Madera Ranch Groundwater Bank

Phase 1 Report

Bureau of Reclamation
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Madera Ranch Groundwater Bank Phase 1 Report

Summary of Phase 1

The U.S. Bureau of Reclamation (Reclamation) has the opportunity to use the aquifer underlying Madera Ranch and nearby lands in Madera County as a groundwater bank for the storage and later retrieval of water. Madera Ranch is located on the eastern side of the San Joaquin Valley, approximately 20 miles northwest of Fresno (Figure 1) and is owned by Mr. Heber Perrett. Mr. Perrett has proposed (Perrett Proposal) that the landowner would build, own, and operate groundwater recharge and retrieval facilities on the ranch and conveyance facilities between the ranch and Mendota Pool and that the use of these facilities could be leased to Reclamation. Users of the bank would supply the water that would be recharged and later extracted. The Phase 1 investigation described in this report was conducted to determine the viability of the Madera Ranch Groundwater Bank (Bank) as a federally leased facility (including participation by potential non-federal partners) and to provide the basis for a decision regarding further federal participation. Table 1 summarizes the key issues investigated in Phase 1.

Table 1. Key Issues

Question	Response
What is the need for the Madera Ranch Groundwater Bank?	The timing and amount of pumping from the Sacramento-San Joaquin Delta (Delta) is controlled to protect the Delta's ecosystem. Those controls reduce the flexibility and reliability of the state, federal, and local water systems to meet consumptive water demands. Additional water storage capacity south of the Delta would restore some flexibility and reliability.
What is Reclamation's interest in the Perrett Proposal?	The Bank could provide storage for a water reserve account to assist the U.S. Department of the Interior (Interior) in meeting Central Valley Project Improvement Act (CVPIA) requirements, in improving CVP operational flexibility, and in improving drought year water management. Use of the Bank could be accomplished in conjunction with non-federal partners.
Where would the water supplies come from?	The Bank could store CVP federal project water, flood flows from the San Joaquin River, acquired water, and non-federal partner water.
What is the potential yield of the Bank?	Preliminary water operation studies show that the Bank could provide an average annual yield of 70,000 acre-feet.
Is the Perrett proposal physically viable? Is the geohydrology at the Bank conducive to groundwater storage and retrieval?	Preliminary investigations of the aquifer and soil characteristics in the area indicate that a groundwater storage and retrieval facility is viable, although the presence of a subsurface silty clay layer will require special consideration.
What is the cost to Reclamation to lease the Bank under the Perrett proposal?	Mr. Perrett proposes to lease the use of his facilities to Reclamation for $14.8 million per year. This equates to $226 per acre-foot of water based on an annual yield of 70,000 acre-feet. The term of the lease is 20 years.
What are the environmental concerns?	The U.S. Fish and Wildlife Service (FWS) designated the property as "Priority 1" habitat in their Draft Recovery Plan for Upland Species of the San Joaquin Valley. Reconnaissance surveys show vernal pool sites, sensitive plant communities, and the potential presence of up to 40 special status species. The undisturbed areas of the ranch could provide habitat benefit if managed for that purpose.
What are the local issues?	Issues include: Impacts on surface and groundwater quality; impacts to surrounding groundwater levels; local flooding caused by new facilities; impacts on community taxes impacts on land subsidence; a desire to be involved in review and decision-making processes; and payment for study and implementation costs.

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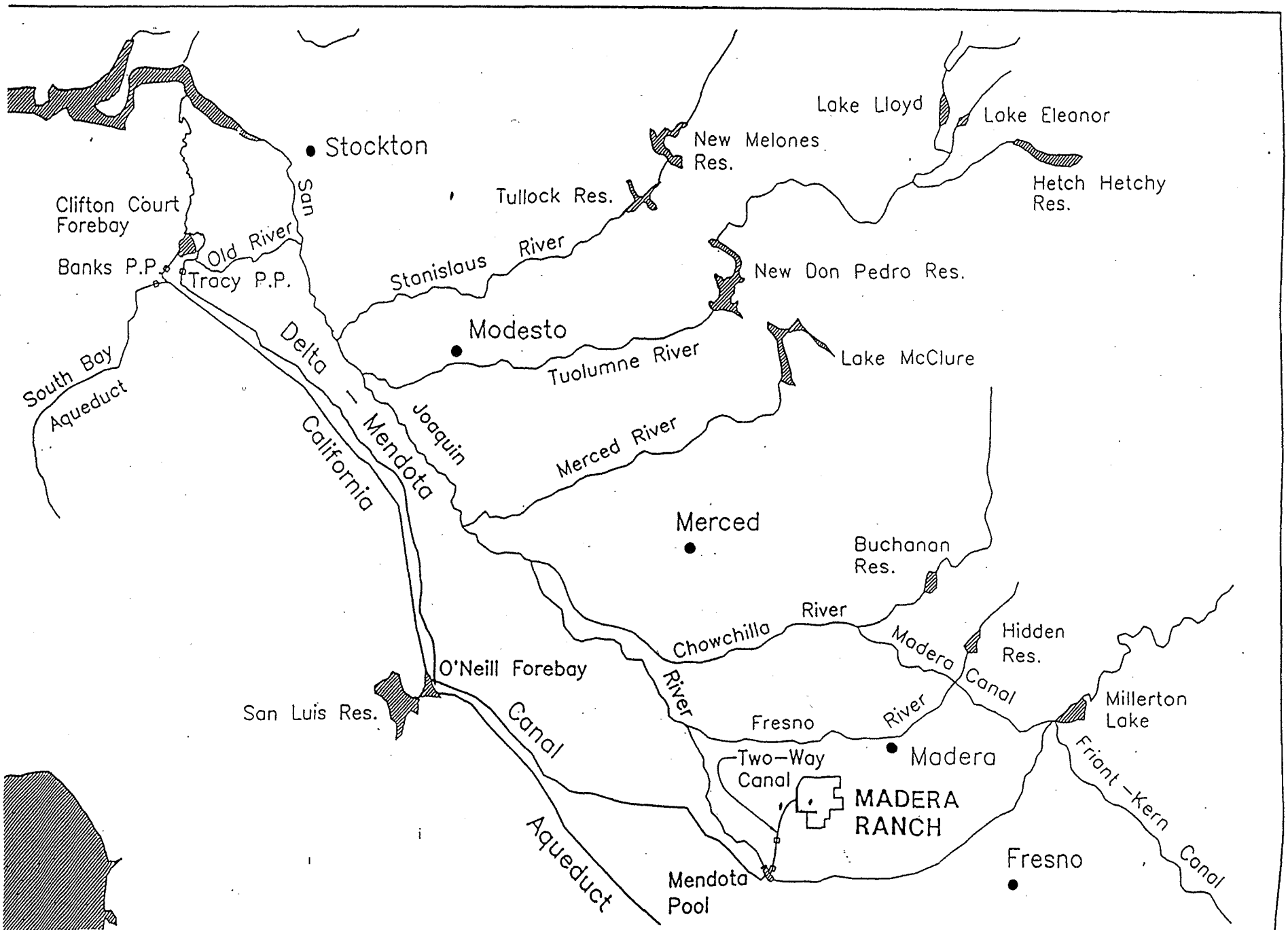

Figure 1
Madera Ranch Groundwater Bank

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The Proposal From Mr. Heber Perrett

Madera Ranch is located in southwestern Madera County in California's Central Valley. The ranch consists of 13,600 acres; approximately 1,000 acres are irrigated and the remainder are used for dryland farming. Underlying the ranch and nearby lands is an aquifer in which water level-shave been lowered by pumping. This aquifer could be developed as an underground bank for the addition and later retrieval of water. The space available in the aquifer would be utilized by pumping water from Mendota Pool, via a new canal, into a series of infiltration basins overlying the aquifer; the water would percolate into the aquifer over time. When needed, water could be retrieved from the aquifer through extraction wells and returned to the Mendota Pool via the new canal.

Mr. Heber Perrett, a private citizen and owner of Madera Ranch, made a formal, unsolicited proposal to Reclamation on August 13, 1996 to build, own, and operate recharge and extraction facilities on his ranch for lease to Reclamation. He would also build, own, and operate conveyance facilities to and from Mendota Pool (Figure 2). The features of the proposed Madera Ranch Groundwater Bank are summarized in Table 2.

