

**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 30	<b>Structural Option Name</b> FKC Conveyance Improvements to North Kern Recharge and Recovery Facilities		<b>Revision Date</b> 19 Mar 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	D. Whitbeck		J. Roldan
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Not available at this time.

Total Construction Cost: Not available at this time.

**Objective of Option**

North Kern Water Storage District proposes to build a turnout, pump station, discharge conduit, and recovery wells to facilitate pumping water from the Calloway Canal into the Lerdo Canal so that easterly recharge and recovery facilities of the District will have a connection with Friant-Kern Canal supplies. These improvements will allow the District to regulate additional wet-year supplies for use during dry years. This option may help meet the water management goal by allowing for conjunctive management of surface and groundwater resources between North Kern and other Friant long-term contracting districts, including Delano-Earlimart Irrigation District.

**Performance Criteria**

- 1 Turnout on the Friant-Kern Canal should be capable of diverting 150 cfs.
- 2 Pump station should be capable of pumping 150 cfs into the proposed discharge pipeline.
- 3 Discharge pipeline to run 3.5 miles between the Calloway and Lerdo Canal and should be capable of carrying 150 cfs.
- 4 Four deep recovery wells should each be able to recover water at a rate of 24 cfs.

**Design Criteria**

- 1 Reclamation Cost Estimating Guidelines

**Description**

North Kern Water Storage District (North Kern) is located along the Friant Kern Canal (FKC) near Bakersfield, CA. While North Kern is not a long-term CVP contractor, the District has previously entered into temporary contracts for diversion and use of CVP water from the Friant-Kern Canal, typically during very wet periods. Currently, diversions are limited to the Calloway Canal; however, proposed improvements would allow a portion of this water to be lifted into the Lerdo Canal at a location which provides the maximum utility to North Kern, i.e. the high point of North Kern's distribution system. North Kern proposes to build a turnout, pump station, discharge conduit, and recovery wells to facilitate pumping water into the Lerdo Canal so that easterly recharge and recovery facilities of the District will have a connection with Friant-Kern Canal supplies.

North Kern's existing turnout from the Friant-Kern Canal (at the 8-1 Lateral) does not have enough capacity to simultaneously serve both the westerly and easterly recharge facilities of North Kern. The new turnout would be built to deliver water into the Calloway Canal at Snow Road and will be used to serve the westerly demands of North Kern. This will allow the existing turnout to be used to supply water to the new pump station that will convey water to the easterly recharge facilities of North Kern.

New surface water supplies delivered to these areas will be used in-lieu of pumping groundwater and to directly recharge groundwater. In addition, four deep wells would be built to recover and deliver water back to the Friant-Kern Canal or other District distribution facilities. See **Figure 30-1**.

In addition to diverting water during wet years, North Kern entered into an exchange agreement in 2006 with Delano-Earlimart Irrigation District whereby 30,000 acre-feet of water was brought into North Kern and 27,000 acre-feet of that supply will be returned to Delano-Earlimart in subsequent years. This exchange agreement will utilize the proposed facilities and provide direct benefit in accordance with the water management goals.

North Kern owns and operates more than 70 groundwater recovery wells distributed throughout its service area. When North Kern is not fully utilizing its wells for District purposes, they could be made available for other purposes. In this regard, North Kern has used its wells, from time to time, to provide water to neighboring water districts, including Shafter-Wasco ID and Cawelo WD, under exchange agreements. The proposed improvements could provide an opportunity to use the existing wells to help achieve the water management goals by banking excess Friant-Kern supplies beneath North Kern and, subsequently, recovering and delivering the water back to the Friant-Kern Canal or other Friant long-term contracting districts when needed. In addition, Option 36 proposes interconnection facilities between Shafter-Wasco ID and North Kern facilities creating additional opportunities for exchanges and banking agreements.

Historical surface water deliveries to North Kern have ranged from 10,000 acre-feet during the driest of years to 400,000 acre-feet during the wettest of the years. In wet years, the district has capacity to directly recharge at least 200,000 acre-feet of excess water. During dry years, the District has used its existing recovery wells to pump more than 80,000 acre-feet from the ground in one year.

*Recommendation for Water Management Approach:*

This project may provide a mechanism to capture surplus San Joaquin River supplies from the Friant-Kern Canal and store the excess supplies through direct and in-lieu recharge in North Kern's easterly facilities served by the Lerdo Canal. The district has reportedly been able to recharge over 200,000 acre-feet in a given year, and has been able to recover up to 80,000 acre-feet from wells during dry years. Proposed facilities would provide an additional 150 cfs direct and in-lieu recharge supply as well as 100 cfs return-flow capacity to the Friant-Kern Canal. The proximity of North Kern to the Cross Valley Canal and connections detailed in other options may allow North Kern to be a storage site for Recirculation water as well.

**Construction Considerations**

Construction considerations would be assessed once a more detailed feasibility study has been completed.

**Schedule**

Engineering and Design: Dec-2008 (anticipated completion)

Agreements and Funding: Jan-2009 to Jan-2010

Land Acquisition: Jan-2010 to June-2010

Construction: June-2010 to Feb-2011

Operational: Mar-2011

**Real Estate Requirements**

- **Fee Purchase** Land purchase may be necessary for, pump stations and recovery wells. Quantity unknown.
- **Access Rights** Unknown
- **Permanent and Temporary Easements** A license will be required with the USBR for the turnout on the Friant-Kern Canal. Permanent easements will be required for construction, operation and maintenance of the discharge pipeline. Temporary easements may be required for construction activities outside the boundaries of the permanent easements.

- **Flowage Easements** None

#### **Coordination with Other Options**

This option should be coordinated with options 36, 105, 106, and 107, which deal with improvements to the Calloway Canal and connections to the Friant-Kern Canal, Shafter-Wasco ID and Cross Valley Canal, to provide the greatest potential benefit for water management. This project may be combined to form an alternative that will involve capturing surplus San Joaquin River supplies during wet years and storing them for later extraction during dry years. North Kern is also in a location to take advantage of supplies brought across the valley in the Cross Valley Canal, as such may be able to store State Water Project or Recirculation water supplies.

#### **Operational and Maintenance Requirements**

- **Operations**

The proposed pump stations will be automated to run by PLC based on water availability.

- **Maintenance**

Routine maintenance will be required to keep the discharge pipeline, pump station, wells, and associated facilities in working condition.

- **Monitoring Requirements**

Water diversion may need to be monitored, particularly if an agreement is made to use land beneath North Kern as a groundwater banking site.

#### **Future Requirements for Design**

Some engineering and design work may have previously been completed by the IRWMP Management Group. Depending on the information available, a detailed feasibility study will need to be performed to assess the proposed project, including completion of the alternative formulation report to assess whether this project will work in accordance with the water management goal. Flow data, topographic mapping, subsurface investigations, and groundwater levels may be required for design. Rights to divert additional water need to be verified. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

#### **Potential Environmental Impacts**

- **Temporary (During Construction):**

Construction of new pump stations and discharge pipeline will potentially impact surrounding farm operations.

- **Permanent (Operation-Related):**

Transfer and exchange agreements between districts will require environmental documentation.

#### **Sub-Options considered but Rejected**

None

#### **Figures**

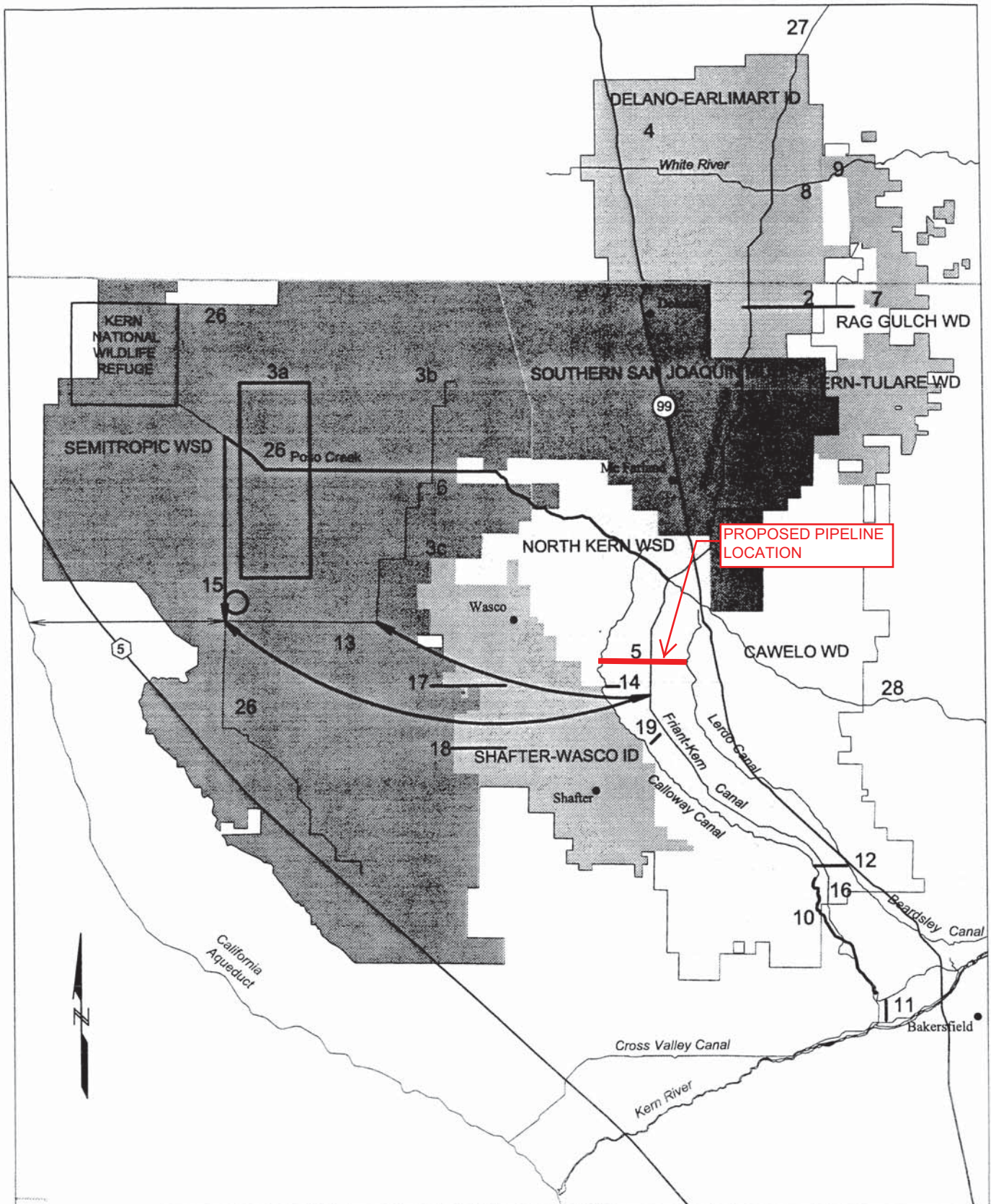
- 30-1 Region Map
- 30-2 Project Location Map

#### **Attachments**

#### **References**

- 30-1 GEI Consultants, Poso Creek Integrated Regional Water Management Plan, Appendix. D. *No. 05 G-W Banking Conveyance Improvements to North Kern Recharge and Recovery Facilities East of the Friant-Kern Canal*, July 2007





