



# **KERN WATER BANK**

**Status Report No. 3**

**Department of Water Resources**

**April 1990**



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The Kern Water Bank is a conjunctive use ground water program of the State Water Project being developed by the Department in coordination with the Kern County Water Agency and other local interests. The program will augment the dependable supply of the SWP by storing water in the Kern County ground water basin in coordination with surface water storage and conveyance facilities.

This report summarizes the progress and activities of the Kern Water Bank program that have taken place since our last report in February 1989. In the past year, the Department, along with the Kern County Water Agency, has focused on developing the initial elements of the Kern Water Bank and conducting planning studies for first stage facilities and operations of the Kern Fan Element. With assistance from local water districts, we are also evaluating local elements.

As with any future project, the Department's goal is to develop a technically feasible, economically competitive, and environmentally sound program that will increase supplies for the State Water Project. Several specific components are involved in the Department's planning studies. The process involves geologic exploration and ground water investigations, ground water modeling, water supply operation studies, water quality investigations, determination of preliminary designs and cost estimates, economic and financial analyses, and environmental assessment studies.

Comments or questions about the program may be directed to Steve Macaulay, Program Manager, State Water Project Planning Branch, Division of Planning, Department of Water Resources, P. O. Box 942836, Sacramento, CA 94236-0001; (916) 324-7192.

**THE KERN FAN ELEMENT**

Staged Development .....	1
First Stage Description .....	1
Construction .....	2
General Operation .....	2
Recharge Facilities .....	2
Kern Element Recharge Basins .....	4
City of Bakersfield's 2800-Acre Recharge Facility .....	4
Extraction Facilities .....	4
Conveyance Facilities .....	5
Cross Valley Canal .....	5
Buena Vista Water Storage District Facilities .....	5
Kern River Canal .....	5
Technical Studies .....	5
Exploration and Monitoring .....	6
Water Quality Evaluation .....	8
Ground Water Modeling .....	10
Water Supply Operation Studies .....	10
Land Management and Land Use .....	11
Operational Issues .....	11
Ground Water Purchase .....	12

**LOCAL ELEMENTS**

Semitropic Water Storage District .....	12
Kern County Water Agency-Improvement District No. 4 .....	13
Kern Delta Water District .....	13
Buena Vista Water Storage District and West Kern Water District .....	14
Rosedale-Rio Bravo Water Storage District .....	14

**INSTITUTIONAL ACTIVITIES**

Department/Agency Kern Water Bank Contract .....	14
City of Bakersfield Agreement .....	15
Other Future Agreements .....	15
Institutional Issues .....	15

<b>ENVIRONMENTAL STUDIES</b> .....	16
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## THE KERN FAN ELEMENT

As a result of a strong interest in accelerating the development of the Kern Water Bank program over the past year, the Department of Water Resources is pursuing a staged plan of development for the Kern Fan Element. Earlier plans were to have the Kern Fan Element operational in 1994. The Department now expects to have a partially operational initial stage in 1991.

### Staged Development

The first stage of the Kern Fan Element will be a scaled-down operation of the ultimate project, as set forth in the Department's report, *Kern River Fan Element - Kern Water Bank, Preliminary Technical Report* (April 1987). Subsequent development will increase operations to the ultimate size. Although the plan for development of the Kern Fan Element has changed, the various planning studies that must be performed remain the same. The Department has been continuing its efforts to conduct various field investigations and other planning study tasks which began last year and has begun several technical and environmental studies. Its work includes subsurface exploration and ground water investigations on the property to obtain site-specific information on recharge and extraction potential and aquifer characteristics. Soil borings are being drilled at potential recharge sites, a monitoring well network is being installed, and water levels and water quality are regularly monitored.

The Department has also begun State Water Project water supply operation studies to evaluate various delivery schedules to and from the Kern Fan Element. The refined ground water model for the Kern Fan Element is presently being calibrated and will be used

to evaluate the impact of various recharge and extraction patterns on ground water conditions in the project area. Preliminary layouts and designs are being prepared for recharge, extraction, and related facilities.

The results of the Department's studies for the first stage will be presented in a feasibility report. This will be followed by a draft supplemental environmental impact report. Both are expected to be completed at the end of this year (1990), with a final environmental impact report in early 1991. The feasibility report will detail the technical, economic, and financial aspects of the proposed project. The EIR will address the environmental aspects of the proposed project and project alternatives.

After the first stage planning is complete, some of these activities will be continued to develop the ultimate project. The operational experience gained from the first stage will also assist the Department in designing and operating subsequent development of the Kern Fan Element and local elements.

### First Stage Description

The first stage is planned for a maximum storage of 300,000 acre-feet. The principal facilities on the Kern Fan Element property will consist of up to 1,000 acres of recharge basins and up to 30 existing/new wells. Under an agreement with the City of Bakersfield, existing recharge basins in the City's 2800-acre recharge facility will be used when they are available. The first stage will rely on the use of existing canals, recharge basins, wells, and related facilities as much as possible. Use of some of these canals will require agreements with local water entities. Water for recharge will be pumped through the SWP's Delta

Pumping Plant into the California Aqueduct, and then into the Cross Valley Canal at Tupman, under an agreement with CVC Participants. Water from the CVC will be turned out to recharge basins on the Kern Fan Element property or the City's recharge facility. Water will be extracted by pumping from wells on the Kern Fan Element property and conveying it to local canals, from which much of it would be exchanged with local water users for water that would otherwise have been delivered from the California Aqueduct. Some water will be pumped directly back to the Aqueduct when exchanges are not feasible.

The general plan of the recharge, pumping, and conveyance facilities for the first stage of the Kern Fan Element is shown on Figure 1.

○ **Construction.** In addition to the use of existing facilities, new recharge basins, wells, canals, and pipeline facilities are expected to be constructed on the Kern Fan Element property. Outside the property, the first stage will require the construction of turnouts from the Cross Valley Canal, a metering structure at River Turnout No. 1, a siphon under the Kern River Canal from the City's 2800-acre recharge facility to the Kern Fan Element property, and pumpback facilities to the California Aqueduct at the Buena Vista Aquatic Recreation Area. Access roads will be constructed for operation and maintenance of project facilities, and some temporary construction roads will probably be required.