Table 2. Madera Ranch Groundwater Bank Features

Proposal Includes		Major Features Include
Bank capability	390,000 acre-feet	• Gravity turnout from Mendota Pool
Diversion capacity	400 cubic feet per second (cfs)	• A two-way canal with pumping plants to deliver water from Mendota Pool to the ranch for groundwater recharge and from the ranch to Mendota Pool for use
Retrieval capacity	200 cfs	• Two canal re-lift pumping plants to deliver water to the ranch
Recharge pond area	3,500 acres	• Two gravity pumping plant bypass structures to deliver water to Mendota Pool
Water supply	None provided, lessor provides	• Recharge/wetland ponds on the ranch
Power supply	None provided, lessor provides	• Extraction groundwater wells with a manifold pipeline collection system to deliver pumped groundwater to the two-way canal
O&M	Provided by Mr. Perrett	
Conveyance right-of-way	Provided by Mr. Perrett	
Annual lease payment	$14.8 million	
Annual O&M	$400,000	
Term of lease	(20 years)	

Reclamation undertook a preliminary evaluation to determine whether the proposed Bank could help meet the need for additional water storage in the San Joaquin Valley and to confirm the physical capabilities of the Bank. This evaluation, which was completed in July 1997, found, based on data reviews that no fatal Bank flaws were evident. A significant finding was that flood flows from the San Joaquin River were not sufficient to fully utilize the available capacity of the Bank. It was also noted that geological, environmental, and operational concerns exist, and further evaluation was recommended.

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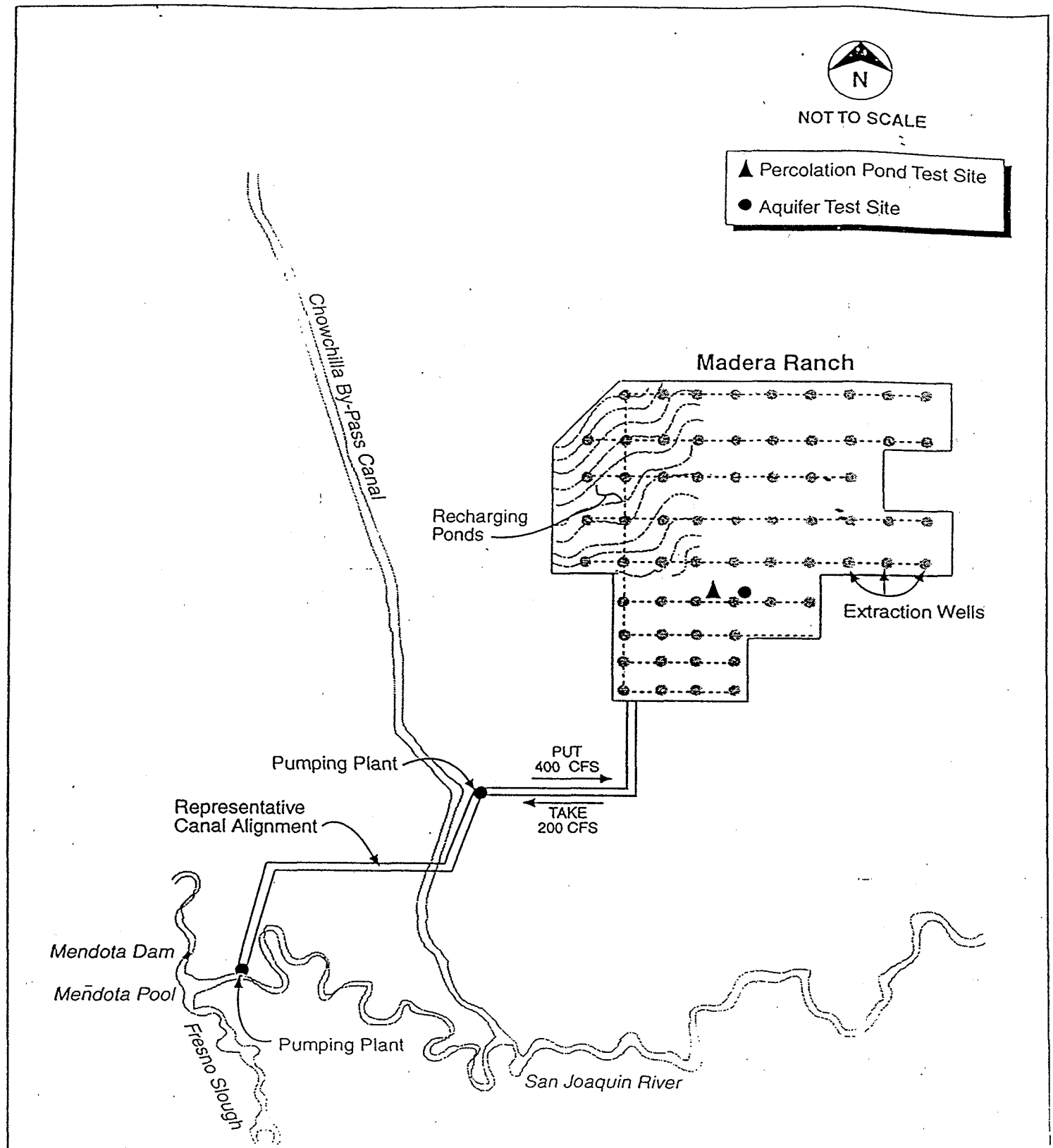

Figure 2
Madera Ranch Groundwater Bank

Phase 1

Approach

Following the conclusion of the preliminary evaluation in July 1997, Reclamation and the San Luis and Delta Mendota Water Authority (SLDMWA) agreed to undertake the first phase of a two phased investigation. Their agreement was documented in a letter to Mr. Perrett dated November 24, 1997. Phase 1 was designed to examine the Perrett Proposal to determine the viability of the Bank as a privately owned facility leased to Reclamation. Phase 1 activities focused on addressing previously identified technical issues (e.g., ecological, environmental, and operational concerns), as the basis for an informed recommendation on whether or not to proceed to Phase 2.

Phase 2 will focus on further resolution of technical issues, public involvement, environmental compliance, negotiated agreements, permit application processes, and potentially congressional authorizations. In addition, Phase 2 will explore the scenario for a federally owned and operated facility.

The November 24th letter to Mr. Perrett described 13 tasks to be accomplished in Phase 1. The tasks focused on investigating several technical issues critical to the Bank's operation and performance and on identifying logistical activities (e.g., permits, environmental compliance, negotiations) required to implement a groundwater banking project. Table 3 lists these tasks and references the page(s) in this report where each task is discussed.

Table 3. Phase 1 Tasks

Task	Reference Page #
1. Resolve remaining technical issues at an appraisal level, including field tests, such as infiltration and pump tests, to confirm the hydrogeologic properties of the site.	9-17
2. Appraise the option of diverting flood flows directly from the Chowchilla Bypass flood channel to Madera Ranch.	9
3. Develop a management plan for the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) process.	28
4. Develop a strategy for requesting the right to appropriate surplus flood flows for groundwater storage.	22-23
5. Explore options to structure the relationship between Reclamation and additional potential partners. Develop repayment options.	23
6. Begin discussions with interested stakeholders, including local groundwater users and environmental organizations. Identify key interests.	21
7. Initiate dialogue with key officials at CALFED to explore participation.	23
8. Prepare a negotiation strategy.	24
9. Confirm legal authority for the proposed actions.	24

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Task	Reference Page #
10. Document known ecological information on Madera Ranch and the surrounding area.	15
11. Explore the integrated operation of the Bank and the CVP.	8-9
12. Develop a public involvement plan.	25
13. Document Phase 1, including the go/no go recommendation and a schedule for Phase 2 completion.	26-28

Methods and Results

Water Operations

To conduct the Phase 1 analysis of the Perrett Proposal, it was necessary to develop an operation scenario. This was done in cooperation with the SLDMWA and the Santa Clara Valley Water District. Both the Authority and Santa Clara Valley Water District. Both entities were previously aware of the Perrett Proposal and were curious about the Bank's potential performance and costs.

The operation scenario specifies patterns of water delivery to, and extraction from, the Bank. As much as 400 cfs could be diverted from the Mendota Pool through the proposed new canal to Madera Ranch. The operation scenario assumed the availability of flood flow diverted from the San Joaquin River. Any remaining capacity could be supplied with water delivered by the Delta Mendota Canal (DMC) to Mendota Pool. For this scenario the DMC deliveries would occur during December, January, and February, except during dry and critically dry years. Water delivered by the DMC was assumed to be federal project water, acquired water, or water belonging to non-federal partners.

