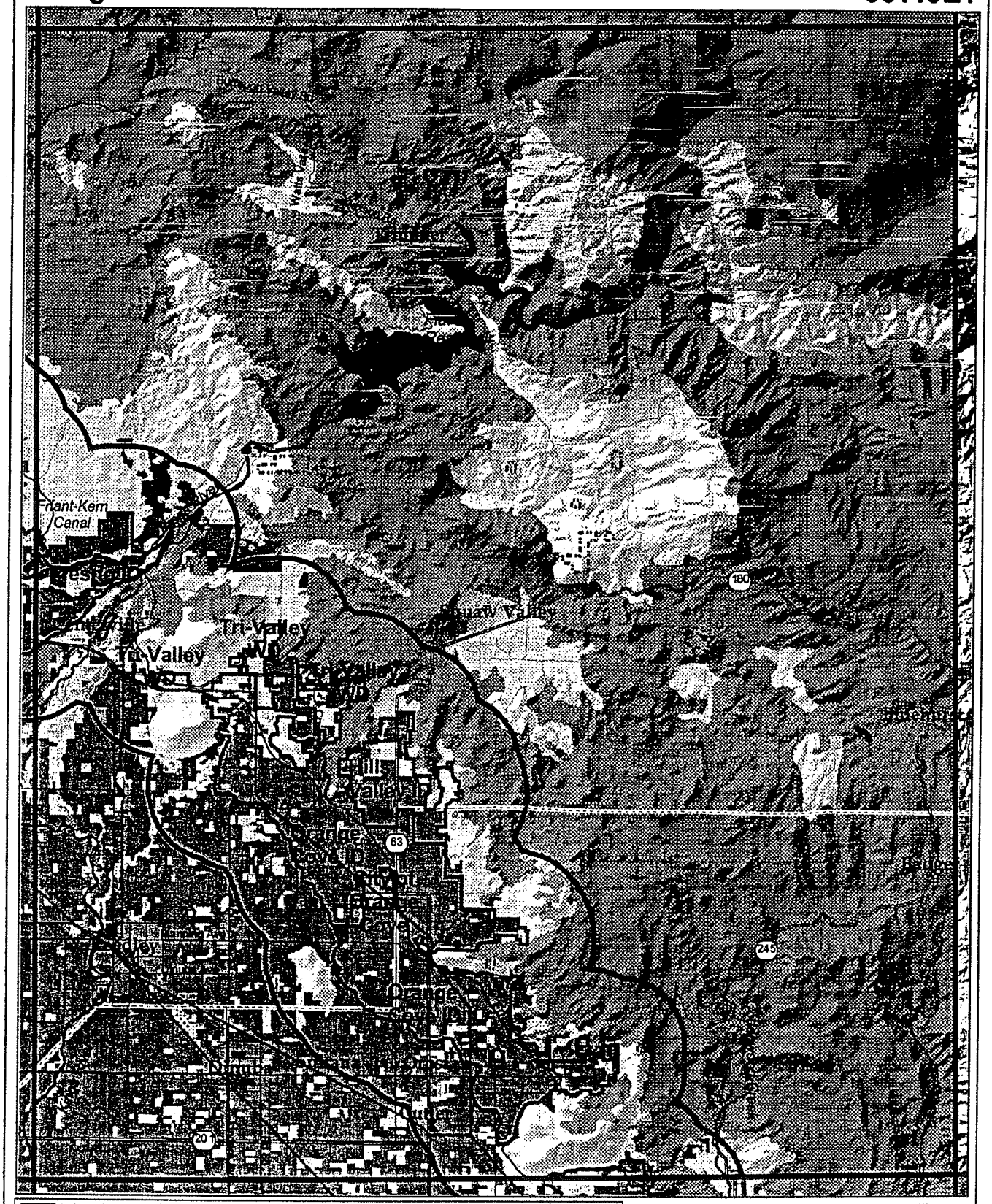
1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series

CSUS/ESRP GIS 01-2001

Orange Cove

36119E1



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

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- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
- Wetland