Poso Creek Integrated Regional  
Water Management Plan



Proposed Project  
Components

Poso Creek Regional Management Group

June 2007

Appendix D

Figure 30-1: Region Map



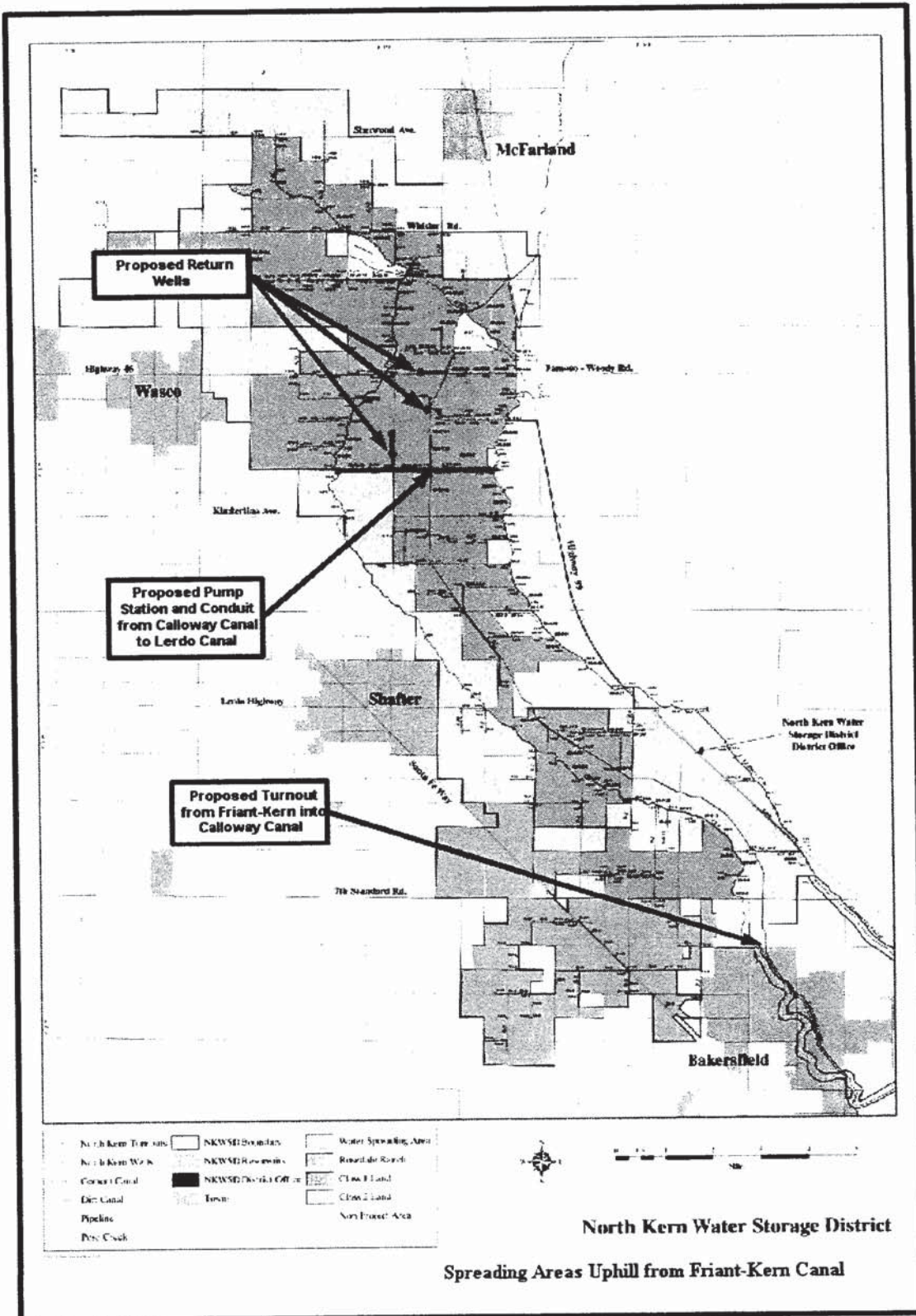


Figure 30-2: Project Location Map





**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 31	<b>Structural Option Name</b> Delano-Earlimart ID and Pixley ID Groundwater Bank		<b>Revision Date</b> 1 Feb 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal  
Total Construction Cost: Not available at this time.  
Annual O&M Cost: Unknown  
Project life: Unknown

**Objective of Option**

This option is intended to meet the water management goal by capturing surplus flows on the San Joaquin River (SJR) and Deer Creek, including Recovered Water Account supplies, and storing them in the Pixley Irrigation District (PID) underground for later extraction and conversion to regulated irrigation supply in years when the Delano-Earlimart Irrigation District (DEID) experiences shortages due to the SJR restoration program.

**Performance Criteria**

- 1 Estimated dry year recovery capability for DEID = 30,000 acre-feet.
- 2 Estimated normal year recovery capability for DEID = 12,000 acre-feet.
- 3 Estimated normal year in-lieu or direct recharge in PID = 30,000 acre-feet.
- 4 Estimated wet year in-lieu or direct recharge in PID = 50,000 acre-feet.

**Design Criteria**

- 1
- 2
- 3
- 4
- 5

**Description**

The PID is not a Friant Contractor. The PID depends on groundwater, transfers from Friant Division contractors, surplus wet year water and their somewhat unpredictable Cross Valley Contract supply to meet consumptive irrigation demand. Only 55 percent of the PID's 70,000 acres can receive surface water. Because of this, groundwater elevations beneath the PID are much lower than beneath its neighboring Friant Division districts, such as the DEID.

The groundwater depression beneath PID creates an opportunity to develop a groundwater banking facility with a large storage capacity. DEID and PID are currently conducting a feasibility study to determine the appropriate location and size of the proposed recharge, extraction and conveyance facilities (**Figures 31-1 and 31-2**).

The project is envisioned as an in-lieu and direct recharge project. When irrigation demand exists within PID, surplus SJR flows, Deer Creek flows and any excess DEID supplies will be delivered to PID growers for in-lieu recharge. At times of little or no PID irrigation demand, these same supplies will be recharged directly in 515 acres of recharge basins. It is estimated that approximately 30,000 acre-feet of surplus supply will be available in normal year types for in-lieu and direct recharge activities. In wet years, it is estimated that PID's existing irrigation demand and potential direct recharge capability will allow approximately 50,000 acre-feet of surplus water to be recharged through both in-lieu and direct recharge activities.

DEID is anticipating recovery of approximately 30,000 acre-feet in dry years and 12,000 acre-feet in normal years with 21 extraction wells providing over 100 cfs of production capacity. The water recovered in normal years will be used to satisfy the irrigation demand of lands within the DEID which are not authorized to take delivery of Central Valley Project supplies due to Reclamation Law, otherwise known as "excess lands."

### **Construction Considerations**

Due to the need to locate the project site within an area of favorable soil for recharge, it will likely be necessary to import suitable levee fill material. Due to the incompatibility of levee and recharge basin soil types, it is imperative that the contractor minimize the spreading and commingling of the levee fill with the soil in the recharge area which could reduce the final infiltration rates of the basins. In addition, due to the need to work in the proximity, and often directly on, adjacent landowners' property, it will be necessary to coordinate with landowners on construction activities, especially large hauling operations that may inconvenience or disrupt their daily operations.

### **Schedule**

Planning:	10/06 to 09/08
Agreements:	06/08 to 06/09
Design:	06/08 to 02/09
Property:	06/08 to 06/09
Construction:	06/09 to 06/11
Operational:	06/11

### **Real Estate Requirements**

- **Fee Purchase** The project will require the purchase of 515 acres for the construction of recharge basins and well fields.
- **Access Rights** While it is unknown at the current time, access rights may be necessary if DEID and/or PID personnel must travel through private landowner property to access project infrastructure. One potential location may be along the Deer Creek, where DEID and PID personnel may need to operate and maintain new control structures within the channel.
- **Permanent and Temporary Easements** Permanent easements will be required for approximately 6 miles of new pipelines to convey the recovered groundwater to the DEID existing distribution system.
- **Flowage Easements** Permits or easements may be required to use the Deer Creek channel as a recharge facility and for conveyance of surplus SJR flows to the recharge basins on a routine, long-term basis.

### **Coordination with Other Options**

Option 47 would enhance this option by providing additional surface water irrigation demand within PID for in-lieu recharge. In addition, Option 44 would provide additional conveyance capacity to deliver surplus SJR supplies from the Friant-Kern Canal (FKC) into the PID and would provide access to surplus Tule River supplies as well.

This option is located in the vicinity of Options 33, 39, and 48, all of which are groundwater recharge and/or banking projects. The interaction of these facilities and impacts on the regional aquifer should be evaluated. All of these options rely on surplus SJR flows for recharge purposes and many utilize surplus flows from Deer Creek which has less surplus flow to offer. Competition for the same water resources will

be an issue that should be evaluated. The close proximity of these options will also cause capacity problems within the Friant-Kern Canal. Option 60, and most likely Option 61, will be needed to increase the capacity of the FKC, and consequently, increase the surplus flows available from the SJR to distribute to these projects.

To ease the competition for surplus SJR water supplies, Options 55 and 56, Trans-Valley Canal and Multi-District Bidirectional Conveyance Project, could make State Water Project and Cross Valley Canal supplies available for recharge. Option 53 could also provide access to State Water Project and Cross Valley Canal supplies through an FKC-CVC Intertie, FKC pump-back facilities and exchange agreements with other Friant Division districts. It should be noted that place of use issues must first be overcome, or strategic multi-district exchange agreements must be developed, to enable State Water Project supplies to be a viable source of water for this project.

This option could also provide a location to store any San Joaquin River water recirculated through Options 58 and 59 during periods of low demand on the FKC. It could also be a component of a regional, multi-agency groundwater banking program.

#### **Operational and Maintenance Requirements**

- **Operations**

**Recharge:** Surplus water from the SJR will be diverted from the FKC into Deer Creek via the wasteway gates at the Deer Creek check structure. The surplus flows will then be diverted out of Deer Creek and into the project recharge basins. SCADA control of the FKC wasteway gates at Deer Creek and the project diversion structure within Deer Creek could facilitate the operation tremendously and reduce staffing needs. It would also allow 24-hour monitoring of basin levels, channel flows, and control structure failures. It should be noted that the FKC wasteway gates are controlled by the Friant Water Authority, and consequently, their SCADA system would require upgrades as well. **Extraction:** The wells will extract groundwater and deliver it through new pipeline connections to existing DEID distribution laterals for ultimate delivery to growers. SCADA controls could be extremely helpful in monitoring pump output, pump performance, and on/off status.

- **Maintenance**

Routine maintenance will be required on all proposed project facilities. New recharge basins and levees will require weed and pest control, occasional silt removal, discing, and grading. Pumps, motors and electrical panels will also require routine maintenance. Most routine maintenance can be performed while the system is in operation, although more extensive maintenance should be performed when the system is down. This will be different for the recharge and extraction components which will be operating at different times of the year.

- **Monitoring Requirements**

A monitoring program with a network of monitoring wells will likely be required to assess the project's impact on the underlying aquifer, impacts to adjacent landowners, and additional hydrogeologic characteristics of the aquifer.

#### **Future Requirements for Design**

A feasibility study is currently underway and should be available in early 2008. Environmental documentation will be required and it is likely that additional subsurface investigations will be required as well.

#### **Potential Environmental Impacts**

- **Temporary (During Construction)**

The significant earthwork involved in the construction of the recharge basins may impact sensitive species. Permits will likely be required for any construction work in or around the Deer Creek channel.

- **Permanent (Operation-Related)**

Anticipated issues include the conversion of agricultural land to direct recharge reservoirs, permitting associated with the use of Deer Creek as a recharge facility, and the avoidance/mitigation of potential impacts to landowners adjacent to the proposed extraction facilities.

**Sub-Options considered but Rejected**

None.

**Drawings****Figures**

- 31-1 Project Location Map
- 31-2 Project Facility Map (Draft Figure - Provost & Pritchard Engineering Group Draft Feasibility Study)

**Attachments****References**

- 31-1 Friant Water Users Authority, *San Joaquin River Restoration Program Water Management Goal Potential Programs & Projects (Feinstein Report)*, 2007.
- 31-2 Personal communication with Dennis Mills, Provost & Pritchard Engineering Group, January 2008.