In the operation study the maximum amount of water stored in the Bank would be 390,000 acre-feet. Water could be extracted from the Bank at a maximum rate of 200 cfs. This water would be returned to the Mendota Pool via the new canal. The pattern of withdrawals from the Bank was based on historic demand patterns, including agricultural irrigation and wildlife refuge management demands. Withdrawals from the Bank could occur between March and November. Water stored in the Bank could be used to meet other purposes through agreements and exchanges. In addition, the Bank could provide an important component for a water reserve account that would assist the Interior in meeting the requirements of the CVPIA.

The operation scenario was also designed to provide for drought-year water supplies. A reserve of 100,000 acre-feet would be maintained in the Bank during all but critically dry years. During those critically dry years, that reserve could be called upon for drought relief.

To simplify this preliminary analysis, no conveyance or storage losses were used; however, any further analyses must quantify these losses. The Perrett Proposal was analyzed using the operation scenario described and a spreadsheet simulation model. The model simulated Bank operations using present-level development and the 1922 through 1992 hydrologic record, which encompasses periods of drought and flood. The model results are shown in Figure 3. It should be recognized that the pattern of recharge and withdrawal would be different if the initial years of operation were wet instead of generally dry.

The model results indicated that, under the Perrett Proposal, this operation could result in an average annual yield of approximately 70,000 acre-feet. The annual yield averages 75,000 acre-feet during the best 20-year period, and 48,000 acre-feet during the worst 20-year period. The results also indicated that operation of the Bank could provide additional flexibility in operation of the DMC. During summer, the DMC must operate at full capacity to provide enough water in the Mendota Pool for irrigation demands. The DMC lacks flexibility in meeting requested water deliveries in the late summer (e.g., irrigation and wildlife refuge demands). Water from the Bank could be returned to the Mendota Pool when the DMC is running at capacity; the Bank could receive water from the Mendota Pool that is delivered by the DMC in the winter and spring.

Diversion of flood flows out of the Chowchilla Bypass flood channel was also considered. The operation analysis showed that this diversion would add less than 3,000 acre-feet to the average annual yield. This would require the construction of diversion facilities and a separate canal. The additional cost for the Chowchilla Bypass diversion facilities and canal could not be justified.

Geohydrology

To characterize aquifer properties at Madera Ranch, geologic and hydrologic investigations were conducted by Bookman-Edmonston (1998). The investigations included review of studies and reports conducted by others, exploration drilling, a percolation pond test, and an aquifer test. The results of the investigations show:

- A surficial unsaturated zone of variable thickness (termed upper unconfined aquifer)
- An aquitard at about 100 feet depth
- A saturated zone (termed lower semi-confined aquifer)

The results are summarized in the following discussion.

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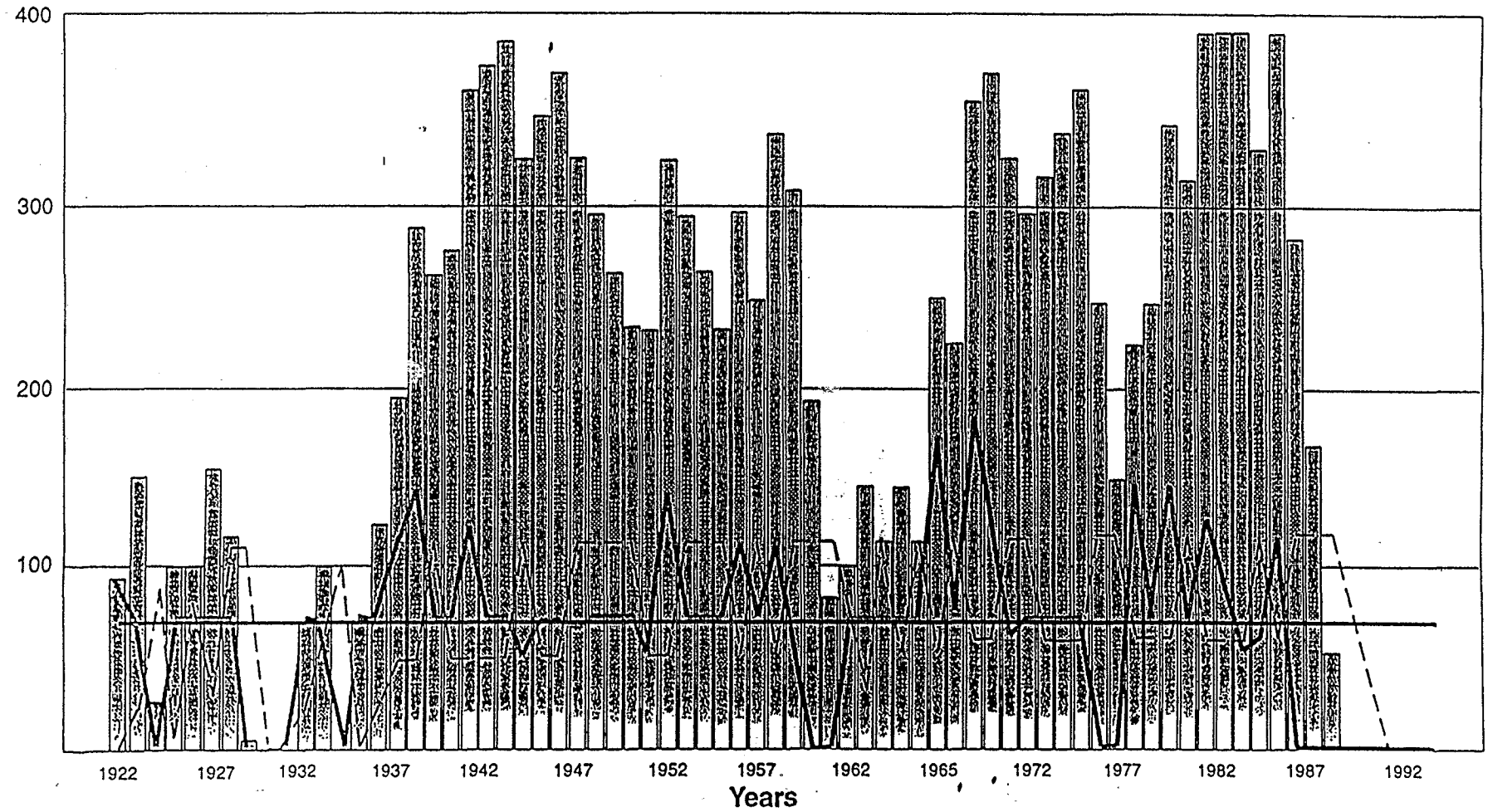

Total Water in the Bank
Annual Recharge
Annual Extraction
Average Annual Extraction (Yield)

Figure 3
Madera Ranch Groundwater Bank Operation Model Simulation Results

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Subsurface Conditions. Madera Ranch is located on the lower alluvial flood plain of the San Joaquin and Fresno rivers. The surficial soils are varied and include silt, sand, clay, and hardpan layers. To characterize subsurface conditions, exploration drilling was conducted at eight sites by Bookman-Edmonston, and other reports and investigations were reviewed.

Below the surficial soils is a heterogeneous mix of clay, silt, sand, and gravel deposits approximately 200 to 250 feet thick. These deposits are divided into an upper aquifer and a lower aquifer that are separated by a clay or silt layer (aquitard) at a depth that ranges from 58 to 100 feet. Data collected thus far are not adequate to determine if the aquitard is continuous.

The Corcoran Clay underlies the lower aquifer throughout the Madera Ranch area. Below the Corcoran Clay are more clay, silt, sand, and gravel deposits hundreds of feet thick; however, the Bank does not involve the use of space below the Concoran Clay. Department of Water Resources and Reclamation maps show that, above the Concoran Clay in the Madera Ranch area, groundwater moves from east to west; average depths to groundwater range between 80 and 110 feet in the east and 85 to 105 feet in the west. Groundwater elevations generally range between 110 and 140 feet in the east and 70 to 90 feet in the west.