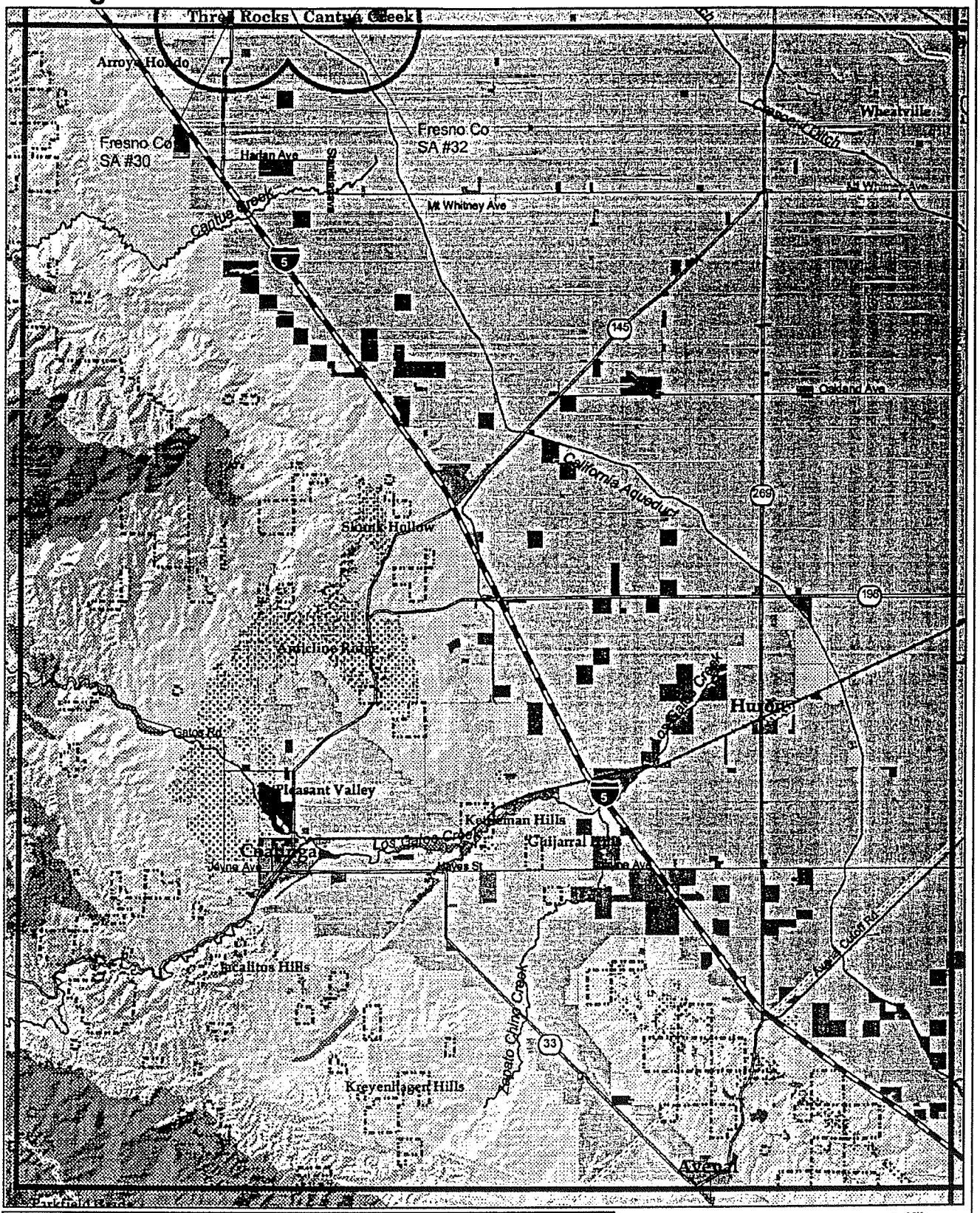
1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Coalinga