The first stage facilities will likely be built under multiple construction contracts, with the work beginning some time in 1991. Some offsite facilities are expected to be constructed under contract through the Kern County Water Agency, the City of Bakersfield, and various water districts. Construction of the first stage is expected to take about 12 months.

○ **General Operation.** The ultimate design and operation of the Kern Fan Element will be based to a large extent on experience gained in operating the first stage, which will identify potential problems and improve future operation.

Under an agreement with the Kern County Water Agency, the Department will schedule deliveries for the Kern Fan Element and the Agency will operate the project facilities. The first stage will operate under a concept of advanced delivery of SWP entitlement water. Under this concept, water delivered for recharge will be considered a portion of the Agency's future SWP entitlement. This water will be in addition to the year's entitlement deliveries to the Agency. In the years of extraction, this water will be pumped out and delivered to the Agency's member units, and the Department will reduce entitlement deliveries from the California Aqueduct by an equal amount. Some of the extracted water will be pumped back into the California Aqueduct for delivery to the Agency's member units that cannot be served from local canals adjacent to the extraction area.

○ **Recharge Facilities.** The planned maximum annual recharge for the first stage is 90,000 acre-feet. Recharge alternatives for both 6- and 12-month periods are being considered. The monthly recharge would be 7,500 acre-feet for a 12-month schedule and 15,000 acre-feet for a 6-month schedule. The assumed recharge capability of the initial recharge basins on the Kern Fan Element property and the City of Bakersfield's 2800-acre recharge facility is expected to be sufficient to recharge up to 15,000 acre-feet per month. Under an agreement with the City, the 2800-acre recharge facility will be available to the Department whenever it is not being used to recharge local water.

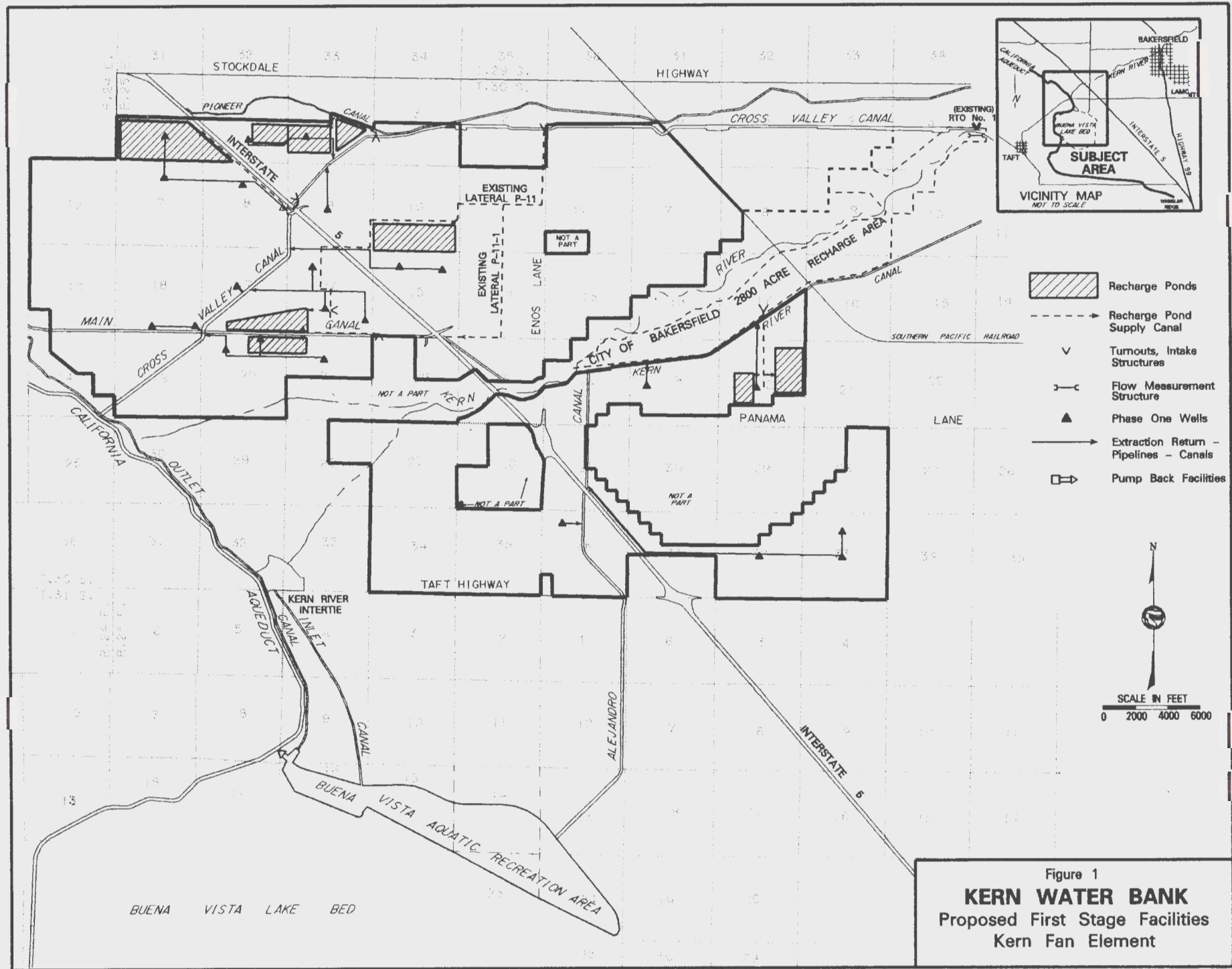


Figure 1  
**KERN WATER BANK**  
 Proposed First Stage Facilities  
 Kern Fan Element

**Kern Element Recharge Basins.** Five sites on the Kern Fan Element property are currently planned for recharge (Figure 1). One of them consists of 360 acres of existing recharge basins. These basins, which were constructed and used for recharge by the previous landowner, will require some modifications and improvements before they can be used. The remaining four sites will require the construction of new ponds on lands that are or have recently been in agricultural production.