The upper unconfined aquifer in the vicinity of Madera Ranch (unsaturated at present) is from 55 to 100 feet thick and consists of mostly permeable sediments with interbeds of silts and clays. In places, up to 20 feet of clays and silts overlie this upper aquifer. The clay layer (aquitard) that underlies the upper aquifer ranges from 3 to 15 feet thick. The aquitard may impede water from entering the lower, semi-confined aquifer from the upper aquifer. The vertical hydraulic conductivity of the aquitard was estimated to range from 0.001 foot per day to 0.05 foot per day based on the observed composition of the aquitard. The lower, semi-confined aquifer, which ranges from 105 to 222 feet thick under the ranch, contains two zones; it has an upper layer of generally finer material and a lower zone of coarser material. Figure 4, an approximately north-south cross section of the geohydrologic system as described by Bookman-Edmonston, shows the location of the upper aquifer (Aquifer 1) and the lower aquifer (Aquifer 2) separated by the aquitard.

Percolation Pond Test. The percolation pond test site is on the southern boundary of the ranch. The test was initiated in November 1997 and continues to date. The testing indicates that the subsurface soils in the area are quite conducive to groundwater recharge. The data show a percolation rate from the infiltration basin of about 1.8 feet per day. The horizontal hydraulic conductivity of the upper aquifer is estimated to range between 50 and 175 feet per day. The vertical hydraulic conductivity is estimated to be about 2 feet per day. Lateral spreading of water from the infiltration basin at the base of the upper aquifer resulted in mounding of less than 10 feet on top of the aquitard. Although water reached the base of the upper aquifer, it was not detected in the lower semi-confined aquifer during the 3-month duration of the test.

Aquifer Test. An aquifer test was performed in January 1998 at the southeastern boundary of the ranch, about one-half mile east of the percolation pond test site. The test was conducted using farm wells known to be perforated above the Concoran Clay and below the aquitard. Analysis of results from this

test indicated a probable range of transmissivities between 55,000 and 245,000 gallons per day per foot (corresponding horizontal hydraulic conductivities ranged between 50 and 95 feet per day) and storage coefficients between 0.01 and 0.0001. These values represent favorable characteristics for groundwater retrieval from the lower aquifer. The cone of depression created by pumping at 1,200 gallons per minute for 3 days was observed at distances of up to one-half mile, which supports the conclusion that the lower aquifer in the vicinity of the test is semi-confined.

Groundwater Modeling. The operations modeling previously described was conducted to determine the timing and availability of water supply, the timing of demand, and the amount of storage available so that the average annual yield of the Bank could be estimated. It was necessary to conduct groundwater modeling to determine whether the available supply would recharge the aquifers and whether pumping to meet demand could be accomplished without dewatering the aquifers. The groundwater modeling was also used to estimate the impact of Bank operation on groundwater elevations adjacent to the Bank.

A three-layer finite element groundwater model bounded by the Chowchilla River, the San Joaquin River, and the Sierra foothills was used to evaluate Bank operation and impact. This model is adequate for preliminary planning. A detailed unsaturated zone model would be needed for a more complete impact and operation analysis.

The results of the geologic and hydrologic investigations were used to estimate the parameter values for the model. The parameter values were taken to represent a conservative analysis of the viability of operating the Bank and to estimate impacts on groundwater elevations.

The parameter values are shown in Table 4.

Table 4. Model Parameter Values

Parameter	Value
Upper Aquifer	
Horizontal hydraulic conductivity (ft/day)	30 - 175
Specific yield	0.08 - 0.23
Aquitard	
Vertical hydraulic conductivity (ft/day)	0.001 - 0.05
Lower Aquifer	
Horizontal hydraulic conductivity (ft/day)	50 - 95
Storage coefficient	0.0066

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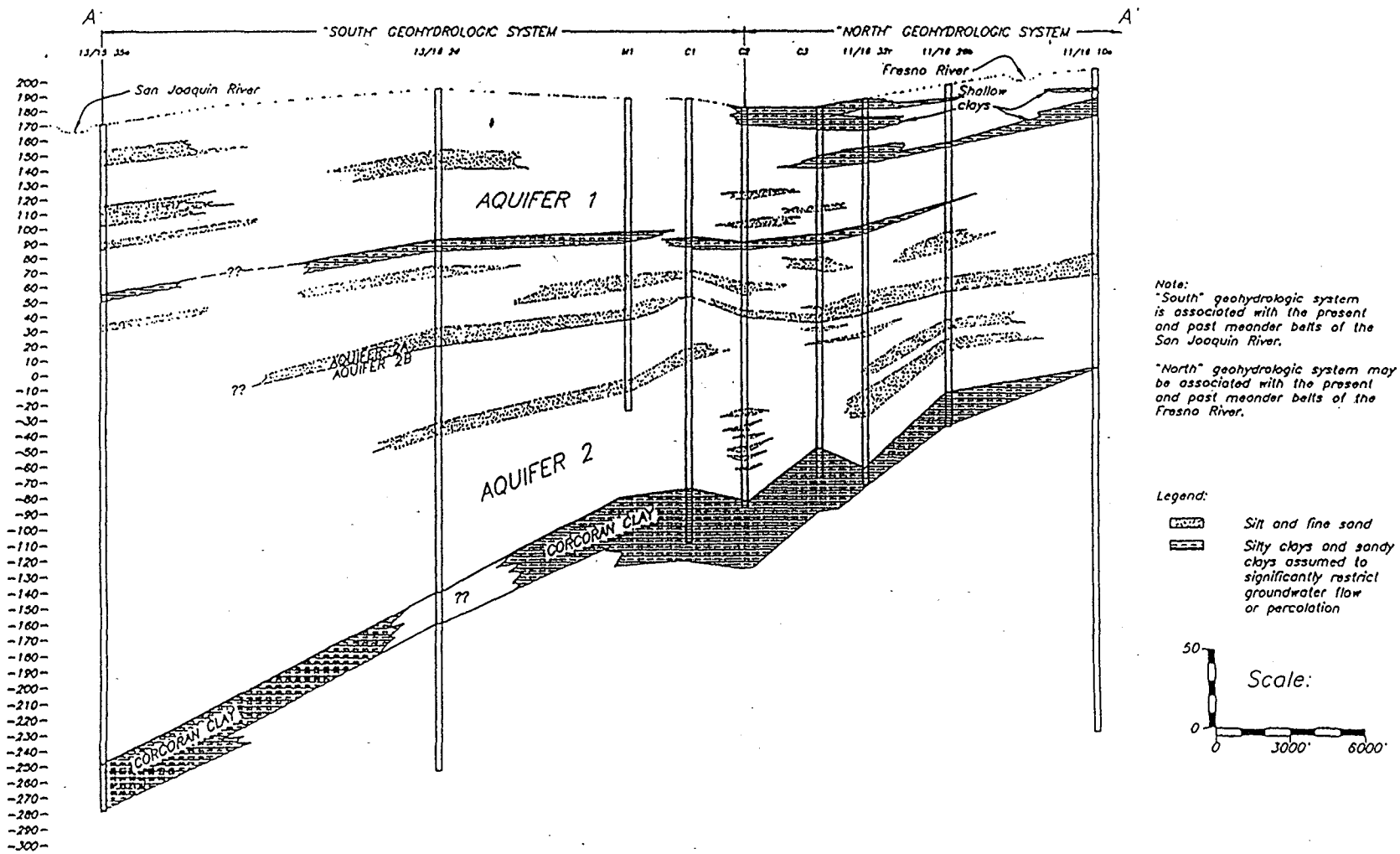

Figure 4
Madera Ranch Groundwater Banking Project
Cross Section A-A'

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The quantities and timing of water delivered to the recharge ponds and of water withdrawals that were used for the model simulations are the same as those used to estimate the 70,000 acre-feet annual average yield in the operations studies, as described in the previous section. The groundwater model run covered the 22-year period between 1969 and 1990. Project operations were superimposed upon historic groundwater conditions.

The groundwater model shows that Bank operation is viable, though the location and size of the recharge basins may have to be refined. Figures 5 and 6 show generalized schematics of the aquifer conditions under Bank operations.

Figure 5 shows aquifer conditions after a period of groundwater recharge. A mound has developed under the recharge ponds and nearby lands. Some of the water has passed through the aquitard and raised the pressure head of groundwater in the lower aquifer. The recharged water extends beyond the ranch boundaries and moves towards the west away from the ranch.

Figure 6 shows aquifer conditions after a period of drought and groundwater withdrawal. The mound in the upper aquifer has been greatly reduced, and a cone of depression has developed in the lower aquifer.

Although the quantity of water extracted is balanced with the total amount of water that has been recharged, it should be noted that the water withdrawn is not in all cases the same water that has been recharged.