36120A1



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

- Industrial/transp.
- Urban
- Mixed urban
- Barren
- Cropland and pasture
- Orchards and vinyards
- Confined feeding operations
- Idle land
- Water
- Grassland/unknown rangeland
- Shrub and brush/mixed rangeland
- Deciduous forest
- Evergreen forest
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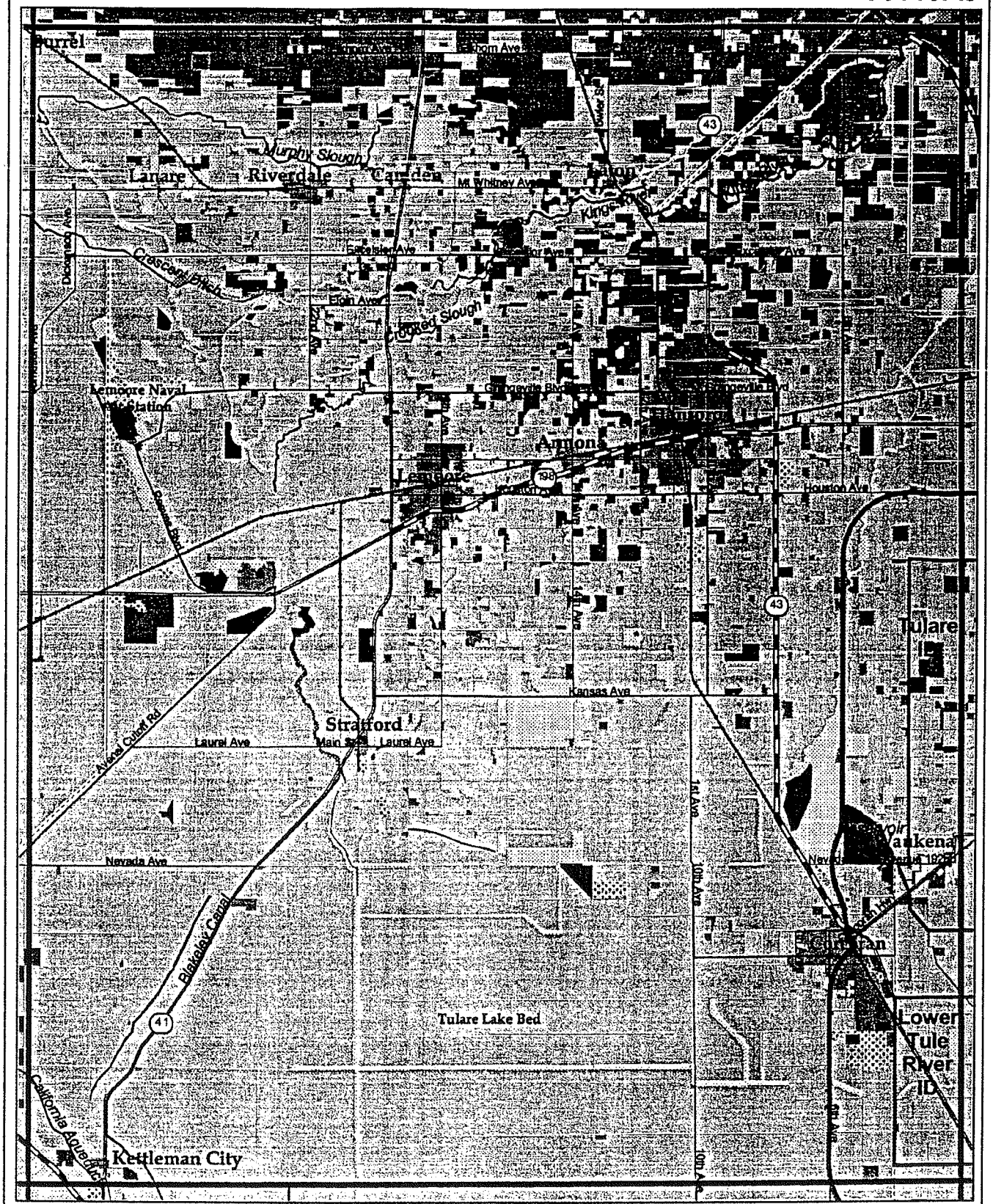
1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Lemoore