Figure 31-1



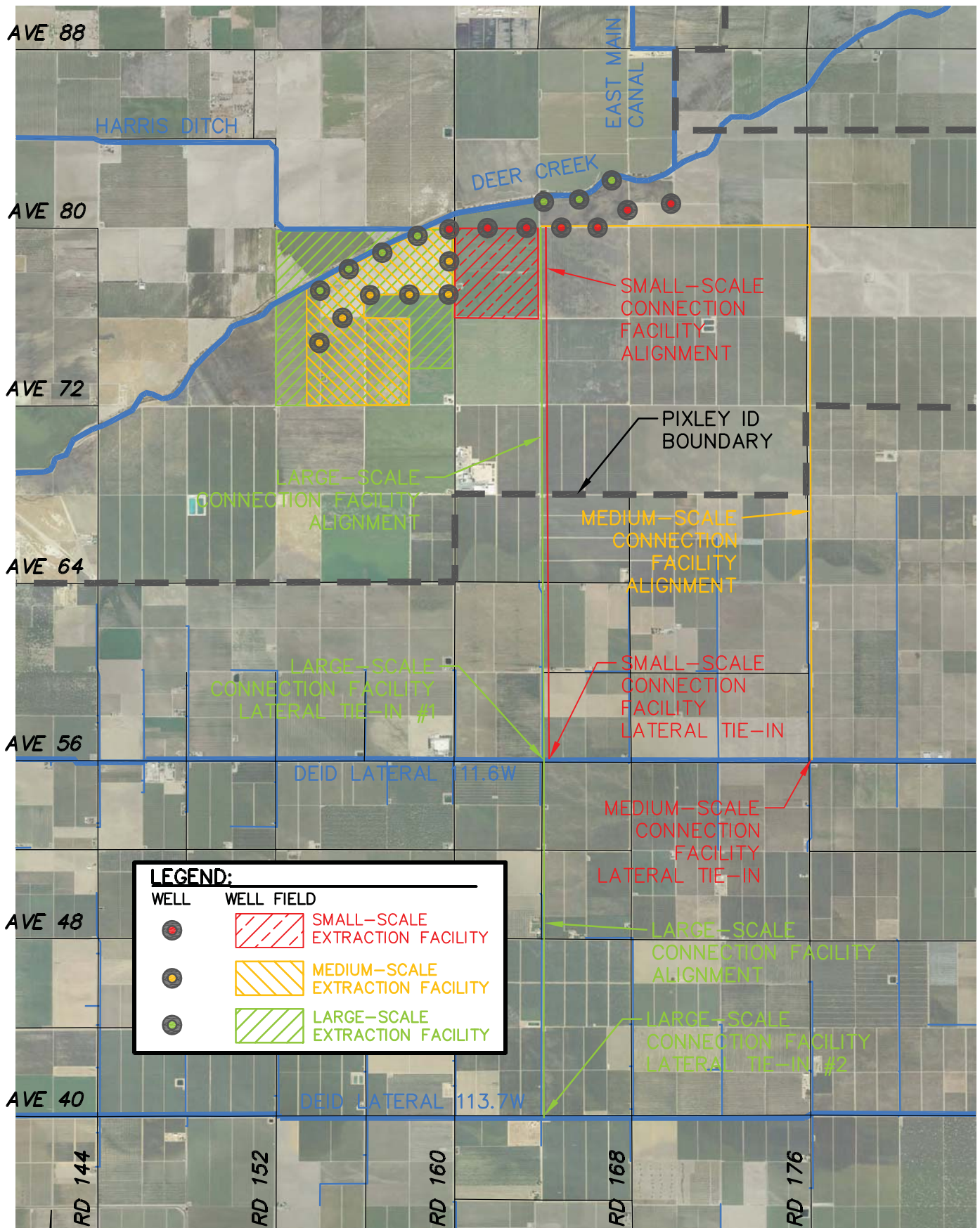
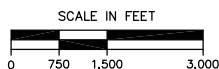


FIGURE 31-2



EST. 1968  
**PROVOST & PRITCHARD**  
 ENGINEERING GROUP  
 An Employee Owned Company  
 3500 WEST ORCHARD COURT  
 VISALIA, CALIFORNIA 93277-7055  
 559/636-1166 FAX 559/636-1177  
 www.ppeng.com

DEID-PID JOINT GROUNDWATER  
 BANKING PROGRAM STUDY  
 PIXLEY IRRIGATION DISTRICT  
 TULARE COUNTY, CA

PROJECT FACILITY MAP  
 FIGURE X.X

DESIGN ENGINEER:	Dennis Mills
DRAFTER:	ASC
SCALE:	AS SHOWN
DATE:	1-18-08
JOB NO:	3159 06V1
SHEET	1 OF 1





**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 32	<b>Structural Option Name</b> Rancho de Kaweah Surface Water Banking Facility		<b>Revision Date</b> 29 Jan 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		D. Dorratcague
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal  
 Total Construction Cost: Not available at this time.  
 Annual O&M Cost: Unknown  
 Project life: 30 years (extraction well lifespan)

**Objective of Option**

To store excess San Joaquin River and Kaweah River surface water, including Recovered Water Account supplies, in wet and above normal years for use in years when the water supplies of participating districts are inadequate to meet their demands due to reductions in Central Valley Project deliveries for river restoration. Participating districts are currently unable to store flood flows when available and extract the stored supply to offset shortages caused by river restoration.

**Performance Criteria**

- 1 Recover approximately 18,000 acre-feet in normal and dry years.

**Design Criteria**

- 1 Depth to groundwater at project site = 15 feet (2004)

**Description**

Twenty-five years prior to the construction of the Friant-Kern Canal (FKC), the Lindsay-Strathmore Irrigation District (LSID) utilized groundwater extraction wells on a 1,300-acre, district-owned property known as Rancho de Kaweah to provide water to its growers. Using 39 extraction wells, LSID was allowed to extract up to 18,000 acre-feet annually until 1948.

LSID is currently proposing to convert a portion of the property into a banking facility. This will require the construction of levees in and around a 320-acre section of the property situated adjacent to the Kaweah River (**Figure 32-1**). Several recharge cells will be needed due to the slope of the land. Several extraction wells already exist on the property, although they will likely need to be modified to increase capacity and to prevent inundation when the new recharge ponds are filled. Depending on the rate and direction of migration of stored groundwater, additional extraction wells may need to be restored on the remaining 980 acres of the ranch. New piping and booster pumps will be required to convey the extracted groundwater to the FKC and/or Kaweah River for distribution to the participating districts. Exchanges may be possible at times between project participants that may reduce the need to deliver all extracted groundwater through new conveyance facilities. A Warren Act Contract will be needed to convey the non-Project groundwater in the FKC.

The water supply for the proposed banking facility will be from the San Joaquin River and the Kaweah River. San Joaquin River flows utilized in this project will most likely be surplus flows in the form of Section 215 or Recovered Water Account supplies, although it will be possible to use Class 1 and Class 2

supplies that are excess to project participants' needs in any given year. These flows will be released into the Kaweah River through wasteway gates on the FKC and conveyed approximately one mile in the Kaweah River to the project site. Similarly, Kaweah River flows utilized in the project will likely be surplus flows in wetter years, although a portion of a normal year's supply may be banked if it is surplus to a district's needs or is in danger of being spilled from Terminus dam outside the irrigation season.

Potential project participants include LSID, Kaweah Delta Water Conservation District, Exeter Irrigation District, Ivanhoe Irrigation District and Tulare Irrigation District.

#### **Construction Considerations**

Due to the location of the project site adjacent to the Kaweah River, it is very likely that suitable levee material must be imported. Due to the incompatibility of levee and recharge basin soil types, it is imperative that the contractor minimize the spreading and commingling of the levee fill with the soil in the recharge area which could reduce the final infiltration rates of the basins. In addition, earthwork in the immediate vicinity of the existing extraction wells must not damage the pumps, motors and electrical services (if they are to be reused) and must not impact the alignment and functionality of the casings.

#### **Schedule**

Planning	2008
Agreements	2008
Design	2008-09
Property	2009
Construction	2009-10
Operational	2011

#### **Real Estate Requirements**

- **Fee Purchase:** None. LSID currently owns the 320-acre project site.
- **Access Rights:** None.
- **Permanent and Temporary Easements:** Additional permanent easements may be required for the alignment of the new pipeline from the extraction wells to the FKC. A license for any facilities on U.S. Bureau of Reclamation right-of-way will also be required.
- **Flowage Easements:** Close coordination with the Friant Water Authority and Kaweah Delta Water Conservation District will be required to deliver surplus San Joaquin River flows from the FKC into the Kaweah River. In addition, a Warren Act Contract will be required to convey extracted groundwater in the FKC.

#### **Coordination with Other Options**

This option could work in conjunction with LSID's exchange program with Tulare ID (refer to Option 38) to make additional water supply available to both parties in all year types. As much as this option provides additional conjunctive use capability for Tulare ID, it may enable Tulare ID to provide a more reliable dry year supply for Class 1 districts as envisioned in Option 34. It could also be a component of a regional, multi-agency groundwater banking program (a subject for an additional option). In addition, the Trans-Valley Canal (Option 55) could potentially provide surplus State Water Project supplies or recirculated SJR supplies (Options 58 and 59) for recharge at the project site depending on the location of the intertie between the FKC and the proposed Trans-Valley Canal or the availability of exchange options with project participants. It should be noted that place of use issues must first be overcome to enable State Water Project supplies to be a viable source of water for this project.

This option does not preclude other options from being undertaken, although it does reduce the amount of SJR surplus water available for use in other options. However, Options 60 and 61, capacity correction and increase of the FKC, would ease the restriction of flood water conveyance to all the proposed groundwater banking projects served by the FKC, thus increasing the available surplus San Joaquin River supply.

**Operational and Maintenance Requirements**

• **Operations**

Recharge basin operations will require a SCADA control system to provide ground-water level monitoring, alarm capability, pump control, and inflow and outflow control. The SCADA system should prevent the need for additional staffing during the irrigation season; however, staff will need to be on call during the off hours of the winter months during the normal recharge operation period.

• **Maintenance**

Routine maintenance will be required on all proposed project facilities. New recharge ponds and levees will require weed and pest control, occasional silt removal, discing and grading, pumps, motors and electrical panels will also require routine maintenance. Most routine maintenance can be performed while the system is in operation, although more extensive maintenance should be performed when the system is down. This will be different for the recharge and extraction components, which will be operating at different times of the year.

• **Monitoring Requirements**

Groundwater levels will be monitored to identify the volume of water banked, the impacts of the banking project to the surrounding area and the groundwater migration rates toward or away from the Kaweah River.

**Future Requirements for Design**

In 2004, the depth to groundwater at the proposed project site was approximately 15 feet. In order to determine the viability of the proposed project site as a banking facility, the long-term storage capacity and groundwater migration rates under the site will need to be evaluated. In addition, infiltration rates and the actual recharge surface area, required for levee layout, must be evaluated to determine if the recharge capability will meet the needs of the project participants. Similarly, the existing extraction wells must be tested to determine if additional wells will be required to meet target return flows, as well as all appurtenant piping.

**Potential Environmental Impacts**

• **Temporary (During Construction)**

The construction of the proposed levees and pipelines will require a significant amount of earthwork. A review of sensitive species within the project area may be required, as well as mitigation measures to avoid any negative impacts. In addition, a significant hauling operation of levee material is expected. Dust, noise and traffic impacts should be evaluated.

• **Permanent (Operation-Related)**

It is expected that the overall impact to the groundwater levels in the surrounding area will be positive, especially in light of the expected depletion of groundwater due to the SJR settlement. However, due to the relatively high groundwater levels in the vicinity of the Kaweah River and proposed project site, there may be localized negative groundwater impacts to adjacent properties if water levels rise too high and begin affecting crops and structures.

**Sub-Options considered but Rejected**

None.