Figure 7 shows a time series of the impact of Bank operations on groundwater pressure in the lower aquifer. Groundwater pressure is shown directly under the ranch and at the west edge of the ranch 3 miles west of the ranch. The most extensive reduction in pressure (about 80 feet below historic levels directly beneath the ranch) occurs during the withdrawal sequence associated with the most recent drought. The impact on the lower aquifer is relatively minor 3 miles west of the ranch; simulated pressures are no more than 10 feet below historic levels and are higher than historic much of the time. The impact on the lower aquifer at the western edge of the ranch reaches 34 feet below historic levels during the withdrawal sequence associated with the recent drought. Figure 8 shows a similar impact pattern to the east of the ranch.

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Special Status Species and Habitats

The unfarmed area of Madera Ranch consists of "Priority 1" habitat according to the Draft Recovery Plan for Upland Species in the San Joaquin Valley (U.S. Fish and Wildlife Service, 1997). Priority 1 habitat is defined as a land area where actions "must be taken to prevent extinction or to prevent a species from declining irreversibly in the foreseeable future." Because of the occurrence of this sensitive habitat, an initial site reconnaissance was conducted on January 21, 1998 covering the 3,500 acres of the recharge pond area (Jones and Stokes, 1998). The reconnaissance survey found the presence of jurisdictional wetlands (vernal pools) on the site, the presence of sensitive terrestrial plant communities, and the potential presence of special status plant and wildlife species.

Although it was anticipated (because of the ranch's location and the time of year) that numerous vernal pool complexes would be found on the site, this was not the case. A single 8- to 10-acre alkali vernal pool complex was found on the western side of the ranch. A few small, isolated vernal pools were found in the same area. It is thought that porous surface soils prevent the formation of vernal pools on most of the ranch. Although fewer vernal pools exist than were anticipated, a formal delineation will be required.

The site reconnaissance revealed the presence of five plant communities considered to be sensitive because of their scarcity in the region and statewide. These communities include valley sink scrub, valley saltbush scrub, sacaton grassland, alkali playa, and northern hardpan (alkali) vernal pools. These habitats will have to be accurately mapped.

The site reconnaissance revealed the presence of several species of halophytic plants. Their presence indicates soil conditions that could support several special-status plant species. Fairy shrimp were observed in the vernal pools. Northern harrier, red-tailed hawk, American kestrel, and black-shouldered kite were observed foraging on the site. Two dens, apparently dug by American badgers, were also observed. The potential presence of special status species was determined through a record search of the Department of Fish and Game's Natural Diversity Database, which indicated that approximately 20 special-status plant species and 18 special-status wildlife species could occur on the site. Field surveys for these species will have to be conducted.

It appears that groundwater banking facilities on Madera Ranch could be located and designed to minimize impacts to sensitive species and habitats. This will require the incorporation of environmental issues into facility design and a clear understanding of the identity and location of environmental resources.

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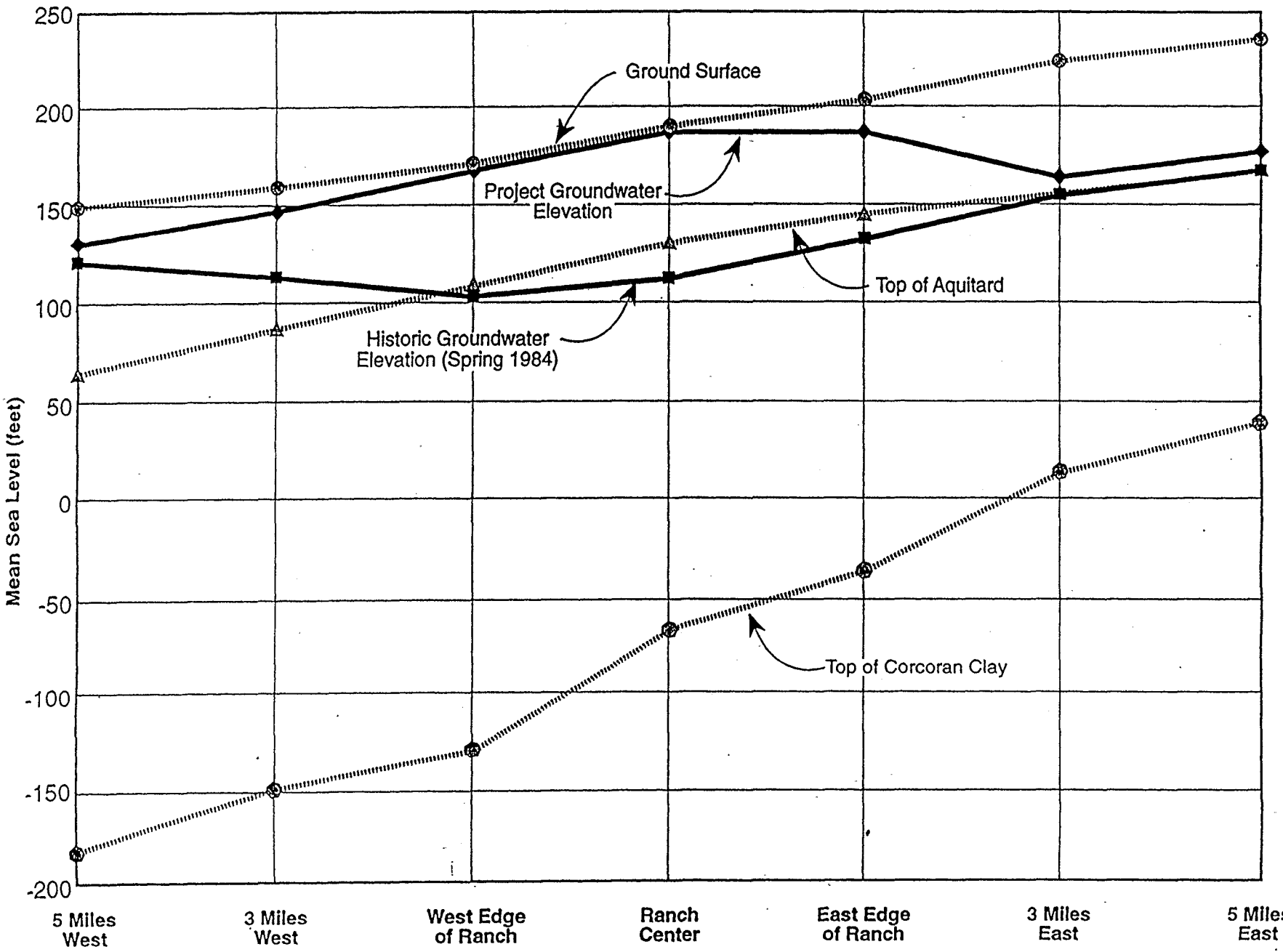

Figure 5

Effect of Project on Groundwater Elevation (Piezometric Head) During Periods of Recharge