All five recharge sites will be served by the Cross Valley Canal through existing/new turnouts and unlined canals. The recharge site south of the Kern River will be served from the Cross Valley Canal through the City's recharge facility. This service will involve construction of a siphon from the 2800-acre recharge facility southward under the Kern River Canal to the Kern Fan Element property. This siphon will allow the City reciprocal use of Kern Fan Element recharge basins to the extent that Department operations in the 2800-acre recharge facility reduce the City's recharge capability that would otherwise have been used by the City and its Basic Spreading Contractors. Similarly, the proposed recharge basins along the Main Canal could also be used by the City. In that case, water could be diverted from the Kern River into the Main Canal to the recharge basins on the Kern Fan Element property. Such sites could also be used by others for local recharge of Kern River water in very wet years.

**City of Bakersfield's 2800-Acre Recharge Facility.** At present, the City has in its 2800-acre recharge facility an estimated 1,200 acres of recharge basins, with a maximum annual recharge capacity of 200,000 acre-feet. The City plans to ultimately increase recharge acreage to about 1,350 acres. It has first priority to spread water in its facility and permits the Agency and other local water districts to spread and extract water there

through separate agreements.

A review of monthly hydrologic data for the Kern River and historical operation of the 2800-acre recharge facility indicates that it will have spreading capacity available for the Kern Fan Element recharge water at least 90 percent of the time. The remaining time essentially occurs in very wet months, when local recharge will take precedence.

Under the plan for operating the first stage of the Kern Fan Element, SWP water will be delivered to the City's recharge facility from the Cross Valley Canal at Kern County Water Agency's River Turnout No. 1. SWP water could also be exchanged for a like amount of local water for recharge in the City's facility. Such exchanges would primarily involve Kern River water. A draft agreement providing for the Department's use of the City's facility has been negotiated among the staffs of the Department, the Agency, and the City.

○ **Extraction Facilities.** The maximum annual extraction capability that is planned for the first stage is 72,000 acre-feet, using up to 30 existing/new wells. Pumps, motors, and appurtenant equipment will have to be modified and improved on existing wells, and some new equipment may be necessary. Installation of new wells is also being evaluated. Most of the wells will be connected for delivery into the Cross Valley Canal (Figure 1). Other wells will be connected to the Kern River and Alejandro canals for delivery to the Buena Vista Aquatic Recreation Area lakes. Alternative well sites just north of the City's recharge facility and other locations are being considered. As previously indicated, much of the extracted water will be exchanged for water that would otherwise have been delivered from the California Aqueduct to the CVC and the Buena Vista Aquatic Recreation Area lakes. The remainder will be pumped back into the California Aqueduct.

○ **Conveyance Facilities.** Agreements with other water entities will be needed so that local conveyance facilities can be used to transport SWP water to the recharge sites and from the extraction wells. On the Kern Fan Element property, the Department will use many of the existing irrigation canals for conveyance and will construct some new canals and pipelines.

**Cross Valley Canal.** The Cross Valley Canal conveys federal exchange water and SWP water to water users in Kern County. The CVC, which has been operating since 1975, is operated by the Agency on behalf of the Cross Valley Canal Participants:

Arvin-Edison Water Storage District  
Cawelo Water District  
Fresno-Tulare Group  
KCWA-Improvement District No. 4  
Kern-Tulare Water District  
Rag Gulch Water District  
Rosedale-Rio Bravo Water Storage District

Water in the CVC that is turned out of the California Aqueduct at Tupman is pumped eastward through the Kern Fan Element property to the Bakersfield area through a series of pumping plants. The CVC is divided into four reaches, and CVC users are charged fees based on the use of each reach. The first reach has a design capacity of 736 cubic feet per second. Thereafter, capacity decreases as water is diverted.

Use of the CVC is essential for operation of the first stage of the Kern Fan Element. For this stage, it is the most economical, practical means of delivering SWP water to and from the Kern Fan Element property. For full development, the previously planned State Canal will be evaluated as a potential delivery alternative to the CVC. However, preliminary studies by the Kern County Water Agency indicate that there should be adequate capacity in the CVC for first stage operations. The

Department is preparing a proposal to the CVC Participants that will request use of the canal for the Kern Fan Element and address general provisions of operation.

**Buena Vista Water Storage District Facilities.** Under an agreement with the Buena Vista Water Storage District, operation of the first stage is expected to require the use of the Alejandro and Main Canals and the lakes in the Buena Vista Aquatic Recreation Area. The district currently operates the Main Canal to recharge local water, when available, by easement through the Kern Fan Element property. The Main Canal would be used to convey water from the CVC or the Kern River for recharge on the Kern Fan Element property. The Main Canal would be used to convey Kern River water for local recharge in wet years or when an exchange with river water has been arranged. The Alejandro Canal and the recreation area's lakes would be used to convey extracted ground water from the Kern Fan Element property south of the Kern River to the California Aqueduct. Four to five wells are expected to deliver water to the Alejandro Canal.

**Kern River Canal.** The Kern River Canal, owned and operated by the City of Bakersfield, will be used in conjunction with Buena Vista Water Storage District's Alejandro Canal and the Buena Vista Aquatic Recreation Area's lakes. Two existing wells are expected to deliver water to the Kern River Canal. Use of the Kern River Canal by the Department is presently provided for in the draft agreement with the City.

○ **Technical Studies**

During 1989, the Department conducted several technical studies for the first stage of the Kern Fan Element to evaluate its recharge and extraction potential more fully, and to determine the water supply benefits that can be expected. These studies include exploration

and monitoring, water quality evaluation, ground water modeling, and integrated State Water Project operations.

**Exploration and Monitoring.** The Department has been investigating the hydrogeology beneath the Kern Fan Element to determine its suitability for ground water recharge, storage, and extraction. These investigations have involved shallow drilling to investigate potential recharge sites. Deeper drilling is being done to evaluate aquifer storage characteristics and patterns of ground water storage.

Shallow drilling investigations, performed in 1989 to provide a detailed evaluation of recharge potential, had two phases. First, very shallow hand augering (20 feet or less) was completed for several potential recharge sites. These borings provided detailed information on the presence of shallow clay or silty layers that would restrict vertical movement of water from recharge ponds. The second phase consisted of drilling 100 holes about 50 feet deep, using a hollow stem auger. These holes provided an overview of shallow soil conditions throughout the Kern Fan Element. The Department plans to continue shallow exploration drilling during 1990 on the potential recharge sites identified for the first stage. Beginning in July, drilling will include about one hole for every 10 acres of potential recharge area. Results of this work will allow selection of the exact recharge sites and provide soil data that can be used to evaluate the rates at which recharge will occur.