36119A5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

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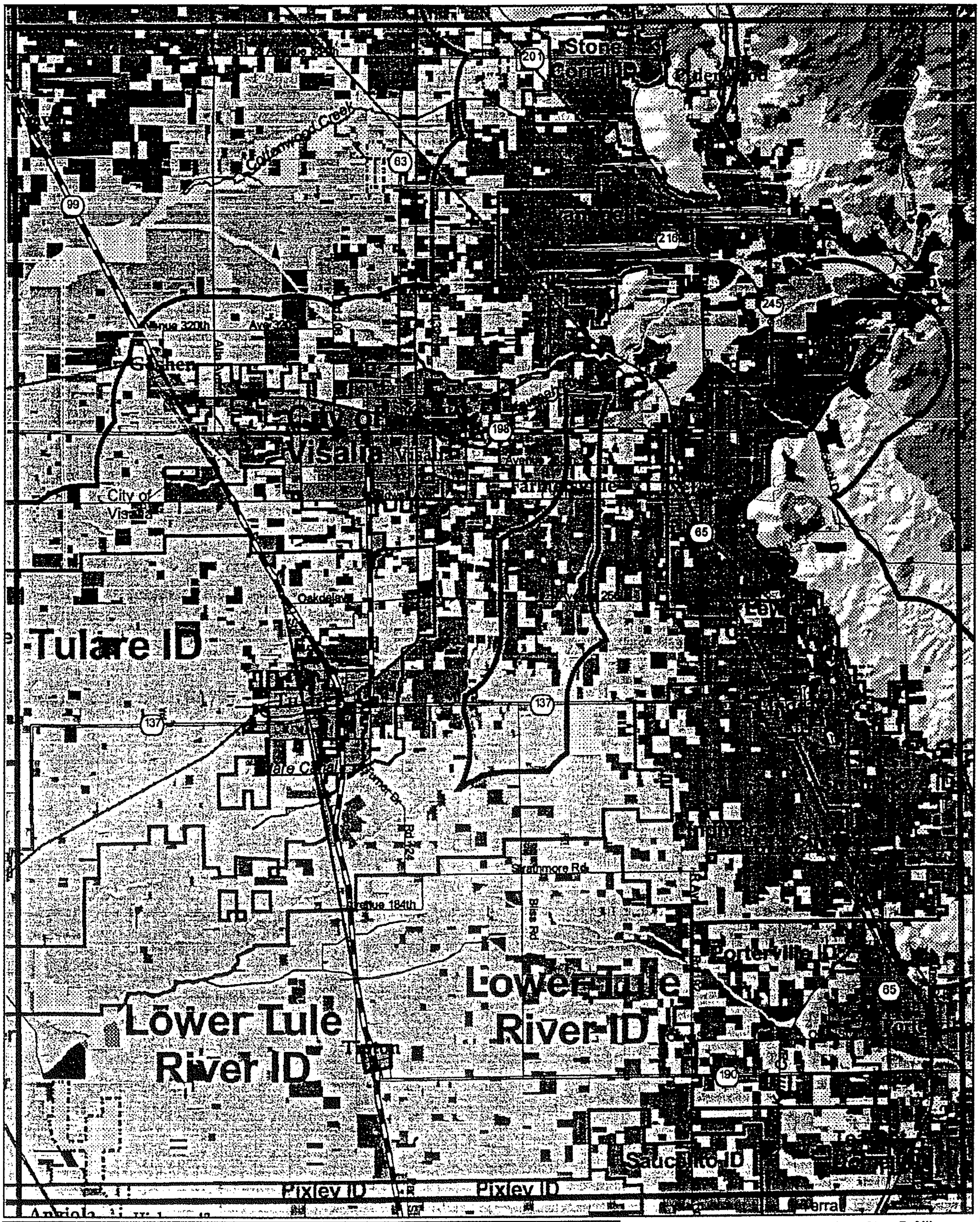
1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Visalia **36119A1**



Friant and Cross Valley Canal water districts boundaries | Two mile buffer | Public and conservation land boundaries

Land use/land cover: Industrial/transp. · Urban · Mixed urban · Barren · Cropland and pasture · Orchards and vinyards · Confined feeding operations · Idle land · Water · Grassland/unknown rangeland · Shrub and brush/mixed rangeland · Deciduous forest · Evergreen forest · Wetland