**Drawings**

None

**Figures**

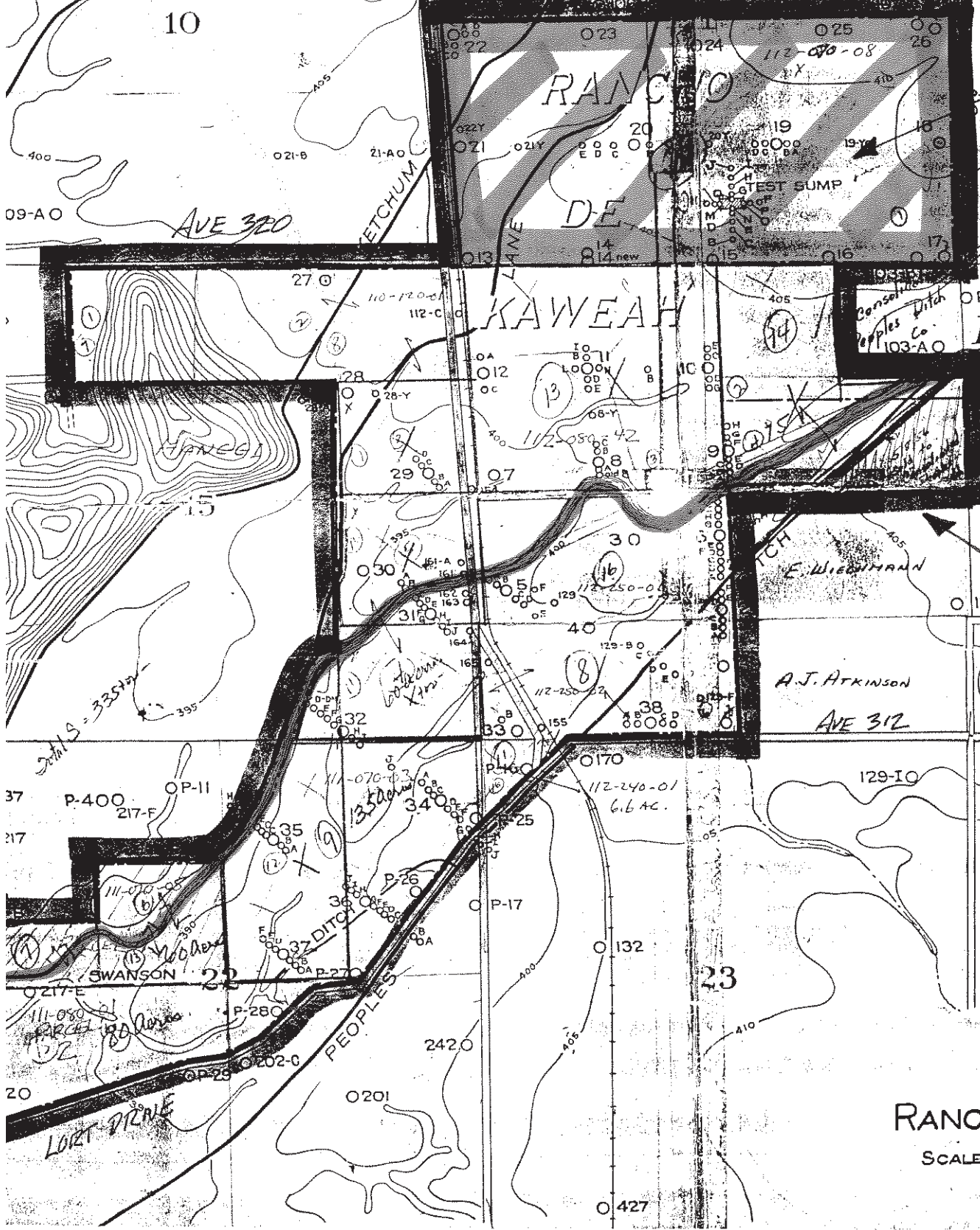
32-1 Site Plan

**Attachments**

**References**

32-1 Personal Communication with Scott Edwards, January 2008

10



Project Site  
(320 acres)

KAWEAH RIVER

Rancho de Kaweah  
Property Boundary  
(1,300 acres)

ROAD 196

EXETER



FIGURE 32-1 - Site Plan



**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 33	<b>Structural Option Name</b> Deer Creek Basin Water Banking Evaluation		<b>Revision Date</b> 28 Jan 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Appraisal  
Total Study Cost: Not available at this time.  
Annual O&M Cost: Unknown  
Project life: Unknown

**Objective of Option**

Develop normal and dry year water supplies for the Deer Creek and Tule River Authority member districts to meet water management goals by mitigating the loss of Central Valley Project Friant Division water supplies due to the San Joaquin River settlement.

**Performance Criteria**

- 1
- 2
- 3
- 4

**Design Criteria**

- 1
- 2
- 3
- 4
- 5

**Description**

The Deer Creek and Tule River Authority (DCTRA) is a joint powers authority comprised of seven irrigation districts and over 220,000 acres. The DCTRA was formed to facilitate more efficient management and operations of the member districts' surface and groundwater supplies. In 2006, the DCTRA updated and adopted its Groundwater Management Plan to facilitate groundwater management.

The DCTRA owns and operates 250 acres of recharge basins for the benefit of its member districts at the intersection of the Friant-Kern Canal and Deer Creek in Tulare County just east of the Saucelito Irrigation District boundary and the Friant-Kern Canal (Figure 33-1). Surplus flows from the San Joaquin River and Deer Creek are delivered to the basins for recharge purposes. Currently, the DCTRA is unable to recover the recharged water due to a lack of extraction wells.

The recharge basins were identified by a regional groundwater study as a potential site for future recharge evaluation (Figure 33-2). The proposed study will investigate the feasibility of utilizing the existing basins for recharge and extraction.

The project will allow the DCTRA member districts to capture and store wet year surplus flows, including Section 215 and Recovered Water Account supplies, for subsequent recovery in normal to dry years to directly meet water management goals. It will also provide the DCTRA with a mechanism to recover the cost of recharge operations through the sale of recovered groundwater.

#### **Construction Considerations**

Due to the need to work in the proximity, and often directly on, adjacent landowners' property to construct distribution pipelines, it may be necessary to coordinate with landowners on construction activities, especially excavation operations that may inconvenience or disrupt their daily operations.

#### **Schedule**

Feasibility Study: 6/08 – 5/10 (Refer to the schedule on Figure 33-3)

#### **Real Estate Requirements**

- **Fee Purchase** The DCTRA currently owns the existing recharge basins. However, additional acreage may be required to construct a well field for groundwater recovery.
- **Access Rights** Unknown at this time.
- **Permanent and Temporary Easements** It is expected that additional permanent easements will be required to construct and maintain pipelines from the new extraction wells to existing district distribution systems or to the Friant-Kern Canal (FKC). A license with the U.S. Bureau of Reclamation will be required to construct facilities on the FKC right-of-way.
- **Flowage Easements** A Warren Act Contract will be required to convey the recovered groundwater in the FKC.

#### **Coordination with Other Options**

This option could be enhanced through Options 55 and 56, Trans-Valley Canal and Multi-District Bidirectional Conveyance Project, which could make State Water Project and Cross Valley Canal (CVC) supplies available for recharge. Option 53 could also provide access to State Water Project and CVC supplies through an FKC–CVC Intertie, FKC pump-back facilities, and exchange agreements with Friant Contractors on the southern end of the FKC. In much the same way, this option could also provide a location to store any San Joaquin River water recirculated through Options 58 and 59. It could also be a component of a regional, multi-agency groundwater banking program. It should be noted that place of use issues must first be overcome to enable State Water Project supplies to be a viable source of water for this project.

The use of this area could affect the Delano-Earlimart & Pixley ground water bank, which is located about 8 miles to the west (Option 31). It could also affect Saucelito ID's proposed recharge basins (Option 48). The impact of each water recharge/banking option on the other two options should be evaluated. In addition, the cumulative impact of all three options should be evaluated.

This option does not preclude other options from being undertaken, although it does reduce the amount of SJR surplus water available for use in other options. However, Options 60 and 61, capacity correction and increase of the FKC, would ease the restriction of flood water conveyance to all the proposed groundwater projects served by the FKC, thus increasing the available surplus San Joaquin River supply.

#### **Operational and Maintenance Requirements**

##### • **Operations**

**Recharge:** Surplus water from the San Joaquin River will be diverted from the FKC into Deer Creek via the wasteway gates at the Deer Creek check structure. The surplus flows will then be diverted out of Deer Creek and into the existing DCTRA recharge basins. SCADA control of the FKC wasteway gates at Deer Creek and the inlet gates on Deer Creek at the DCTRA basins could facilitate the operation tremendously and reduce staffing needs. It will also allow 24-hour monitoring of basin levels, channel flows, and control structure failures. It should be noted that the FKC wasteway gates are controlled by the Friant Water Authority, and consequently, their SCADA system would require upgrades as well. **Extraction:** The wells



will extract groundwater and deliver it through new pipeline connections to existing member district distribution laterals or to the FKC for delivery to member districts or exchange with other Friant districts. SCADA controls could be extremely helpful in monitoring pump output, pump performance, and on/off status. Initially, DCTRA staff will likely monitor the recharge and extraction operations on a 24-hour basis, although depending on the reliability of the SCADA system and project infrastructure, DCTRA staff may simply be “on call” during off-hours and rely on the SCADA alarm functions to notify them of operational problems.

- **Maintenance**

Routine maintenance will be required on all proposed project facilities. Existing recharge basins and levees will require weed and pest control, occasional silt removal, discing, and grading. Pumps, motors and electrical panels will also require routine maintenance. Most routine maintenance can be performed while the system is in operation, although more extensive maintenance should be performed when the system is down. This will be different for the recharge and extraction components, which will be operating at different times of the year.

- **Monitoring Requirements**

The feasibility study will install 8 monitoring wells, 4 locations with 2 at each location (Figures 33-1 and 33-4), and recommend an appropriate monitoring program based on site conditions. It will likely be developed to provide information on impacts to adjacent landowners from recharge and extraction, total volume of water stored, rates of groundwater migration into and out of the project area, and aquifer characteristics.

### **Future Requirements for Design**

The proposed study will establish the feasibility of completing necessary improvements and arrangements to facilitate groundwater storage and recovery of stored surface water supplies. The proposed study consists of groundwater monitoring well construction, data compilation and evaluation, water storage and recovery assessments, structural considerations and the development of necessary agreements. The following benefits are anticipated from the study: 1) Development of specific hydrogeologic data for the proposed project site; 2) Specific project details and features ready for future implementation; 3) Improved surface water management and groundwater recovery capabilities development; and 4) Continued implementation of the region’s Groundwater Management Plan objectives through the pursuit of additional recharge facilities and opportunities.

### **Potential Environmental Impacts**

- **Temporary (During Construction)**

Permits will likely be required for any construction work in or around the Deer Creek channel.

- **Permanent (Operation-Related)**

Impact to adjacent landowners from the extraction of groundwater is expected to be a sensitive issue. In addition, coordination of flood flow operations on Deer Creek with DCTRA recharge operations will be required to avoid impacts to downstream communities and property.

### **Sub-Options considered but Rejected**

None.