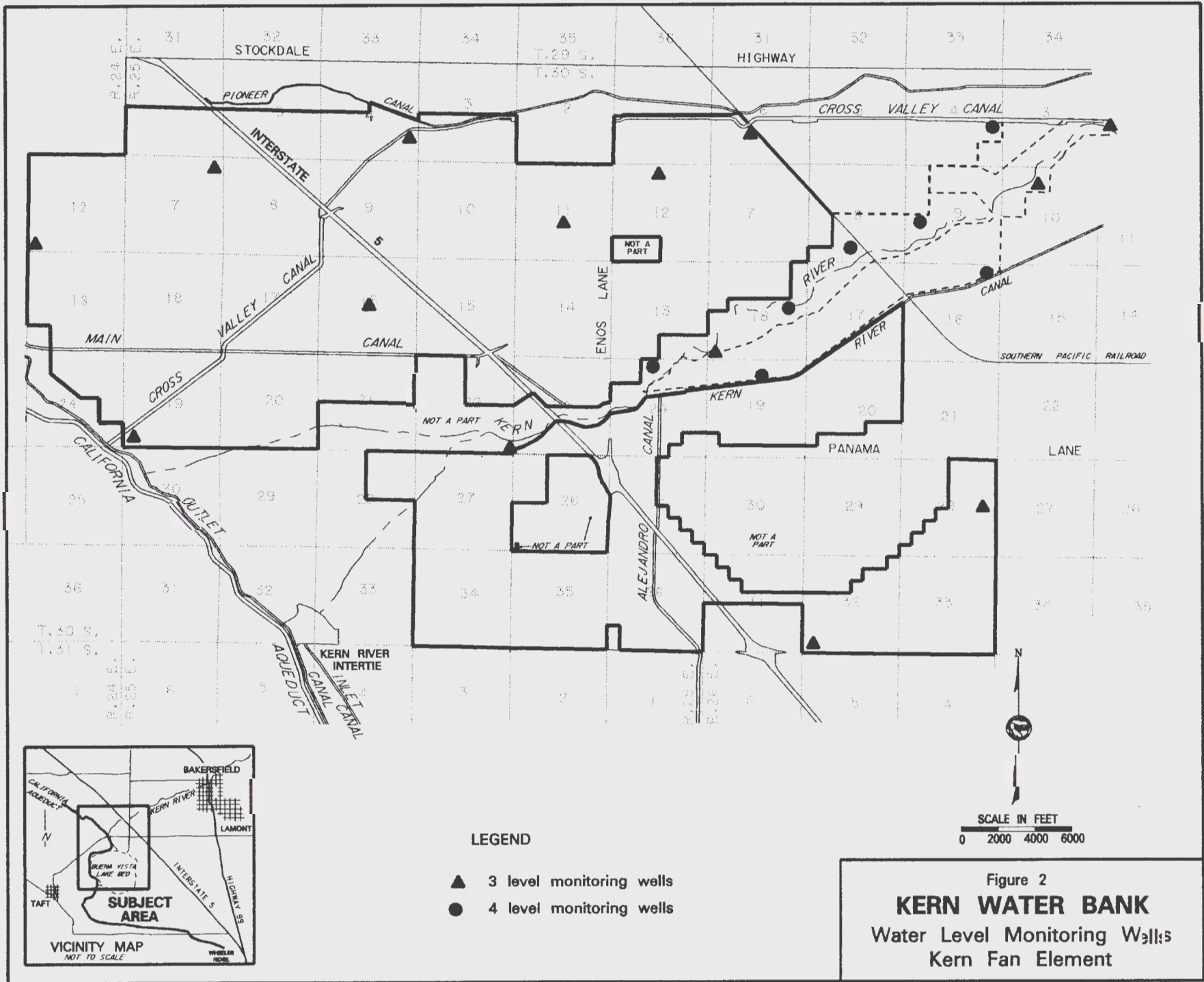
A second shallow exploration in 1989 defined the extent of water with high total dissolved solids (TDS greater than 1,000 parts per million) on the southwestern fringe of the Kern Fan Element. During July 1989, ten holes were drilled to a maximum depth of 150 feet near the Cross Valley Canal turnout from the California Aqueduct. This exploration found that the high TDS water is restricted to

a small area about one mile from the California Aqueduct near Tupman. The Department is coordinating with West Kern Water District and Buena Vista Water Storage District to extend exploration to the south and develop a network of monitoring wells so that the movement of the high TDS water can be identified.

The Department has also been developing a network of ground water monitoring wells to obtain water level and water quality data for analysis of water movement beneath the Kern Fan Element. The drilling of each well provides geologic data through driller's logs and electric logs of soil material. The network also provides a continuous record of ground water levels in specific aquifer layers that can be used in development of a ground water model. The network began with construction of monitoring wells in the City's 2800-acre recharge facility, followed by additional wells on the Kern Fan Element property (Figure 2). In 1987, the Department began the construction of three triple-tube (three-level) monitoring wells in the 2800-acre recharge facility. By July 1988, a ten-site monitoring network (including seven four-level monitoring wells previously built by the City) was operational in the 2800-acre recharge facility, with data collected by the Agency semimonthly during spring and summer and monthly during fall and winter.

In June 1989, the Department completed five triple-tube monitoring wells on the Kern Fan Element property and, by June 1990, had constructed six more wells, completing the initial monitoring network (Figure 2). The Department has also purchased four electronic data loggers that continuously record water levels in three aquifer layers. These will be used in ten wells in the 2800-acre recharge facility and rotated among the 11 triple-tube monitoring wells on the Kern Fan Element to obtain water level information relating to short-term impacts of extraction in nearby wells.





The Department plans to extend the monitoring network beyond its property boundaries, starting in fall 1990. Twenty two-well clusters are to be placed mostly in adjacent water districts at sites near the boundaries of the Kern Fan Ground Water Model. Construction, which will be coordinated with these water agencies, will take two years. The proposed locations of these new monitoring wells and the existing monitoring network are shown on Figure 3.