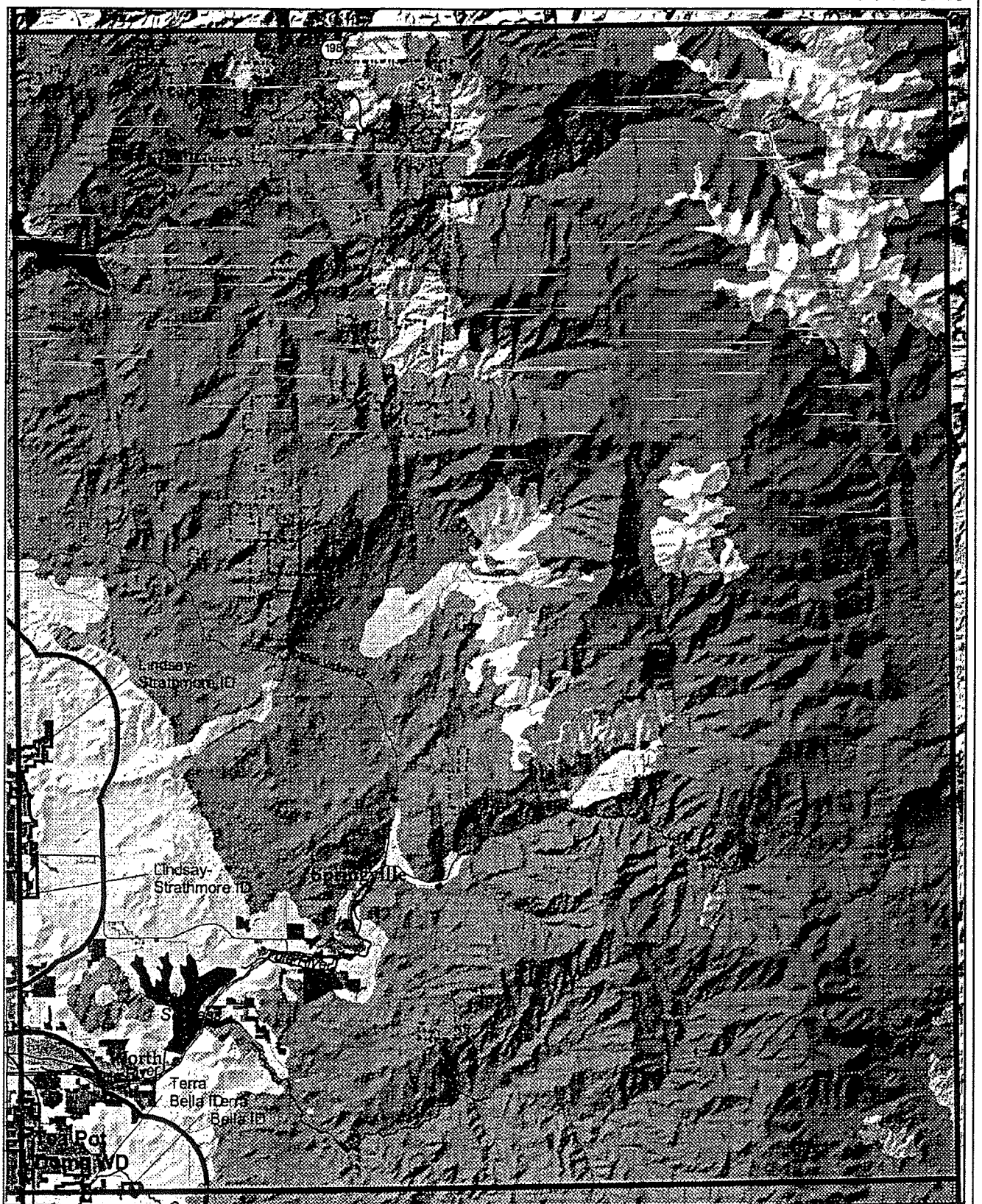
1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 Kilometers

1:250 000 30 Minute Series
CSUS/ESRP GIS 01-2001

Three Rivers

36118A5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

Industrial/transp.
Urban
Mixed urban
Barren
Cropland and pasture
Orchards and vinyards
Confined feeding operations
Idle land
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Grassland/unknown rangeland
Shrub and brush/mixed rangeland
Deciduous forest
Evergreen forest
Wetland

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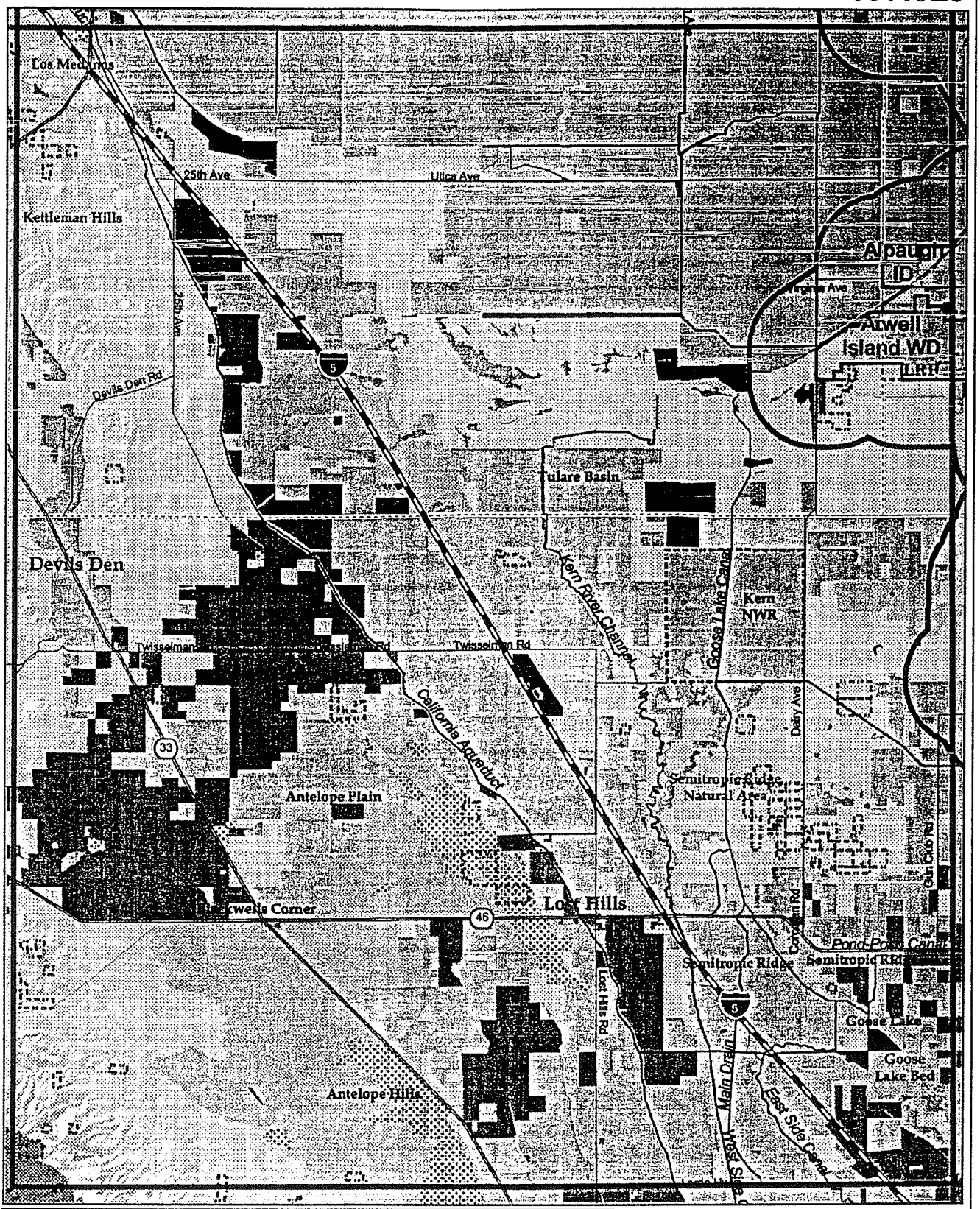
CSUS/ESRP GIS 01-2001