### **Drawings**

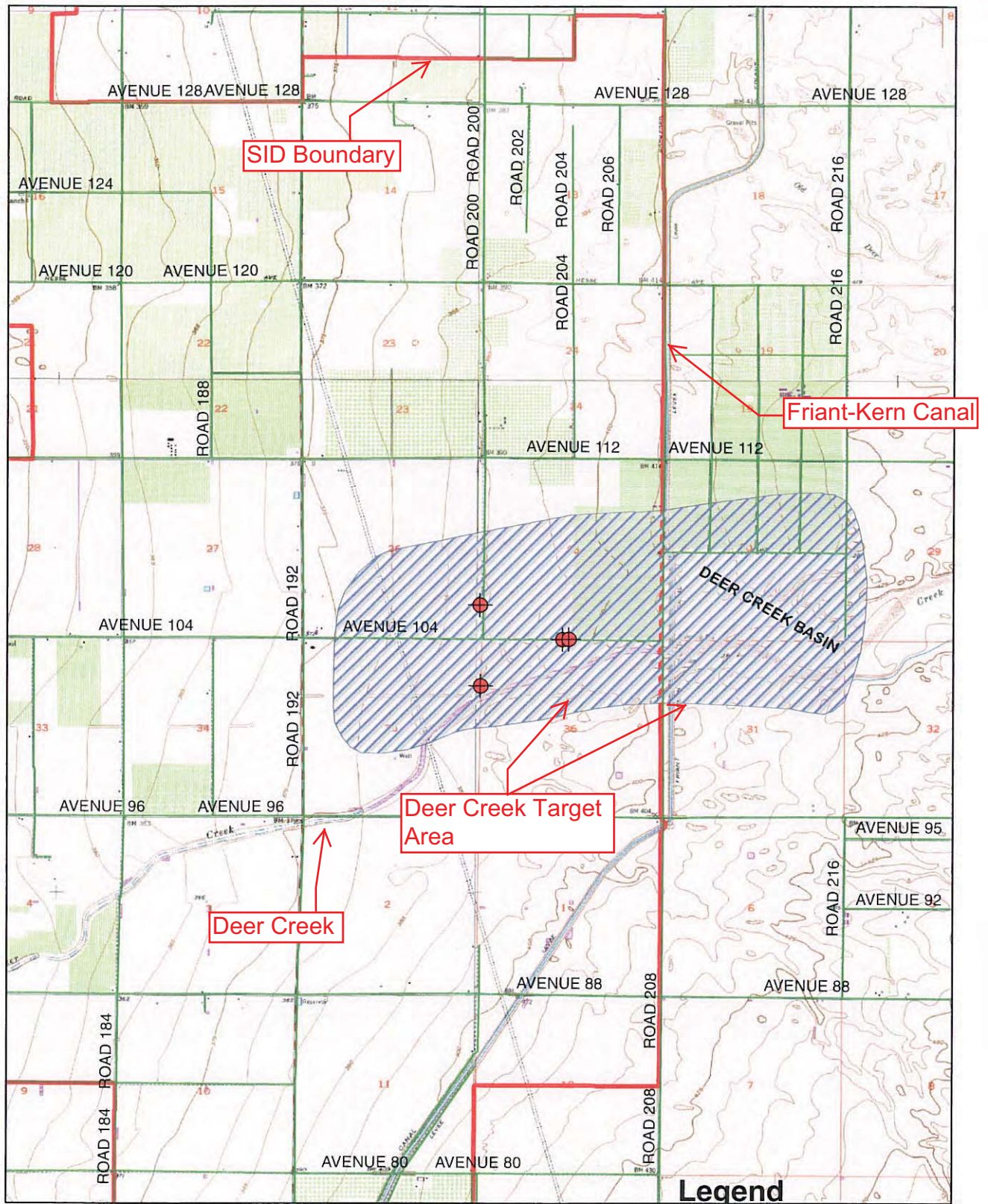
### **Figures**

- 33-1 Figure 3-1 Project Location (Reference 33-1)
- 33-2 Figure 3-2 Soil Permeabilities (Reference 33-1)
- 33-3 Figure 3-3 Project Schedule (Reference 33-1)
- 33-4 Figure 3-4 Surface Lid Monitoring Well (Reference 33-1)

**Attachments**

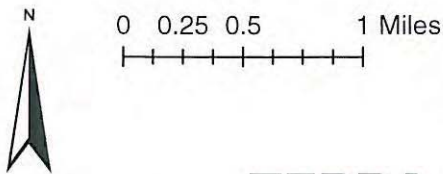
**References**

- 33-1 Keller-Wegley Engineering, *Grant Application AB303 – Local Groundwater Assistance Program Terra Bella Irrigation District*, December 2007.
- 33-2 Telephone Conversation with Sean Geivet, TBID Manager, January 15, 2008.



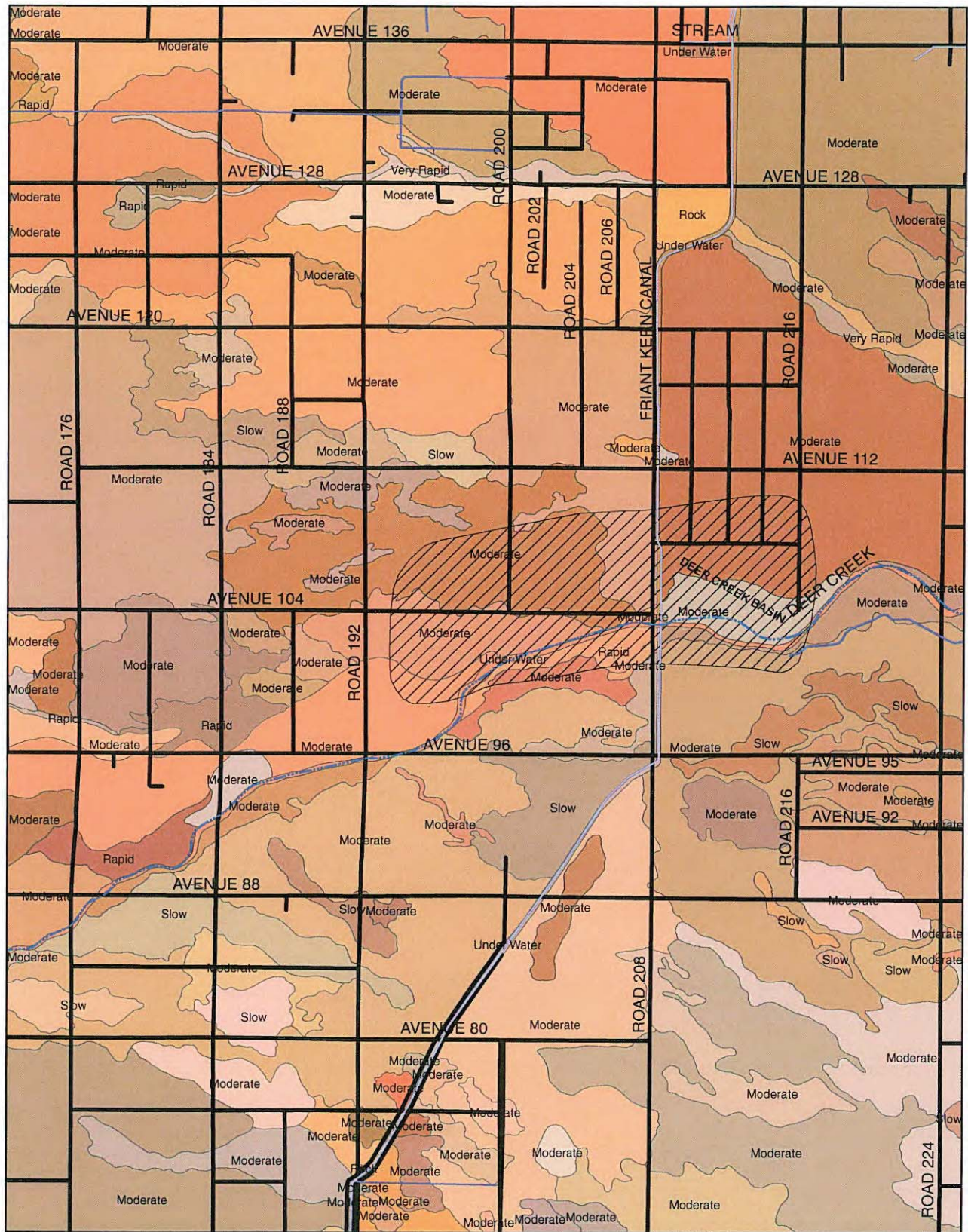
- Legend**
- Saucelito Irrigation District
  - Deer Creek Target Area
  - Monitoring Wells