**Water Quality Evaluation.** Before purchasing the Kern Fan Element property, the Department contracted with Camp, Dresser, and McKee, Incorporated, to conduct an initial toxics assessment of the area. In their August 1987 report, CDM concluded that the previous petroleum and agricultural activities on the property did not appear to present a significant problem for Kern Fan Element operations. However, because of limited data, CDM recommended that a more detailed sampling program be conducted to confirm their assessment. During 1989, the Department began analyzing water quality of agricultural production wells, sampling monitoring wells, and analyzing soil samples collected during shallow exploration drilling. The Department has also begun identifying point sources of pollution on the property, including oil pipelines, oil fields, and other facilities.

During the summer of 1989, the Department sampled all available agricultural production wells in use on the Kern Fan Element property. Between March and June, 1989, samples were collected from 42 wells. Twenty-three wells could not be sampled because they were not operable or were inaccessible. Results of this sampling showed that ground water below the Kern Fan Element was generally of excellent quality, with an average TDS of 330 parts per million (ppm) and a maximum of 1,060 ppm. However, some problems were

identified. Ethylene dibromide (EDB), which has been used by farmers for nematode control, was detected in four wells in one area at concentrations between 0.07 and 0.60 parts per billion (ppb), and the herbicide Eptam and the pesticide toxaphene were detected in one well in the western part of the property. The maximum contaminant level for EDB is set at its level of detection (0.02 ppb).

In December 1989, the Department conducted its first quarterly water quality sampling of the monitoring wells in the Kern Fan Element and the 2800-acre recharge facility. Analyses of these samples showed generally good mineral quality. However, near Tupman, low levels of the herbicide diuron were found in one well, and excessive levels of arsenic were found near the intersection of Interstate 5 and Taft Highway. Sampling of these wells will be continued and expanded to include newly constructed monitoring wells.

During the summer of 1989, analyses were performed on soil samples collected from 57 test holes at 10-foot increments to a depth of 50 feet. No detectable amounts of aldicarb, EDB, or 1,2-dibromo-3-chloropropane (DBCP) were found. Additional soil samples were collected in areas showing surface contamination related to oilfield operations. These were analyzed for total petroleum hydrocarbons and showed that contamination was limited mainly to the first three feet below the surface. Further soil analysis planned for the first stage recharge pond sites is expected to be completed by October 1990.

In spring 1989, the Department identified an area of apparent oil contamination adjacent to a Chevron oil pipeline easement in the northeast corner of the property. At the Department's request, Chevron investigated this site and found oil-contaminated soil for about 200 feet along the easement and to a depth of 65 feet. Sampling of a monitoring well constructed by Chevron at the site showed a

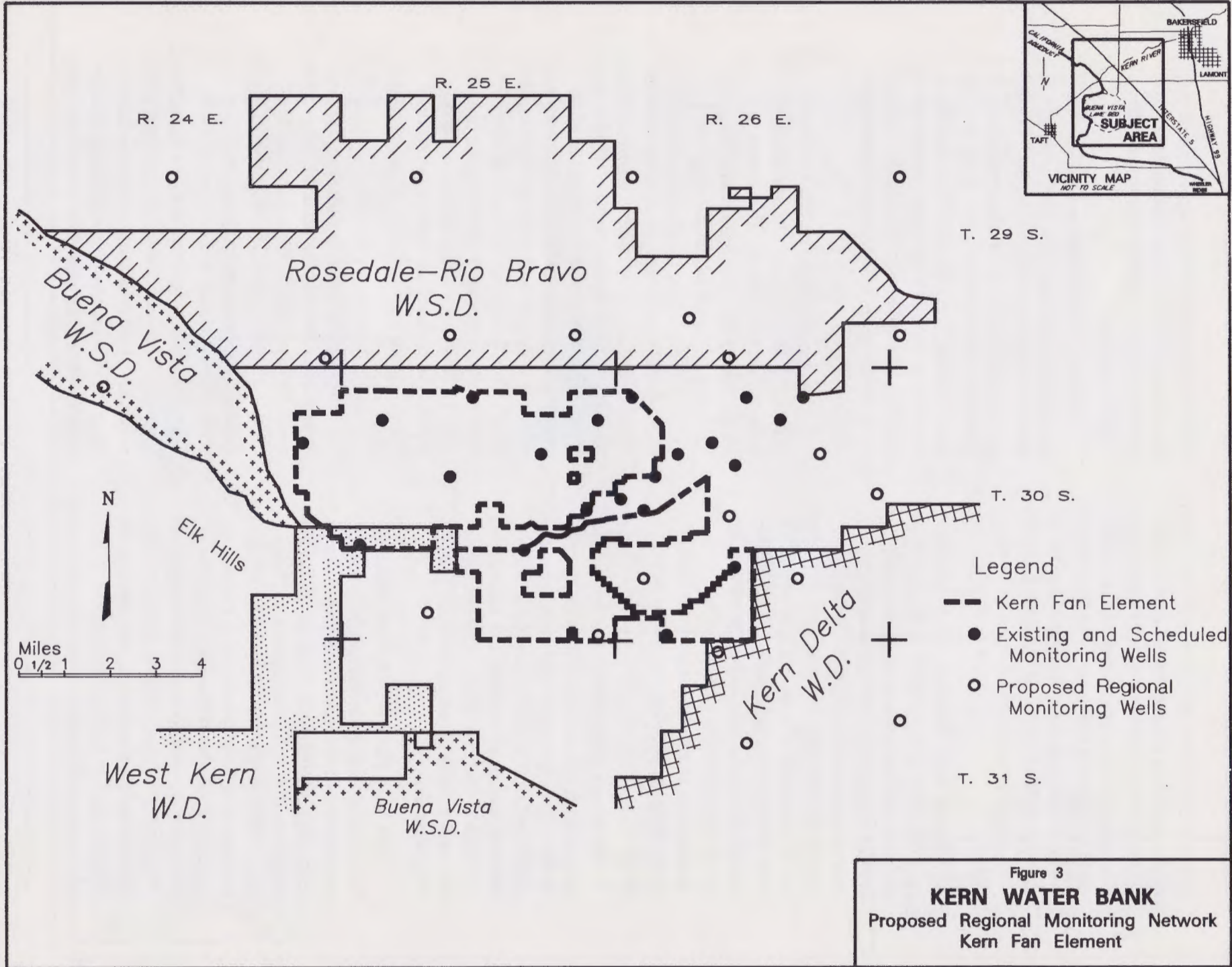
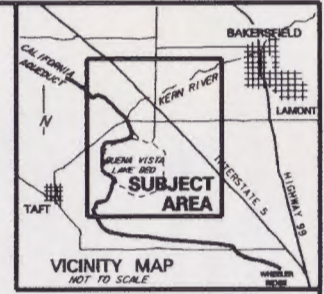