Lost Hills

35119E5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

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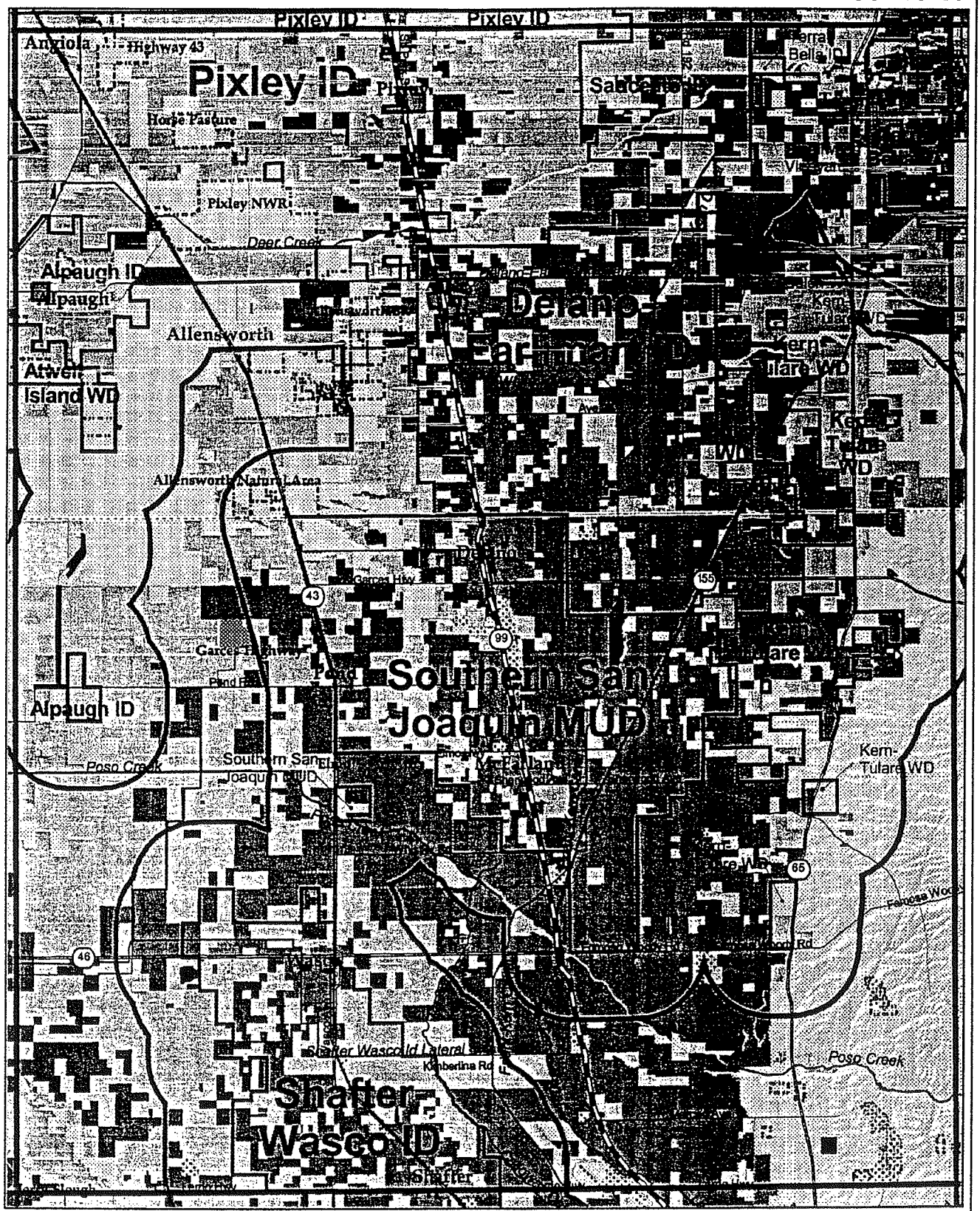
CSUS/ESRP GIS 01-2001