Figure 33-1




**PROJECT LOCATION**  
**TERRA BELLA IRRIGATION DISTRICT**





**Legend**

 Deer Creek Target Area

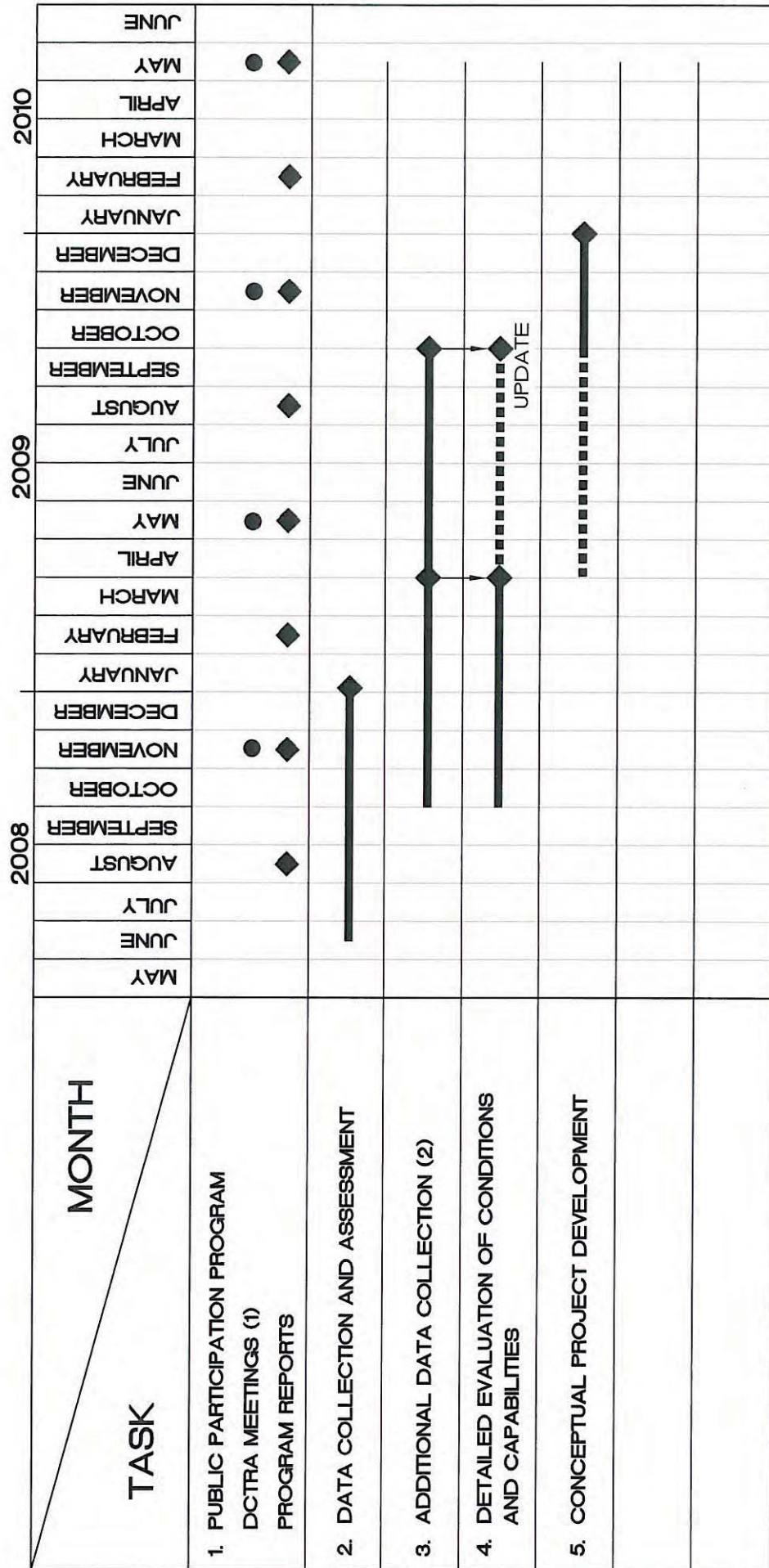


0 0.35 0.7 1.4 Miles  
|-----|-----|-----|

**SOIL PERMEABILITIES**  
**TERRA BELLA IRRIGATION DISTRICT**



# PROJECT SCHEDULE AB 303 GRANT APPLICATION TERRA BELLA IRRIGATION DISTRICT



- LEGEND**
- ◆ MILESTONE/DELIVERABLE
  - MEETING
  - REVIEW PERIOD/DURATION
  - ◆ TASK CONTINUATION - AS NEEDED

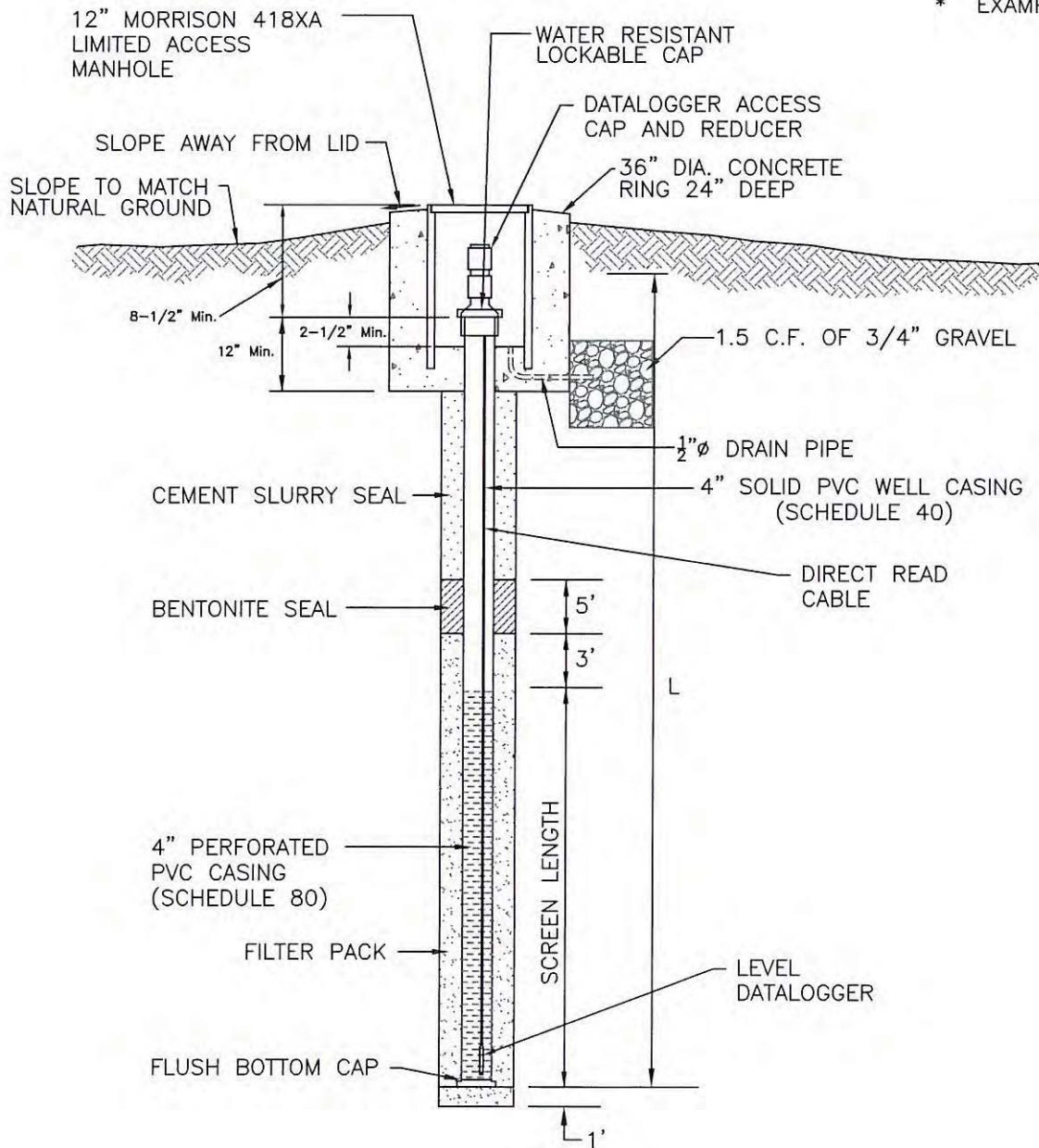
- NOTES**
1. MEETINGS WITH PROJECT ELEMENT. AUTHORITY MEETS IN ODD NUMBERED MONTHS (MEETING NOT SHOWN)
  2. AS NECESSARY. INCLUDES CEQA, CONSTRUCTION AND MONITORING





MONITORING WELL DATA		
PARAMETER	MONITORING WELL NUMBER	
	MW-4	MW-5
DEPTH (L) (ft.)	110	120
SCREEN LENGTH (ft.)	60	60
LATITUDE	35°58'55.08"N	35°58'30.54"N
LONGITUDE	119°07'31.5"W	119°07'31.74"W

\* EXAMPLE DATA



**SURFACE LID MONITORING WELL  
DEER CREEK AND TULE RIVER AUTHORITY**



**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 36	<b>Structural Option Name</b> Upgrade of Shafter-Wasco ID Interconnection Facilities		<b>Revision Date</b> 24 Mar 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	D. Whitbeck		J. Roldan
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal

Total Construction Cost: Not available at this time.

**Objective of Option**

Shafter-Wasco Irrigation District proposes to construct two interconnection pipelines with North Kern Water Storage District. The first will be a bidirectional connection between the Calloway Canal and Shafter-Wasco's Lateral 134.4. The second interconnection pipeline will connect North Kern's "8-5" ditch to Shafter-Wasco's Lateral 137.2. The interconnection pipelines will allow North Kern to return recovered groundwater to Shafter-Wasco. In addition, North Kern and Shafter-Wasco will be able to share surplus San Joaquin River and Kern River supplies when available.

**Performance Criteria**

- 1 The north system bi-directional connection between the Calloway Canal and Shafter-Wasco's Lateral 134.4 is proposed to have a total pumped capacity of 75 cfs.
- 2 The south system connection from the "8-5" ditch to Shafter-Wasco's Lateral 137.2 is proposed to be a 48-inch diameter gravity flow pipe with 50 cfs capacity.
- 3 Increase energy savings by delivering surface water supplies to Shafter-Wasco for use in-lieu of groundwater pumping.
- 4 Increase conjunctive management of surface and groundwater resources.

**Design Criteria**

- 1 Reclamation Cost Estimating Guidelines

**Description**

Shafter-Wasco Irrigation District (Shafter-Wasco) and North Kern Water Storage District (North Kern) are neighboring districts that are both located in the southern portion of the San Joaquin Valley. See **Figure 36-1**. North Kern is located directly adjacent to the Friant-Kern Canal, but does not have a long-term contract for Friant water. Shafter-Wasco is a Friant long-term contractor, and meets its customer demand by diverting a combination of water from a turnout on the Friant-Kern Canal and pumping groundwater reserves.

During very wet periods there are times when excess surface water is available in the San Joaquin River and Kern River. Historically, when excess water is available, North Kern has been able to enter into temporary contracts allowing them to divert Section 215 supplies from the Friant-Kern Canal. Shafter-Wasco and North Kern would like to have the flexibility to divert water from the San Joaquin and Kern Rivers into either district's systems based on current hydrologic and infrastructure capacity conditions.

Shafter-Wasco also has agreements with North Kern to bank excess water beneath North Kern. In dry years, both of these proposed connections may also be used to return water that Shafter-Wasco has previously contracted to store beneath North Kern. Shafter-Wasco would also like to use these facilities as part of an exchange agreement where North Kern would deliver off-peak season Kern River water in exchange for peak season Class One water for energy and supply management purposes.

Connection to Shafter-Wasco's north system would consist of a bidirectional intertie between the Calloway Canal and Shafter-Wasco's Lateral 134.4. A series of parallel 24-inch diameter pipes would connect an existing turnout structure to a new 48-inch diameter pipeline. The 48-inch diameter pipeline would run 180 feet and connect to an existing 48-inch tee in Shafter-Wasco's Lateral 134.4. The system will have a total pumped capacity of 75 cfs. In addition, construction of three 100 hp pumps and motors, a manifold to connect to the existing 48-inch tee in Lateral 134.4, and a stand tank for surge protection may be required.

Connection to Shafter-Wasco's south system would consist of a connection between North Kern's "8-5" ditch and Shafter-Wasco's Lateral 137.2. The interconnection would be a 50 cfs capacity, 48-inch diameter steel pipeline connected to a gated turn-out structure on the "8-5" ditch. The pipeline will be about 60 feet long and water will flow by gravity from North Kern into Shafter-Wasco's south system.

The primary goal of the project is to allow for operational flexibility that may enhance conjunctive use. Associated benefits will include increased water supply reliability through system redundancy and flexibility, increased conjunctive management of surface and groundwater resources, and energy savings through delivery of surface supplies in-lieu of groundwater pumping.

#### *Recommendation for Water Management Approach*

This project represents a groundwater banking and recharge opportunity that would allow Shafter-Wasco to recharge surplus San Joaquin River supplies at a rate of up to 125 cfs by diverting surface water supplies, when available, to North Kern's direct and in-lieu recharge facilities. It would also allow this water to be returned to Shafter-Wasco in dry years. During wet years, this project may also help Shafter-Wasco deliver a portion of North Kern's Kern River supplies for in-lieu recharge. This project, along with North Kern's proposed connection of the Calloway Canal to the Cross Valley Canal (Options 105, 106 and 107) may also provide an opportunity to deliver Recaptured water to Shafter-Wasco through North Kern's system.

#### **Construction Considerations**

Construction considerations would be assessed once the pre-design feasibility study has been obtained and reviewed.

#### **Schedule (Completion Dates)**

Preliminary Design: Dec-2007 (completed)  
Agreements Jun-2008  
Property (inc. R/W) Jan-2009  
Construction Jan-2010  
Operational Jun-2010

#### **Real Estate Requirements**

- **Fee Purchase:** None
- **Access Rights:** Access rights will be assessed based on the feasibility study.
- **Permanent and Temporary Easements:** Some rights-of-way have been acquired, but additional permanent easements will be required for access to pipeline and other facilities. Temporary easements may be required for construction.
- **Flowage Easements** None

#### **Coordination with Other Options**

This option could be coordinated with Options 105, 106 and 107 to bring additional water into Shafter-Wasco, either Recaptured water from the California Aqueduct or surplus San Joaquin River water from the Friant-Kern Canal. Also, Options 69 and 70 consider connections of Shafter-Wasco facilities to Semitropic

Water Storage District's distribution system, which would allow the district to obtain additional SWP supplies. Option 30 would provide groundwater recovery directly into the Friant-Kern Canal. The connections to North Kern proposed in this option, the connections to Semitropic proposed in Options 69 and 70, and the groundwater recovery in Option 30 could significantly enhance east-west conveyance, groundwater recharge and groundwater recovery for the benefit of the Friant Division in accordance with the Water Management Goal.

#### **Operational and Maintenance Requirements**

- **Operations**

Pump stations will likely run on PLC and will be remotely adjusted based on water supply availability in the North Kern and Shafter-Wasco distribution systems.

- **Maintenance**

Routine maintenance will be required to ensure that pipelines and facilities are working and in good condition.

- **Monitoring Requirements**

None.

#### **Future Requirements for Design**

According to information provided by the Poso Creek Integrated Regional Water Management Group, preliminary design for this project has been completed. Depending on the availability and detail of the completed design, additional work may need to be performed to assess the proposed project. The alternative formulation report needs to be completed to assess whether this project will work in accordance with the water management goal. Flow data, topographic mapping, subsurface investigations, and groundwater levels may be required for design. Rights to divert additional water or to obtain water from the proposed sources need to be verified. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

#### **Potential Environmental Impacts**

- **Temporary (During Construction):**

Construction of a new pipeline has potential to impact operation of surrounding farms.

- **Permanent (Operation-Related):**

Transfer, exchange and banking agreements between districts will require environmental documentation.