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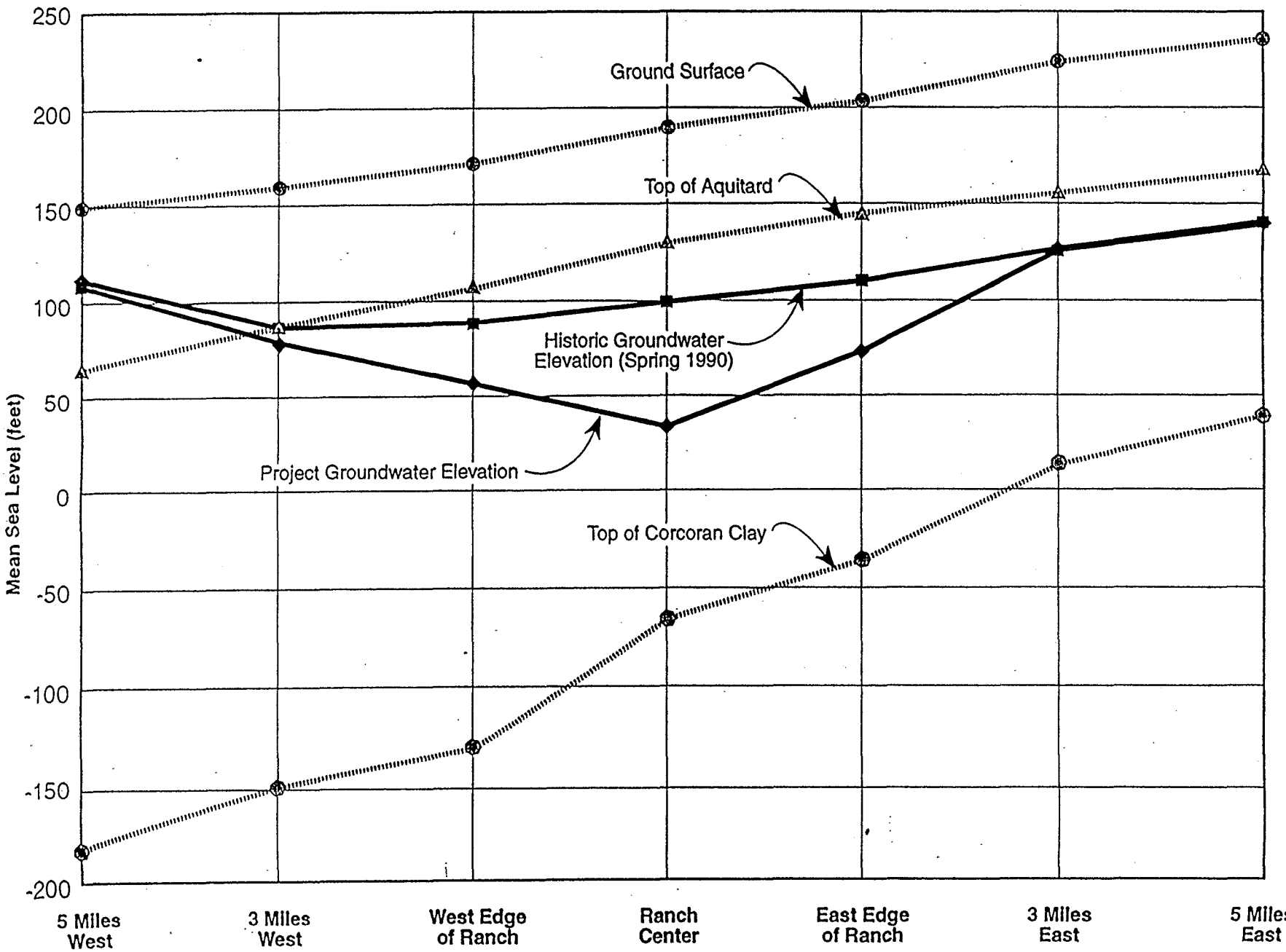

Figure 6

Effect of Project on Groundwater Elevation (Piezometric Head) During Periods of Withdrawal

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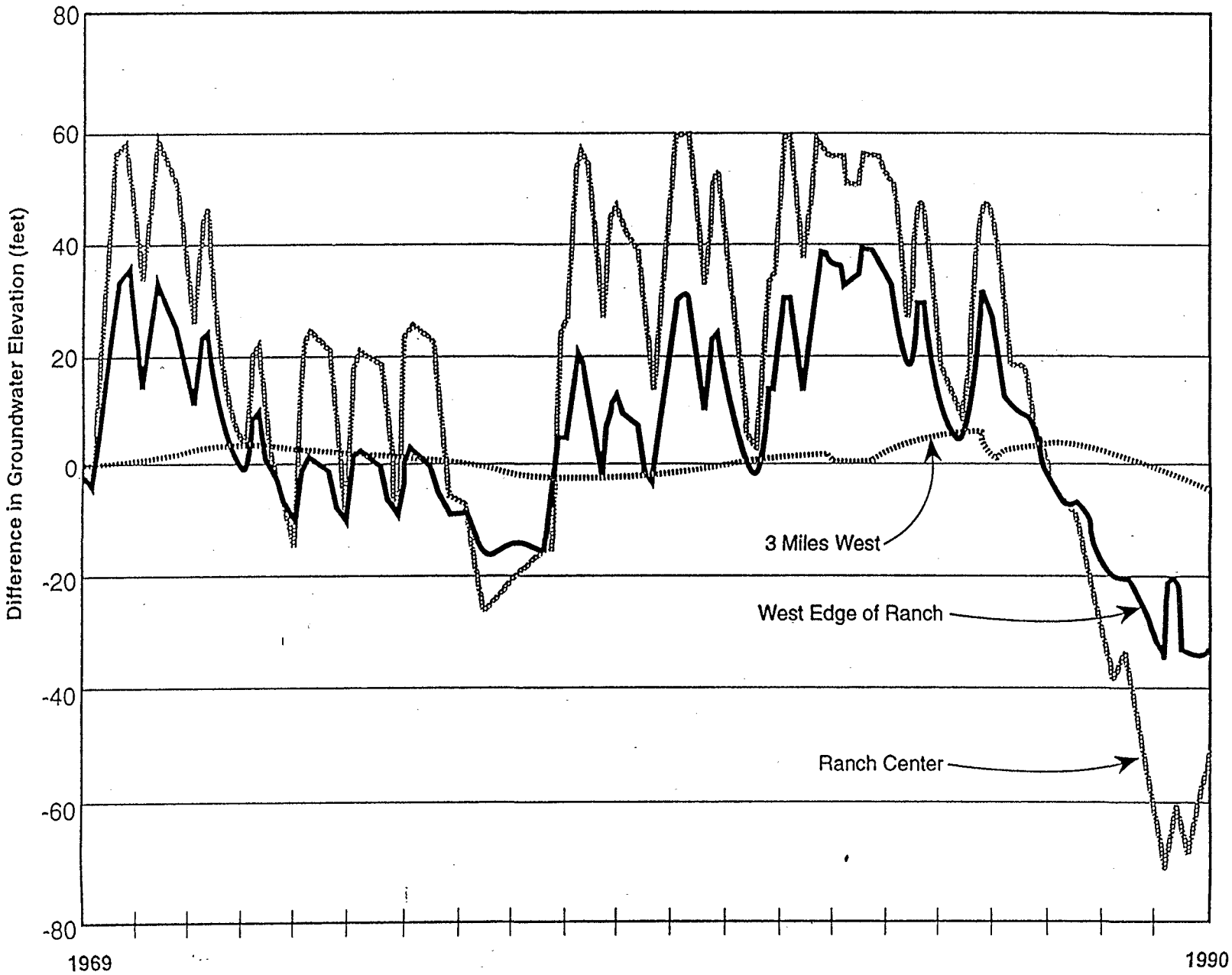

Figure 7

Time Series of the Difference in Groundwater Elevation (Piezometric Head) to the West of the Ranch Between Historic and with Project Conditions