Delano

35119E1



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

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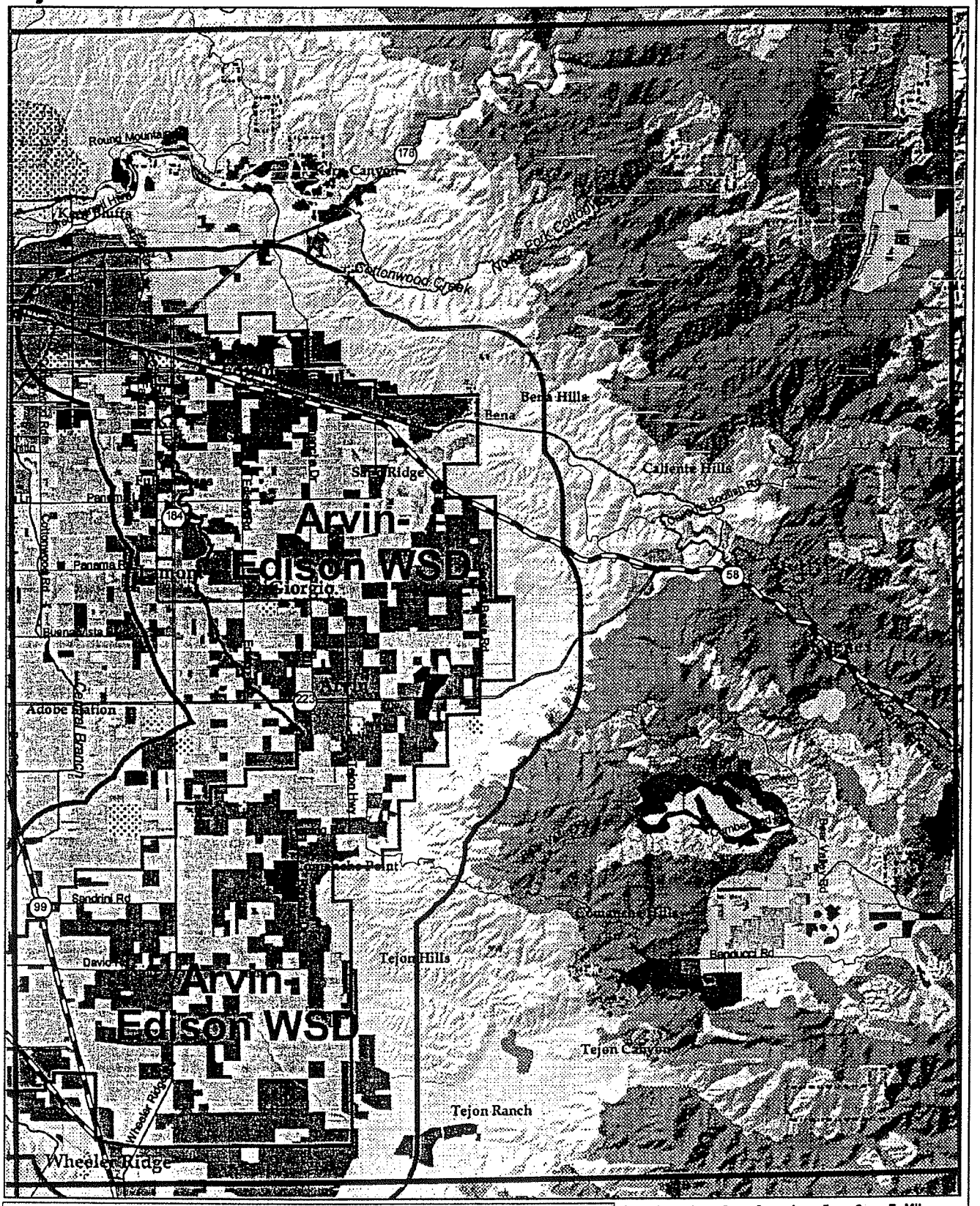
CSUS/ESRP GIS 01-2001