Figure 3  
**KERN WATER BANK**  
Proposed Regional Monitoring Network  
Kern Fan Element

benzene level of 0.01 milligram per liter. The Department has informed the Central Valley Regional Water Quality Control Board of the contamination and has requested their assistance in resolving this issue. The Department is also conducting investigations along the remainder of the pipeline on the Kern Fan Element property to screen for other potential leaks.

**Ground Water Modeling.** In the preliminary technical investigations of the Kern Fan Element, the Department used two-layer ground water flow models to evaluate the local ground water effects of project operations. One of the two models was a finite difference model composed of a square grid in which each node represented about 160 acres. Although this model was useful for reconnaissance level screening of possible operating alternatives, it is not adequate for evaluating actual project operating conditions or impacts.

To correct these deficiencies and to take advantage of the additional data being collected in the exploration and monitoring program, the Department is developing a more detailed version of the Kern Fan Ground Water Model. The new version has four layers and uses a finite difference network with 40-acre nodes.

The Kern Fan Ground Water Model is being calibrated, using historic hydrologic conditions between January 1988 and January 1990. The ground water levels projected during this period will be compared with measured well levels in the area, and model parameters will be adjusted until a reasonable match is achieved. After calibration, the model will be used to predict the impacts of proposed first stage recharge and extraction operations. The model will also continue to be calibrated as further exploration and monitoring data is collected. Ultimately, the model

will be used to evaluate the operation of the first stage of the Kern Fan Element and to maintain storage accounts for State Water Project records.

The other model used in the preliminary evaluation of the Kern Fan Element is the Kern County Ground Water Model. The version of this model used in the preliminary evaluation was a modification of the San Joaquin Ground Water Model, which had been modified to include only Kern County and significant adjacent areas. This model had also been altered to include increased detail near the Kern Fan Element.

Like the original Kern Fan Ground Water Model, the Kern County Ground Water Model included only two layers. This design prevented the model from recognizing the geohydrologic complexity of the Kern County Ground Water Basin. To improve the predictive capability of ground water levels in all of Kern County, the Department began updating the Kern County model. It now includes four layers and additional specification of water supply service areas to better account for variations in pumpage and recharge. The Department's development of the more detailed version was interrupted in 1989 by other priorities. Development of the model is currently planned to be resumed, using Kern County Water Agency staff under the direction of the Department.

**Water Supply Operation Studies.** Operations studies will be performed to evaluate the water supply benefits of the Kern Fan Element. In January 1990, the Department began evaluating specified assumptions of future SWP project staging and developing operational parameters for studies of the Kern Fan Element. The studies will use estimated conveyance and recharge rates for planned first stage facilities, along with a maximum storage capacity of 300,000 acre-feet, to simulate Kern

Fan Element operations during the 1922–1978 operations period. Storage decisions will be coordinated with system-wide operations to make maximum use of total SWP deliveries. Projected SWP yield and Kern Fan Element operating patterns derived from these operations studies will form the basis for the Kern Fan Element economic analysis.

## Land Management and Land Use

When the Department purchased the Kern Fan Element property in 1988, about 16,000 of the 20,000 acres were in agricultural production. For 1990, the Department plans to lease about 12,500 acres for agricultural use and will keep the 3,500 acres leased last year clear of vegetation. By the end of 1993, the Department expects to have all agricultural production on the property phased out. Through contracts with the Kern County Water Agency, the Department is continuing to manage the agricultural leases, maintain facilities, and control nuisance vegetation on the property.

All proposed first-stage facilities will be located in areas of agricultural use. About 1,000 acres will be needed. This means that some agricultural leases will have to be terminated or reduced in area to make way for construction and operation of the project.

Plans for multiple land use such as wetlands, other native wildlife habitat, recreation, and other local uses are being considered for portions of the Kern Fan Element property. The development of wetlands and other wildlife habitat could offset future impacts that may occur as a result of constructing various elements of the Kern Water Bank or other State Water Project facilities. The Department will work with the Department of Fish and Game, the U.S. Fish and Wildlife Service,

and others to negotiate an agreement regarding the mitigation credits for these developments. Areas for recreation and other local uses will also be developed on the property. A land use committee is expected to be formed this spring to develop the plans.

The Department has met with several oil and gas lessees and utility companies having rights to operate on the property to coordinate its plans for the Kern Fan Element. The Department's primary concern regarding oil and gas operations is that existing problem areas are cleaned up and potential water quality problems that might adversely impact water project operations are prevented from occurring. Southern California Edison and Pacific Gas and Electric have several building restrictions within their easements that should not be a problem for Kern Fan Element activities.

## Operational Issues

In operating the Kern Fan Element, the Department recognizes that it will need to address several potential ground water impacts. Some of these deal with ground water levels and some with water quality. The Department will be working on evaluating them so that project facilities and operations can be designed to minimize or avoid them. The following are some of the issues that will be considered:

Potential adverse water level impacts to surrounding ground water users include:

- Damage to surrounding crops due to elevated water levels near recharge areas; and
- Increased pumping lifts by surrounding ground water users (agriculture, oil and gas lessees, the City of Bakersfield, and water districts) near Kern Fan Element production wells.

Potential adverse water quality impacts to surface and ground water and surrounding receptors include:

- Extraction of ground water containing pesticides, hydrocarbons, and high TDS;
- Higher ground water TDS levels caused by recharge and extraction; and
- Oil leaks and hazardous wastes on the Kern Fan Element property.