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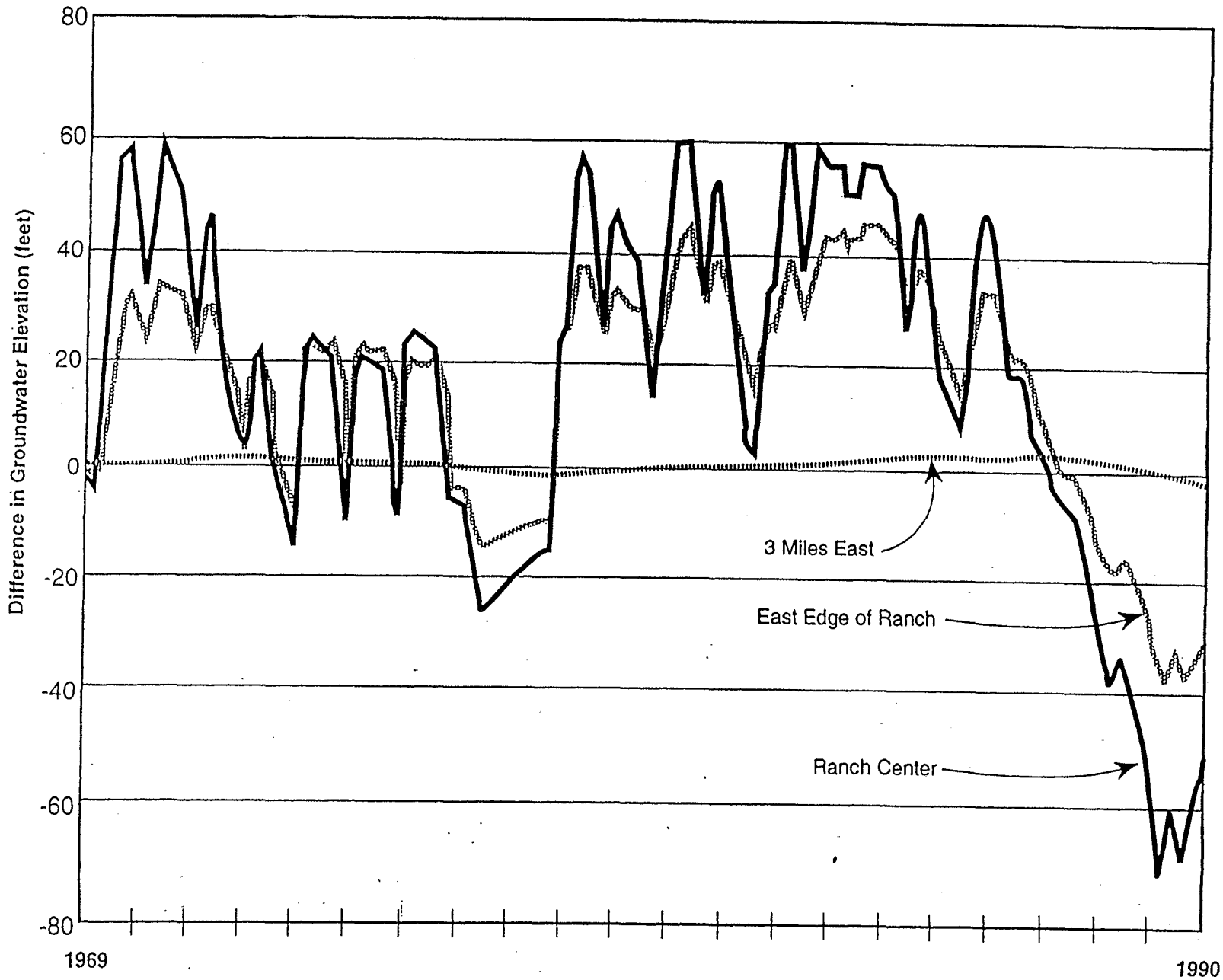

Figure 8
Time Series of the Difference in Groundwater Elevation (Piezometric Head) to the East of the Ranch Between Historic and with Project Conditions

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Section 7(a)(2) of the Endangered Species Act (Public Law 93-205, as amended) requires consultation with the FWS for any federal action that may affect species listed as threatened or endangered. As a result of this consultation process, the FWS may issue a biological opinion describing the actions that must be taken to avoid jeopardizing the continued existence of a species or to reduce the level of impact that may occur when an action is implemented. Reclamation will begin informal consultation at the beginning of Phase 2 and request formal consultation when the proposed action is defined. Reclamation and the FWS will work together to examine opportunities to assist in the recovery of the listed species; these opportunities may be incorporated in this project.

Costs

Mr. Perrett proposes to finance and construct all project facilities. He will acquire rights of way for facilities located off of Madera Ranch. He will also operate and maintain the Bank. It was assumed that CVP power would be used for pumping. The estimate does not include costs to Reclamation for providing water at Mendota Pool, acquisition of water rights, costs to date, or costs associated with Phase 2.

Mr. Perrett proposes to lease the Bank for annual fee over a 20-year period. It was assumed that all costs associated with permitting, designing, purchasing, and building, of the conveyance, transmission, recharge, storage, and extraction land and facilities will be included in the annual lease.

Table 5 shows the estimated annual cost to Reclamation to lease the Madera Ranch Groundwater Bank as proposed by Mr. Perrett. The lease would have a term of 20 years, and the annual lease cost would be constant during that 20-year period.

Table 5. Estimated Annual Cost to Reclamation for the Perrett Proposal

Annual lease cost	$14,800,000
Annual operation and maintenance	$400,000
Average annual yield	70,000 acre-foot
Annual lease and O&M cost per acre-foot	$217per acre-foot
Total pumping cost	$9 per acre-foot
Annual total cost	$226 per acre-foot

Local Concerns

At the initiation of Phase 1, Reclamation issued a press release to inform the public about the evaluation and to identify interested persons. The press release was followed by the distribution of an information package to individuals requesting it. Reclamation held briefings at the Exchange Contractors board meeting in Los Banos on January 6 and at the Madera Irrigation District board meeting in the City of Madera on January 27. A list of interested persons was compiled from telephone requests and attendees at the briefings. Most of the telephone requests were for additional information; however, one individual was interested in the possibility of locating a groundwater bank on his property. Concerns stated at the briefings centered around water quality, changes in flood drainage patterns, groundwater levels, costs, and acquisition of canal rights-of-way. There were also requests to delay completion of the Phase 1 evaluation to allow time for a Reclamation response to local concerns. Because the Phase 1 evaluation focused on the technical viability of operating of the Bank, all local concerns regarding impacts have not been resolved; these issues will be fully explored if Reclamation decides to move forward to Phase 2.

Water Quality (Surface and Ground)

This concern is that the groundwater quality will be degraded by being recharged with lower quality water from the Mendota Pool or that the water quality at the Mendota Pool may be degraded by the pumping of lower quality water from the recharged aquifer. The quality concerns relate to total salts and specific chemical elements.

Based on available water quality data for the aquifer and the Delta Mendota Canal at Mendota Pool, the average quality of surface water and groundwater appear to be comparable. The water quality at the Mendota Pool is variable; there are periods in the summer when the water quality would not be suitable for recharging the aquifer. The operation plan for the Bank would seek to avoid diversions from the Mendota Pool when water quality would adversely impact the aquifer. Further studies would be done in Phase 2 and displayed in environmental documents.

Changes in Flood Patterns

This concern is that the embankments of the new canal to be constructed to transport water between the Mendota Pool and the recharge basins on the Madera Ranch could change existing surface drainage patterns. During flood events, redirected flows could damage areas that have not experienced damage before. The new canal will be designed to adequately pass all local drainage and avoid drainage impacts. These impacts and appropriate mitigations would be analyzed and discussed in the environmental compliance documents.

Impacts to Groundwater Levels

Landowners adjacent to the Madera Ranch are concerned that the operation of a groundwater bank would negatively affect groundwater levels under and near the ranch. Groundwater modeling completed in Phase 1 indicates that use of the Bank would result in higher groundwater levels in most years and lower

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levels in drought periods. Further investigations would define these impacts in more detail, and they would be discussed in the environmental compliance documents. Rules for operating the Bank would be developed with input from owners of nearby lands.

Costs

As taxpayers, members of the public are concerned with the total cost of the project and who will pay for it. There is also a concern that, as individuals, they may be assessed costs through higher water charges or other taxes. If Reclamation moves on to Phase 2, total costs and cost allocations would be explored in detail.

Canal Rights-of-Way

Landowners near the Mendota Pool and the Madera Ranch are concerned with the impacts of the proposed new canal. There is a concern regarding the separation of one parcel into two or more parcels and the acquisition process for the canal rights-of-way. The alignment for the proposed new canal and the methods for acquiring rights-of-way would be determined during Phase 2. The canal will be constructed for two direction flow with a flat slope. The land slope in the area is also generally flat, therefore the canal could follow property lines and field boundaries to avoid severance of parcels.

Other Issues

Water Rights

The operation of a groundwater bank at the Madera Ranch requires the diversion of water from the Mendota Pool to the recharge basins on the ranch. It is believed that the diversion of the CVP water delivered to the Mendota Pool from the DMC could be accomplished without acquiring additional water rights, because the Groundwater Bank would be considered a secondary San Luis storage facility and the operations would be within the provisions of existing CVP permits. The diversion of flood flows on the San Joaquin River, however, would have to be made under a permit issued by the State Water Resources Control Board (SWRCB).

The San Joaquin River and its tributaries in Madera and Kings counties is fully appropriated for January 1 through December 31 (SWRCB Order 89-25). However, Reclamation could request that the SWRCB issue a permit pursuant to a partial assignment of state-filed Application 9369. This state-filed application is for diversion of 2,000,000 acre-feet annually to groundwater storage and it has never been assigned to a water user. Preliminary model simulations indicate that surplus flows on the river from Mendota Pool into the Bank could be diverted.

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As part of its request, Reclamation would complete an in-depth analysis of the hydrology of the San Joaquin River to identify any impacts of the proposed diversion on other beneficial uses and water rights holders. The request would be accompanied by appropriate environmental documentation. Under Section 10504.1 of the Water Code, a request for the assignment of state-filed applications necessitates a mandatory hearing before the SWRCB.