Tejon Ranch

35118A5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

Public and conservation land boundaries

Land use/land cover

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- Mixed urban
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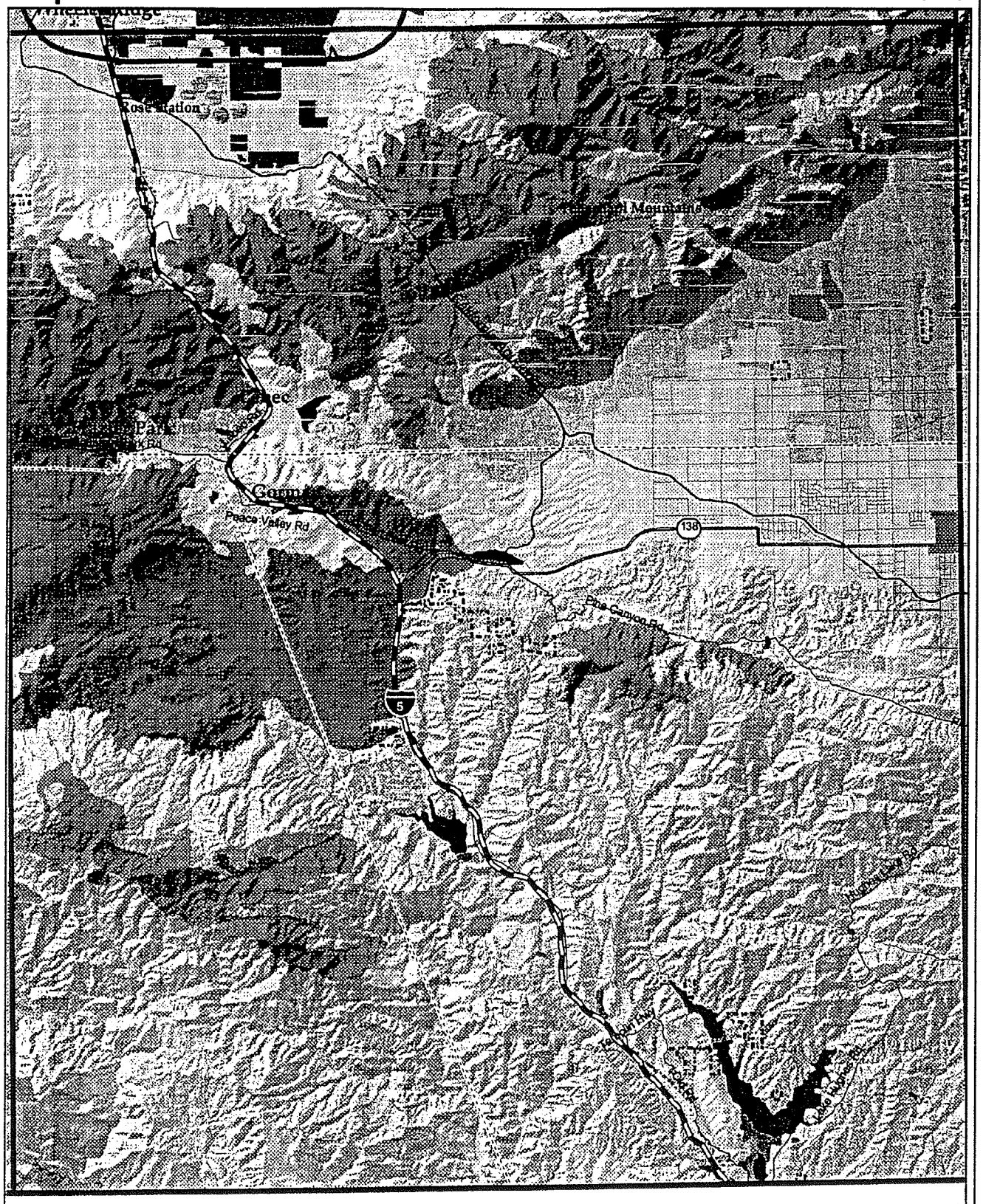
CSUS/ESRP GIS 01-2001

Grapevine

34118E5



Friant and Cross Valley Canal water districts boundaries

Two mile buffer

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