### Ground Water Purchase

The Department has been developing a program to purchase up to 100,000 acre-feet

of ground water from La Hacienda, Inc., in Kern County. This water was Kern River water recharged in the City's 2800-acre recharge facility in recent wet years. If this water is to be of value to future SWP deliveries, a program is needed to extract it from the ground water basin and return it to the California Aqueduct to be integrated with other SWP supplies. The extraction program will use existing facilities on the Kern Fan Element property. The Department has met with the Kern River Fan Group and the Agency's Ground Water Storage Advisory Committee to discuss this program. The Department expects to have a decision on purchasing the water in the next few months.

## LOCAL ELEMENTS

With the assistance of local water districts and their consulting engineers, the Department and the Agency are studying five potential local elements for the Kern Water Bank through contracts with the Kern County Water Agency. The feasibility study of the proposed Semitropic Water Storage District's local element, which was started in September 1988, is continuing. Four other local element prefeasibility studies have begun and are in various stages of completion.

The prefeasibility studies are essentially cursory or reconnaissance-level analyses of proposed projects to determine whether they warrant further planning at a feasibility level. Under these studies, the water districts and their consulting engineers are responsible for performing certain components of the study that primarily concern an analysis of the project within each district's institutional boundaries. The Agency has the primary responsibility for coordinating the work of these local elements. Once these studies are completed, the Department will perform those compo-

nents of the study that involve an analysis of the project from a perspective outside the district's institutional boundaries.

Local element prefeasibility studies are being conducted by the Kern County Water Agency-Improvement District No. 4; Kern Delta Water District; Buena Vista Water Storage District, jointly with West Kern Water District; and Rosedale-Rio Bravo Water Storage District. The project descriptions and status of each of these studies are summarized in the following sections.

### Semitropic Water Storage District

**Project Description.** This proposed local element in the Semitropic Water Storage District involves primarily in-lieu recharge of SWP water with a possibility for direct recharge. Four independent alternatives are being evaluated: (1) providing SWP water for in-lieu recharge to serve 20,000 acres, with provisions for entitlement exchange; (2) in-lieu recharge to serve 30,000 acres, with provisions for entitlement exchange; (3) in-lieu recharge

to serve 40,000 acres, with provisions for entitlement exchange; and (4) in-lieu recharge to serve 40,000 acres, with provisions for entitlement exchange and direct pumpback of water to the California Aqueduct.

*Project Status.* This study is being conducted by the Semitropic Water Storage District and their consulting engineer, Bookman-Edmonston Engineering, is taking much longer than expected, mostly because of the time needed to evaluate several operating assumptions and parameters incorporated into the Department's SWP operations studies. Preliminary results indicate that a significant initial period may be required to fill the ground water storage reservoir to develop a balanced recharge/extraction project over the Department's 1922-1978 hydrologic study period. Ground water operation studies are expected to consider the impacts of the proposed project over the study period, as well as the initial fill period.

The Department completed SWP operation studies for the study, and Semitropic Water Storage District and Bookman-Edmonston have completed their analysis of the potential alternatives. A decision on a recommended alternative is forthcoming.

#### **Kern County Water Agency - Improvement District No. 4**

*Project Description.* This proposed local element in Kern County Water Agency's Improvement District No. 4 (ID4) involves both direct and in-lieu recharge of SWP water. Several direct recharge sites would be available for banking; and both agricultural and municipal and industrial (M&I) in-lieu operations are also proposed. SWP water could be exchanged for Kern River water to meet M&I demands. Banked water could be returned by extraction and delivery to the California

Aqueduct, or the Department could deliver less than ID4's scheduled entitlement and ID4 would pump ground water to make up for the reduction.

*Project Status.* ID4 and their consulting engineer, Kennedy/Jenks/Chilton, have completed a draft report of the prefeasibility study. The report has been reviewed by the Department and the Kern County Water Agency and has recently been reviewed by the Agency's Ground Water Storage Advisory Committee.

The study recommends that a feasibility-level investigation be conducted to evaluate potential local element operations in ID4, that ID4 and the Department share in the costs for the local element, and that ID4 would operate the element on behalf of the SWP.

#### **Kern Delta Water District**

*Project Description.* This proposed local element in the Kern Delta Water District involves a surface water exchange as part of its recharge operation. The extraction operation involves direct delivery either back to the California Aqueduct or, by exchange, for in-district use and release of Kern River supplies for SWP use.

For recharge, a new turnout from the California Aqueduct would deliver SWP water by way of several proposed low-lift pump stations through the Buena Vista Aquatic Recreation Area to an enlarged Maples Canal. The SWP water would be delivered to serve as many as 20,100 acres in the district's Kern Lake and Paloma areas to satisfy irrigation demands that would otherwise be met by Kern River water. Equal amounts of Kern River water that would otherwise be delivered to these two areas would thus be available for direct or in-lieu recharge in higher elevation lands in the district.

Wells would be constructed to return water to the California Aqueduct. This water could also be delivered for in-district use in exchange for its Kern River water. In turn, the Kern River water could be exchanged for SWP entitlement water that would otherwise be turned out at the Cross Valley Canal.

*Project Status.* Kern Delta Water District and their consulting engineer, Boyle Engineering Corporation, have completed a draft pre-feasibility report of the study. The report has been reviewed by the Department and the Kern County Water Agency and will be submitted to the Agency's Ground Water Storage Advisory Committee for comments.

### **Buena Vista Water Storage District and West Kern Water District**

*Project Description.* This proposed local element in the Buena Vista Water Storage District and West Kern Water District involves both direct and in-lieu recharge of SWP water. In-lieu recharge deliveries could be made from mid-January to mid-March to provide up to 40,000 acre-feet of preirrigation water per year. During peak irrigation, mid-May to mid-September, up to 20,000 acre-feet of in-lieu deliveries could be made per year. Up to 20,000 acre-feet of direct recharge could be provided per year with the use of recharge

capabilities in West Kern Water District. Several dry-year extraction concepts will be analyzed.

*Project Status.* Buena Vista Water Storage District and West Kern Water District and their consulting engineer, Boyle Engineering Corporation, are now conducting the study and should complete a report by May 1990.