Partnership Agreements

Reclamation could include other federal, state, or local water agencies in implementing the Perrett Proposal. Before initiating the Phase 1 evaluation, Reclamation met with staff of the SLDMWA and Santa Clara Valley Water District to discuss the potential for partnerships. The interest of the water agencies focused on the capability and cost of the Perrett Proposal. SLDMWA agreed to participate in the Phase 1 evaluation; Santa Clara Valley Water District indicated that interest was cost-dependent and requested to be informed as the evaluation progressed.

If Reclamation were to proceed to Phase 2, a process would be initiated that could lead to agreements with potential partners. Those agreements would have to address the following topics:

- **Potential Partners.** Reclamation would invite federal, state and local agencies to participate in developing partnership agreements. Agencies with needs that could be accommodated by the Bank would express their interest in partnership at that time.

- **Water-Use Purposes.** Potential partners would define their anticipated use of the Bank. The source of water to be stored in the Bank and the eventual use of water from the Bank would be defined. Bank operations would be modeled based on anticipated uses.

- **Funding.** Partners would be asked to share in the cost of implementing a groundwater bank project, including investigations, environmental compliance activities, capital costs, and O&M costs. The allocation of costs would comply with federal laws and regulations for water resource projects.

Relationship to the CALFED Bay Delta Program

The federal and state resource agencies are cooperating in developing a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. All of the alternatives being analyzed by CALFED include at least one configuration providing additional storage south of the Delta. Reclamation met with key CALFED staff to present its evaluation of the Perrett Proposal. CALFED staff indicated that the storage provided by a groundwater bank at the Madera Ranch would help meet storage needs south of the Delta.

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Negotiation Strategy

There are two major options for implementing a groundwater bank project. The first is the Perrett Proposal which was evaluated in Phase 1 and is presented in this report. The Perrett Proposal is for a privately financed, constructed, and operated groundwater bank. The owner would offer a 20-year lease to Reclamation or any other public or private entity for the use of the Bank. The second major option would be a groundwater bank that is federally financed and, constructed and operated by Reclamation.

During the Phase 2 decision process, the two major options described above will be under discussion with the landowner, Heber Perrett. As investigations and negotiations progress, one of these two options will emerge as preferred. Economic factors will be weighed along with public acceptance and environmental impacts.

Federal Legal Authority

All actions in which Reclamation engages must be authorized by the Congress of the United States. The CVP was authorized as a multi-purpose project by an act of Congress (Act of August 26, 1937, ch.832, 50 Stat. 844). That original authorization has been amended or supplemented by at least 15 subsequent Acts. The last major amendment was the CVPIA, Title XXXIV, Public Law 102-575. Section 3406 of the CVPIA expanded the authorized purposes of the CVP to include "mitigation, protection, and restoration of fish and wildlife." If Reclamation decides to use the Groundwater Bank at Madera Ranch, that use would be primarily, if not exclusively, for such mitigation, protection, and restoration purposes. No additional Congressional action would be necessary to permit Reclamation to negotiate a 20-year lease or other suitable instrument granting Reclamation the right to use a privately owned groundwater bank at Madera Ranch.

Section 9(a) of the Reclamation Project Act of August 4, 1939, requires the Secretary of the Interior to prepare a feasibility report and submit it to Congress before expending any federal funds for the construction of any new division of, or new supplemental works on, a federal Reclamation project. In addition, Section 8 of the Federal Water Project Recreation Act of July 9, 1965, prohibits the Secretary from preparing a feasibility report unless the preparation of such a report has been specifically authorized by the Congress. If Reclamation decides to make use of the proposed groundwater bank at Madera Ranch by simply negotiating and entering into a lease (or other suitable instrument) granting Reclamation the right to use that privately owned groundwater bank and the related privately owned conveyance facilities, no feasibility report need be prepared. By engaging in those actions, Reclamation would not be proposing to construct any new division of, or supplemental works on, the CVP. If, however, Reclamation decides to pursue obtaining an ownership interest in the proposed groundwater bank and/or some or all of the related conveyance facilities and, as a result, decides to participate in their construction, Reclamation will have to obtain specific Congressional authorization to prepare a feasibility report. This would have to be done before it could expend any federal funds to pursue these goals.

Public Involvement Plan

It is Reclamation's policy to include public participation in decision processes that lead to federal actions impacting local communities. In the Phase 1 evaluation, Reclamation met with key local officials and are identified interested persons, and recorded the local concerns that were expressed. Early in Phase 2, a formal public involvement plan would be developed; elements of that plan for Phase 2 would include:

- Reclamation and stakeholders roles
- Decision process
- Understanding the publics and their issues
- Briefings events
- Call for partners
- Phase 2 costs
- NEPA/CEQA compliance
- Status reports

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Phase 2

Recommendation From Phase 1

Technical analyses to date support the potential project viability of operating a groundwater bank at Madera Ranch. No fatal flaws were discovered during Phase 1 that would prevent successful development of the Bank. Therefore, Reclamation recommends proceeding to Phase 2, pending discussions with Mr. Perrett.

Proceeding to Phase 2 is an acknowledgment by Reclamation that the proposal and lands have the potential for groundwater banking development and merit further investigation, however, should a fatal flaw be revealed at any time during Phase 2, for which we have no remedy, Reclamation will halt further pursuit of this project until circumstances warrant reconsideration.

Phase 2 Activities

As noted above in the Negotiation Strategy, two scenarios or options will be explored during Phase 2. Scenario 1 encompasses Mr. Perrett's proposal of a privately owned and operated facility leased to Reclamation, and Scenario 2 which envisions a Reclamation land purchase of Madera Ranch and subsequently developing and operating a groundwater banking facility. Under both scenarios, Phase 2 would address technical issues identified in Phase 1 and summarized in Table 6.

The scenario ultimately preferred and pursued will be based on a number of factors including but certainly not limited to: stakeholder consensus, partnership agreements, costs, contract negotiations, environmental issues, and implementation schedules.

Scenario 1

The proposed action under Scenario 1 involves Reclamation's multi-year commitment to lease the services and facilities developed by Mr. Perrett. It also requires that Reclamation complete a number of administrative procedures in addition to the elements that are common to both scenarios. The additional elements would include the development of a Basis of Negotiations (BON), and a Call for Partners.

The BON is a Reclamation policy document approved by the Commissioner, that provides for the framework and parameters such as payment schedules, environmental compliance, legal authority, etc. under which a multi-year contract can be negotiated. The subsequent formal negotiations are noticed in the Federal Register and would be conducted in an open public forum.

The Call for Partners would be Reclamation's invitation to prospective beneficiaries to cost share in Phase 2 activities and to develop appropriate agreements.

Table 6. Technical Issues Identified in Phase 1

Technical Area	Issues	Phase 2 Task
Geotechnical	- Regional geohydrology needs further definition - The response of the aquifer to recharge under project operations needs better definition - Possible land subsidence due to dewatering of semiconfined aquifer	- Topographic surveys, groundwater monitoring, subsurface exploration
Water Quality	- Compatibility of surface water from Mendota Pool with targeted groundwater - Impact of soil salinity in recharge area on groundwater	- Chemical analysis of water from DMC, Mendota Pool and area aquifer - Add water quality parameters to the spreadsheet operations model
Water Operations	Integrated operation of the water bank with CVP needs further definition	Modification of PROSIM to include water bank to simulate integrated operation
Water Rights	Are surplus flood flows available for diversion?	Confirm quantity of water available and possibility of obtaining rights
Cost	How will the project be financed and repaid?	Determine source of funding and allocation of costs for repayment
Environmental	The extent and location of sensitive habitat and special status plant species needs to be defined	- Aerial photography - Habitat maps - Plant surveys - Terrestrial species surveys

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Scenario 2

The proposed action under Scenario 2 involves Reclamation's purchase and acquisition of the Madera Ranch property and subsequent water banking facility development. Key activities under this activity include development of fair market value criteria, mutual selection of a third party appraiser, land appraisal, and negotiation of the purchase price.

Public involvement under this scenario is not as intense as it is under Scenario 1, however we will need and seek stakeholder input on pursuit of this scenario, and also in deciding whether or not to do a single NEPA/CEQA document that includes all impacts associated with the water banking facilities and operations; or to take a two staged approach whereby the first stage environmental document would be limited to the land purchase and acquisition and the second stage document would be disclosed as part of the water rights application process and prior to construction activities.

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