#### **Sub-Options considered but Rejected**

None

#### **Figures**

36-1 Region Map

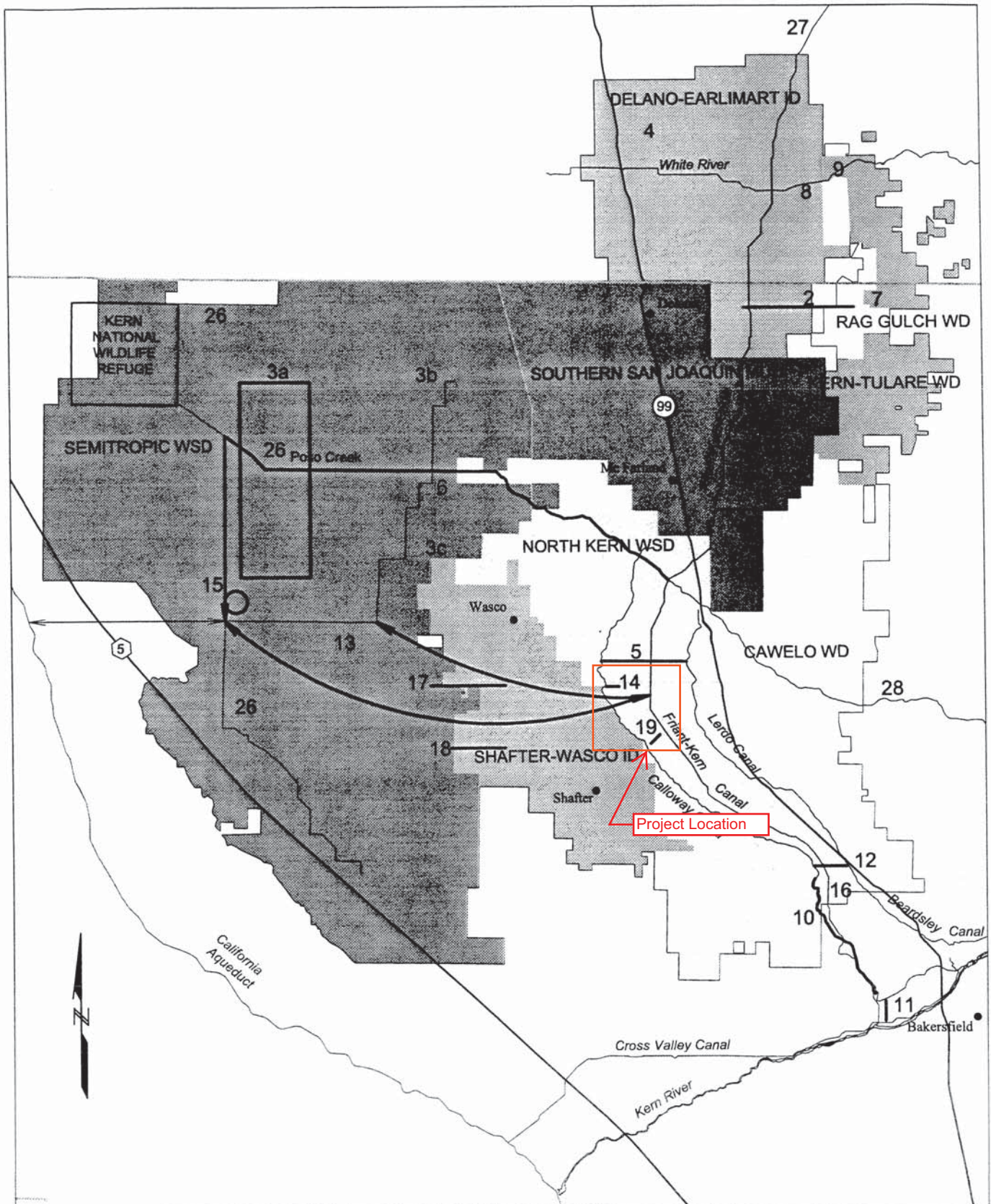
#### **Attachments**

#### **References**

36-1 GEI Consultants, *Poso Creek Integrated Regional Water Management Plan, Appendix. D. No. 14 North Interconnection between North Kern/Shafter-Wasco*, July 2007.

36-2 GEI Consultants, *Poso Creek Integrated Regional Water Management Plan, Appendix. D. No. 19 South Interconnection between North Kern/Shafter-Wasco*, July 2007.





Poso Creek Integrated Regional  
Water Management Plan



Proposed Project  
Components

Poso Creek Regional Management Group

June 2007

Appendix D

Figure 36-1: Region Map





**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 39	<b>Structural Option Name</b> Delano-Earlimart Irrigation District Turnipseed Groundwater Banking Project		<b>Revision Date</b> 29 Jan 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		D. Dorratcague
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Feasibility  
 Total Construction Cost: Not available at this time.  
 Annual O&M Cost: Not available at this time.  
 Project life: 30 years (extraction well lifespan)

**Objective of Option**

The goal of this groundwater banking project is to capture surplus San Joaquin River and White River flows, including Recovered Water Account supplies, and convert them to regulated irrigation supply to mitigate the loss of Central Valley Project supply to San Joaquin River restoration. This project will also provide a source of supply for lands within the District which are not authorized to take delivery of Central Valley Project supplies due to Reclamation Law, otherwise known as “excess lands.”

**Performance Criteria**

- 1 To the greatest extent possible, meet all of the estimated 19,500 acre-feet of irrigation demand from “excess lands” with groundwater from the proposed banking facilities.

**Design Criteria**

- 1 Existing 80-acre basin infiltration rate = 0.4 feet/day
- 2 New 400-acre basin expansion infiltration rate = 0.25 feet/day (assumed)
- 3 Seepage rate in White River = 0.4 feet/day (assumed)
- 4 Extraction well capacity = 2,000 gallons per minute each
- 5 Depth to Groundwater (2 boring sites) = 55 and 69 feet

**Description**

The District recently undertook a study in conjunction with the Metropolitan Water District of Southern California (MWDSC) (Reference 39-1) to expand an existing 80-acre recharge basin, known as the Turnipseed Basin (**Figure 39-1**), located adjacent to the White River as part of a water quality exchange program between the Friant Water Users Authority and the MWDSC.

While the District’s historical groundwater levels have remained fairly stable after the introduction of Central Valley Project (CVP) supplies in 1950 (**Figure 39-2**), recent dramatic increases in the cost of surface supplies have led to a reduction in intentional groundwater recharge by the District. This prompted the District to explore a potential water quality exchange program with MWDSC with the goal of obtaining funding for groundwater banking facilities and programs. The emergence of the San Joaquin River Restoration Settlement and the impending loss of a substantial quantity of CVP supply have forced the District to change its focus from an exchange program to a water acquisition program. It is now envisioned

that the expansion of the Turnipseed Basin will be utilized to capture surplus San Joaquin River flows in the form of Section 215 and Recovered Water Account supplies.

The District does not often use the existing Turnipseed Basin because the high cost of purchasing water must be borne exclusively by the District due to a lack of District-owned extraction facilities with which to recover and sell the water to growers. New District-owned extraction facilities coupled with a source of inexpensive Section 215 or Recovered Water Account supply would make this project much more economically feasible. However, any of the District's existing contract supplies (Class 1 and 2) that are excess to the District's needs in any given year could be banked in the proposed facility. In addition, the District believes that the proposed banking program could result in energy conservation and savings through the use of larger District-owned recovery wells, which would be more efficient than numerous, smaller, private wells.

The proposed banking program is intended to serve lands that are considered ineligible to receive Project water under the Reclamation Reform Act, or "excess lands," due to the size of the farming operations. Approximately 6,000 acres of excess land in the District would be able to receive groundwater pumped from district wells, and consequently, these landowners would not use their private wells (**Figure 39-3**). Despite the fact that these landowners would be receiving groundwater from the District, an in-lieu recharge effect would still be achieved since the groundwater delivered by the district would actually be recharged surplus water, while the landowners would simply be mining groundwater with no recharge effort.

One alternative of this project will be the conversion of the Turnipseed Basin into a banking facility by simply adding four 2,000 gallon per minute extraction wells and a pipeline connection to the existing District distribution system. Recharge capability of the existing site was estimated using a combination of soil maps, test borings, groundwater contours from existing wells, and infiltration tests (**Figures 39-4, 39-5, 39-6, and Attachment 39-4**, respectively). It was determined that the infiltration rate of the basin was approximately 0.4 feet per day. An estimate of available surplus supply for recharge based on historical water availability was also performed (**Attachment 39-5**). The results of the recharge and available water supply analysis were combined into a banking operation analysis which indicated that this alternative has the potential to provide approximately 4,300 acre-feet of average annual yield (**Attachment 39-6**). Assuming 10 percent of this yield is left in storage as mitigation for the groundwater bank, this provides 3,900 acre-feet of usable average annual yield.

A second alternative of this project is to expand the Turnipseed Basin by adding 400 acres of new recharge basins to the north of the existing 80-acre site and between 10 and 21 extraction wells (2,000 gpm capacity each) depending on the assumed number of months available for groundwater recovery operations (**Figure 39-7**). In addition, a parallel distribution system would be constructed to provide additional capacity to deliver the extracted groundwater to growers. A reduced recharge infiltration rate of 0.25 feet per day was assumed for the additional 400 acres. A banking operation analysis indicated that this alternative has the potential to provide approximately 12,000 acre-feet of average annual yield (**Attachment 39-7**). Assuming 10 percent of this yield is left in storage, this provides 10,800 acre-feet of usable average annual yield.

A third alternative of this project is to utilize a three-mile stretch of the White River for recharge by constructing additional control structures, three extraction wells (2,000 gpm capacity each) and a connection to the existing District distribution system. A seepage rate of 0.4 feet per day was assumed. A banking operation analysis indicated that this alternative has the potential to provide approximately 2,600 acre-feet of average annual yield (**Attachment 39-8**). Again, assuming 10 percent of this yield is left in storage, this provides 2,400 acre-feet of usable average annual yield.

#### **Construction Considerations**

With the nature of the soil in the vicinity of the Turnipseed Basin, it will likely be necessary to import suitable levee fill material. Due to the incompatibility of levee and recharge basin soil types, it is

imperative that the contractor minimize the spreading and commingling of the levee fill with the soil in the recharge area which could reduce the final infiltration rates of the basins. In addition, due to the need to work in the proximity, and often directly on, adjacent landowners' property, it will be necessary to coordinate with landowners on construction activities, especially large hauling operations that may inconvenience or disrupt their daily operations.

**Schedule**

	Pilot Program	Complete Project (All Alternatives)
1. Planning	6/05-6/08	5/09-10/10
2. Agreement(s)	4/08-6/08	3/10-9/10
3. Design	1/08-8/08	3/10-10/10
4. Property	N/A for P.P.	1/10-10/10
5. Construction	8/08-3/09	10/10-5/11
6. Operational	3/09-ongoing	5/11-ongoing

**Real Estate Requirements**

- **Fee Purchase:** The Turnipseed Basin expansion alternative will require the purchase of 400 acres of additional recharge area.
- **Access Rights:** While it is unknown at the current time, access rights may be necessary if District personnel must travel through private landowner property to access project infrastructure. One potential location may be along the White River, where District personnel may need to operate and maintain new control structures within the channel.
- **Permanent and Temporary Easements:** Permanent easements will be required for all new distribution infrastructure that is constructed outside of District property and existing easements.
- **Flowage Easements:** Permits or easements may be required to use the White River channel for conveyance of surplus San Joaquin River flows to the Turnipseed Basin on a long-term basis.

**Coordination with Other Options**

This option could be enhanced through Options 55 and 56, Trans-Valley Canal and Multi-District Bidirectional Conveyance Project, which could make State Water Project and Cross Valley Canal supplies available for recharge. Due to the location of the District on the lower end of the Friant-Kern Canal (FKC), Option 53 would also provide access to State Water Project and Cross Valley Canal supplies through an FKC-CVC Intertie and FKC pump-back facilities. This option would also provide a location to store any San Joaquin River water recirculated through Options 58 and 59 during periods of low demand on the FKC. It could also be a component of a regional, multi-agency groundwater banking program. It should be noted that place of use issues must first be overcome to enable State Water Project supplies to be a viable source of water for this project.

This option does not preclude other options from being undertaken, although it does reduce the amount of SJR surplus water available for use in other options, such as the District's own proposed groundwater bank with Pixley Irrigation District (Option 31). However, Options 60 and 61, capacity correction and increase of the FKC, would ease the restriction of flood water conveyance to all the proposed groundwater projects served by the FKC, thus increasing the available surplus San Joaquin River supply.

**Operational and Maintenance Requirements**

• **Operations**

**Recharge:** Surplus water from the San Joaquin River will be diverted from the FKC into the White River via the wasteway gates at the White River check structure. The surplus flows will then be diverted out of the White River and into the existing or expanded Turnipseed Basin. SCADA control of the FKC wasteway gates at White River and the inlet gates on the White River at the Turnipseed Basin will facilitate the operation tremendously and reduce staffing needs. It will also allow 24-hour monitoring of basin levels, channel flows, and control structure failures. It should be noted that the FKC wasteway gates are controlled by the Friant Water Authority, and consequently, their SCADA system would require upgrades as well. **Extraction:** The wells will extract groundwater and deliver it through new pipeline connections to existing District distribution laterals for ultimate delivery to growers. SCADA controls will be

extremely helpful in monitoring pump output, pump performance, and on/off status. Initially, District staff will likely monitor the recharge and extraction operations on a 24-hour basis, although depending on the reliability of the SCADA system and project infrastructure, District staff may simply be “on call” during off-hours and rely on the SCADA alarm functions to notify them of operational problems.