### **Rosedale-Rio Bravo Water Storage District**

*Project Description.* This proposed local element in the Rosedale-Rio Bravo Water Storage District involves both direct and in-lieu recharge of SWP water. Direct recharge would involve the acquisition of an additional 300 acres of recharge land next to the district's present recharge area, and up to 60,000 acre-feet could be recharged per year. In-lieu recharge would involve construction of a surface distribution system to serve about 25,000 acres. Extraction would be provided by inter-connecting existing wells and pumping off-peak. Other alternative dry-year extraction concepts will be evaluated.

*Project Status.* Rosedale-Rio Bravo Water Storage District and their consulting engineer, Boyle Engineering Corporation, are scheduled to complete a draft report in the next few months.

## **INSTITUTIONAL ACTIVITIES**

Several agreements will be necessary to implement the Kern Water Bank. Some of these agreements are currently being negotiated, and negotiations on others will soon be initiated. In the development of those agreements that have already begun, various institutional issues have been discussed and are being resolved.

### **Department/Agency Kern Water Bank Contract**

One of the most important agreements is mandated by Water Code Section 11258, which requires an agreement with the Kern County Water Agency to construct and operate the Kern Water Bank. This agreement will



contain provisions for developing elements of the program, coordinating the involvement of local water districts, operating and maintaining elements, minimizing interference with local ground water uses, determining water losses and mitigation, and identifying local uses of land and improvements. The March 1987 Memorandum of Understanding between the Department and the Agency will provide the basis for negotiating the agreement. The Department and the Agency will be drafting this agreement in the next few months.

### **City of Bakersfield Agreement**

For the last year, staffs of the Department, the Agency, and the City of Bakersfield have been negotiating an agreement that will provide the Department use of the City's 2800-acre recharge facility (depending upon availability) and the Kern River Canal for operation of the Kern Fan Element. The Department, in turn, would pay specified spreading fees and provide the City use of the Kern Fan Element recharge facilities to offset any spreading capability lost due to the Department's use of the City's recharge facilities. A draft of the agreement is being reviewed by the Agency's Ground Water Storage Advisory Committee and the State Water Contractors' Ground Water Committee.

### **Other Future Agreements**

Additional agreements will be required to provide for the use of existing conveyance facilities owned by local water purveyors. Such agreements will provide for Department use of such facilities, define the responsibilities of each party, and provide for appropriate compensation. Work on some of these agreements has begun, and other agreements are expected. Proposals are currently being developed for use of the Cross Valley Canal and Buena Vista Water Storage District facilities. Negoti-

ations are expected to begin soon to discuss the terms and conditions of the Department's use of these facilities.

### **Institutional Issues**

In *Status Report No. 1* (April 1988), several institutional issues concerning a water banking program were identified. During negotiations for the use of the City of Bakersfield's recharge facility and the interim Semitropic local element, substantial progress is being made in resolving some of those issues. They involved indemnification, ground water losses, and the necessity of water rights for interim operation.

The staff of the State Water Resources Control Board has indicated that the Department will need to amend its water rights permit before storing SWP water in the Kern County ground water basin for the Kern Water Bank. Such amendment may not be possible until the conclusion the Bay-Delta hearings process, which may not occur for several years. However, SWRCB's staff has indicated that delivery of SWP water by the Department to the Agency as a predelivery of entitlement is within the scope of the Department's existing permits. Therefore, to help expedite the development of the Kern Water Bank, the Department and the Agency are planning to operate the initial phases of the Kern Fan Element and the Semitropic local element under this predelivery concept. The Department will deliver certain quantities of the Agency's SWP entitlement water in advance, and the Agency will store this water in the Kern County Ground Water Basin. Upon recovery and delivery for use by the Agency or its member units, the Department will offset these deliveries against that year's SWP entitlement deliveries.

In the last few months, the Department, the Agency, and Semitropic Water Storage

District have developed an interim local element program in the Semitropic Water Storage District. Several negotiating sessions have resulted in the development of a potential one-year demonstration program in the district. In putting together a draft agreement for the demonstration program among the parties, the matter of indemnification was a significant issue. The question was who should bear the cost of liability if a court judgment went against the project as a result of damage to a person's rights. Some believed the Department should take full responsibility for activities of the Kern Water Bank as it would with other SWP facilities. However, in the case of the local element, facilities would be owned and operated by the Semitropic Water Storage District. Therefore, others believed that the responsibility should be shared. In the present draft agreement, the indemnification issue was resolved by sharing the risk responsibilities. In general, the district would be responsible for settlements or judgments arising from claims within the district associated with the demonstration program. The Department would assume responsibility for settlements and judgments for any other claims, including

any claims challenging the validity of the program or the agreement. Similar indemnification language will be provided in the Department's agreement with the City of Bakersfield.

In recent months, ways of determining surface water losses for conjunctive use programs have been discussed. At the November 8, 1989, meeting of the Agency's Engineering Subcommittee, Agency staff proposed that specific percentages should be adopted to account for surface water losses due to evaporation and transpiration. A four percent loss was proposed for in-lieu projects and an eight percent loss for direct recharge projects. Department staff indicated that assumed percentage losses would probably be adequate to evaluate projects in reconnaissance-level or feasibility-level studies. However, Department staff declined to commit themselves to such figures as a basis for establishing operating agreements without first obtaining adequate analytical support. At the February 8, 1990, meeting of the Agency's subcommittee, Department staff indicated that they would prepare an analysis of surface water loss computation methods and estimates for the Department's direct recharge project.

## ENVIRONMENTAL STUDIES

Environmental studies planned for the first stage of the Kern Fan Element include surveys of vegetation and wildlife to define environmentally sensitive areas, evaluate potential project impacts, develop initial waterfowl habitat areas, and develop a database for future wildlife resource planning. Preparation of an initial study for the first stage has also begun.

Development of wildlife mitigation and enhancement plans for the Kern Fan Element property and other potential elements will be

coordinated with federal, State, and local interests. The Department plans to work with the Department of Fish and Game, the Department of Parks and Recreation, the California Energy Commission, the Metropolitan Bakersfield Habitat Conservation Plan Committee, the City of Bakersfield, the Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, and Kern County on environmental aspects of the Kern Water Bank. A committee is expected to be formed this spring to develop cooperative plans for land use.



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