- **Maintenance**

Routine maintenance will be required on all proposed project facilities. New recharge basins and levees will require weed and pest control, occasional silt removal, discing, and grading. Pumps, motors and electrical panels will also require routine maintenance. Most routine maintenance can be performed while the system is in operation, although more extensive maintenance should be performed when the system is down. This will be different for the recharge and extraction components which will be operating at different times of the year.

- **Monitoring Requirements**

A monitoring well was constructed at the southwest corner of the existing Turnipseed Basin site to monitor potential groundwater mounding from any future recharge efforts, including pilot programs (Refer to Figure 39-5). Test borings revealed water at 55 feet and 69 feet with a few shallow lenses of sandy clay and sandy silt. Groundwater mounding has been identified as a potential problem at the site. Additional monitoring wells have been proposed for the different alternatives to better understand aquifer characteristics beneath the proposed sites, identify the volume of water banked, monitor impacts to adjacent landowners, and identify groundwater migration rates and directions.

### **Future Requirements for Design**

The District is interested in conducting a pilot program to further investigate the adequacy of the existing Turnipseed Basin site as a banking facility. The District is currently pursuing grants to conduct this work, but is prepared to fund the program with District funds if necessary. The program is expected to include the creation of a groundwater monitoring plan, construction of up to five monitoring wells, establishment of recharge, extraction, and monitoring criteria that are acceptable to the local landowners, construction of one extraction well, and construction of the necessary plumbing to connect the extraction well to the District distribution system. The goal would be to prove the viability of the conversion of the existing Turnipseed Basin into a banking facility and obtain grower support. If this occurs, the remainder of the project will be implemented (construction of 3 to 4 additional extraction wells and appurtenant plumbing) and the expanded Turnipseed Basin and White River alternatives will be more heavily pursued. As part of this process, infiltration rates, potential long-term storage, and groundwater migration at the 400-acre Turnipseed Basin expansion site will be determined. Required control structures, modifications to existing infrastructure, extraction well locations and connection to the District distribution system will also be determined for the White River alternative.

### **Potential Environmental Impacts**

- **Temporary (During Construction)**

The significant earthwork involved in the Turnipseed Basin expansion alternative may impact sensitive species. Permits will likely be required for any construction work in or around the White River channel.

- **Permanent (Operation-Related)**

Impact to adjacent landowners from the extraction of groundwater is expected to be a sensitive issue, as will the conversion of agricultural land to recharge basins. In addition, coordination of flood flow operations on the White River with Turnipseed Basin recharge operations will be required to avoid impacts to downstream communities and property. Permits may be required for recharge operations conducted in the White River channel.

### **Sub-Options considered but Rejected**

None.

### **Drawings**

1 None.

**Figures**

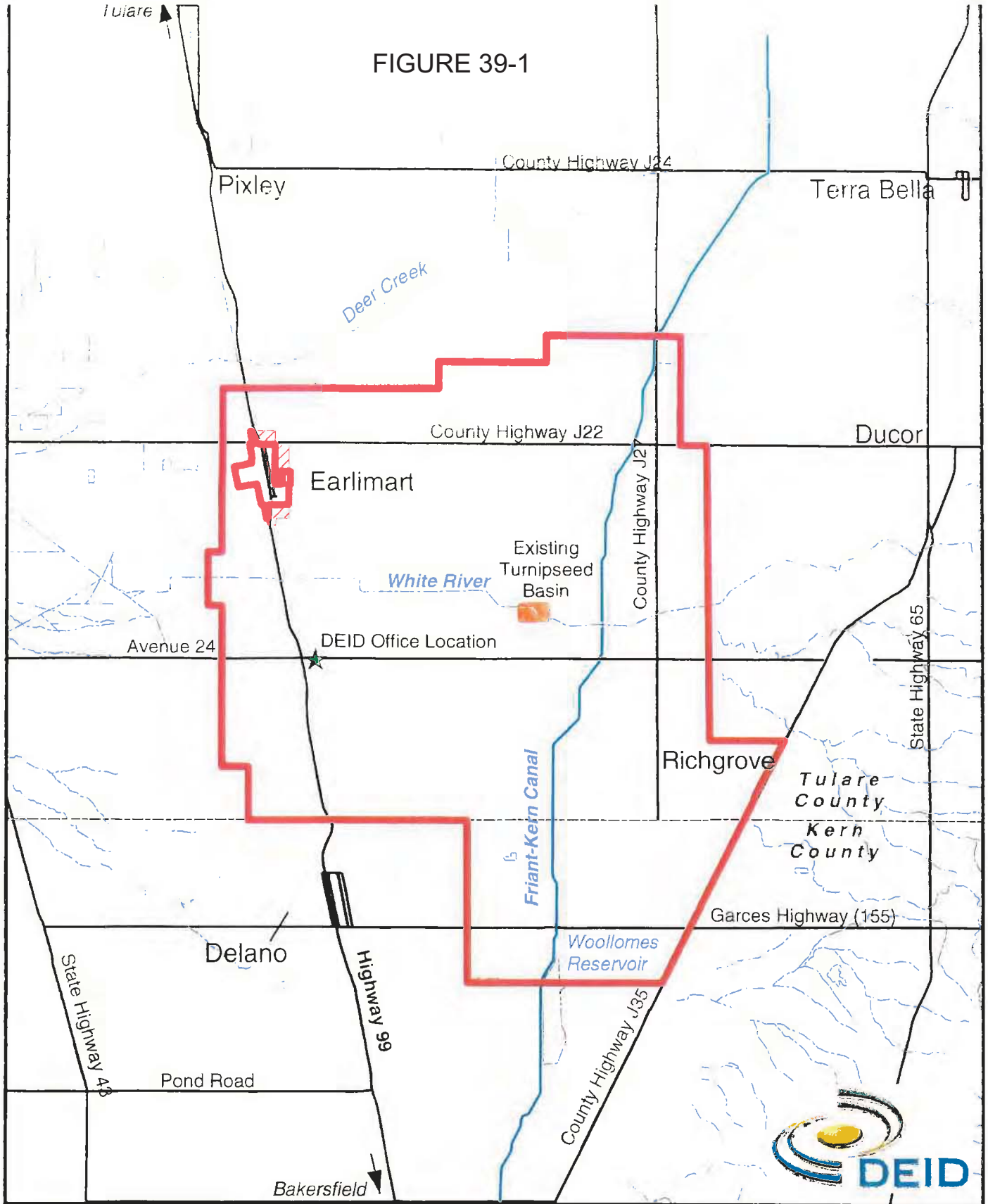
- 39-1 Figure 2 Delano-Earlimart Irrigation District Location Map (Reference 39-1)
- 39-2 Figure 6 Delano-Earlimart Irrigation District Surface Water Deliveries vs. Average District Depth to Groundwater in Wells (Reference 39-1)
- 39-3 Figure 9 Delano-Earlimart Irrigation District Excess Land (Reference 39-1)
- 39-4 Figure 13 Delano-Earlimart Irrigation District Turnipseed Basins (Reference 39-1)
- 39-5 Figure 12 Delano-Earlimart Irrigation District Borings & Monitor Well (Reference 39-1)
- 39-6 Figure 7 Delano-Earlimart Irrigation District Elevation of Water in Wells Spring 2005 (Reference 39-1)
- 39-7 Figure 14 Delano-Earlimart Irrigation District Proposed Turnipseed Facilities (Reference 39-1)

**Attachments****References**

- 39-1 Provost & Pritchard Engineering Group, Inc., *Investigation of Changed Water Sources – A Study for Delano-Earlimart Irrigation District and the Metropolitan Water District of Southern California*, December 2006.

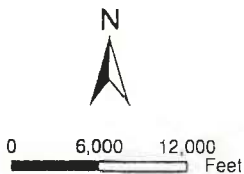


FIGURE 39-1



**Legend**

- County Boundary
- Detachments
- DEID Boundary
- Highway
- River/Canal



*Delano-Earlimart  
Irrigation District  
Location Map  
Figure 2*

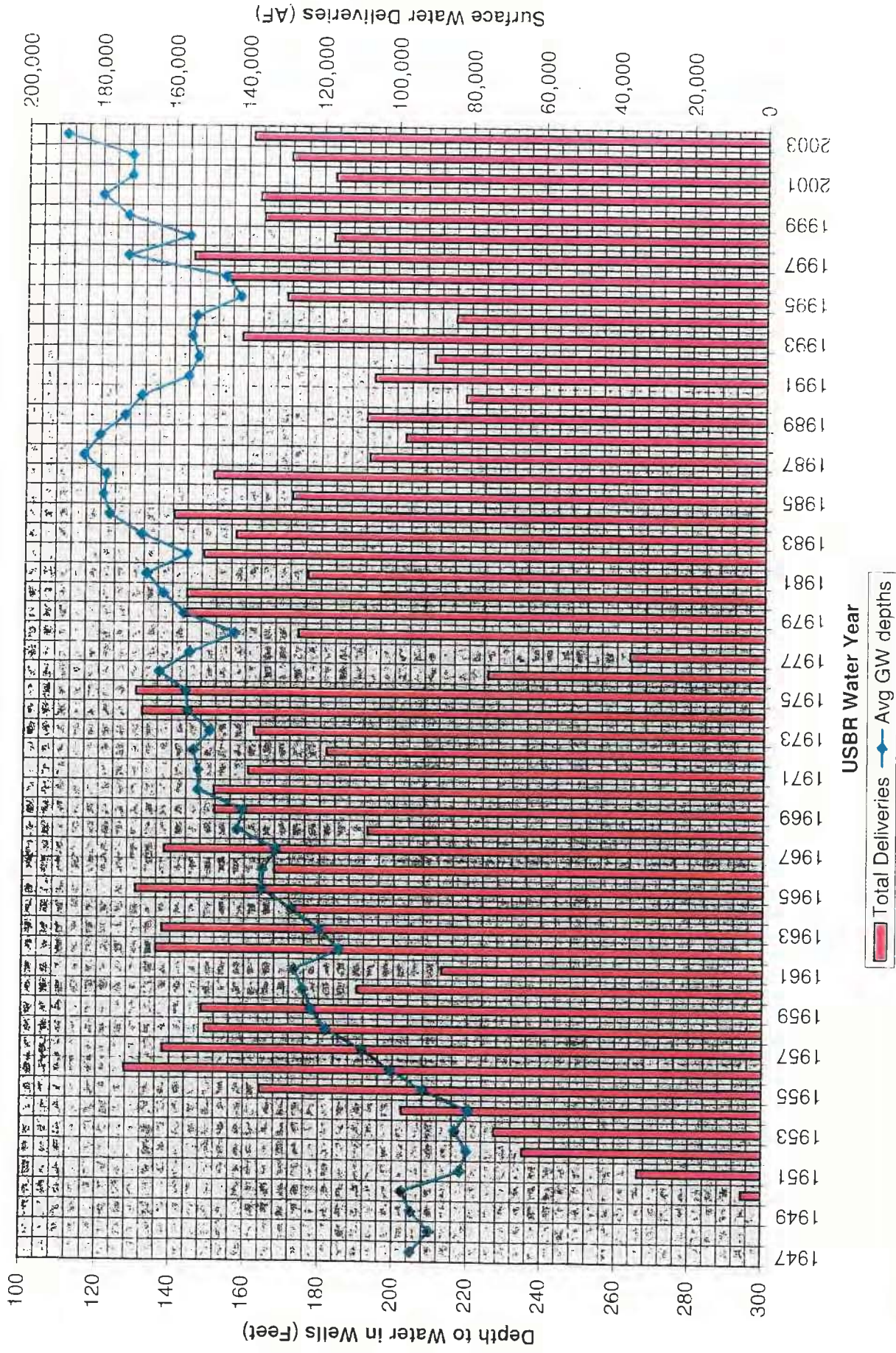






FIGURE 39-2

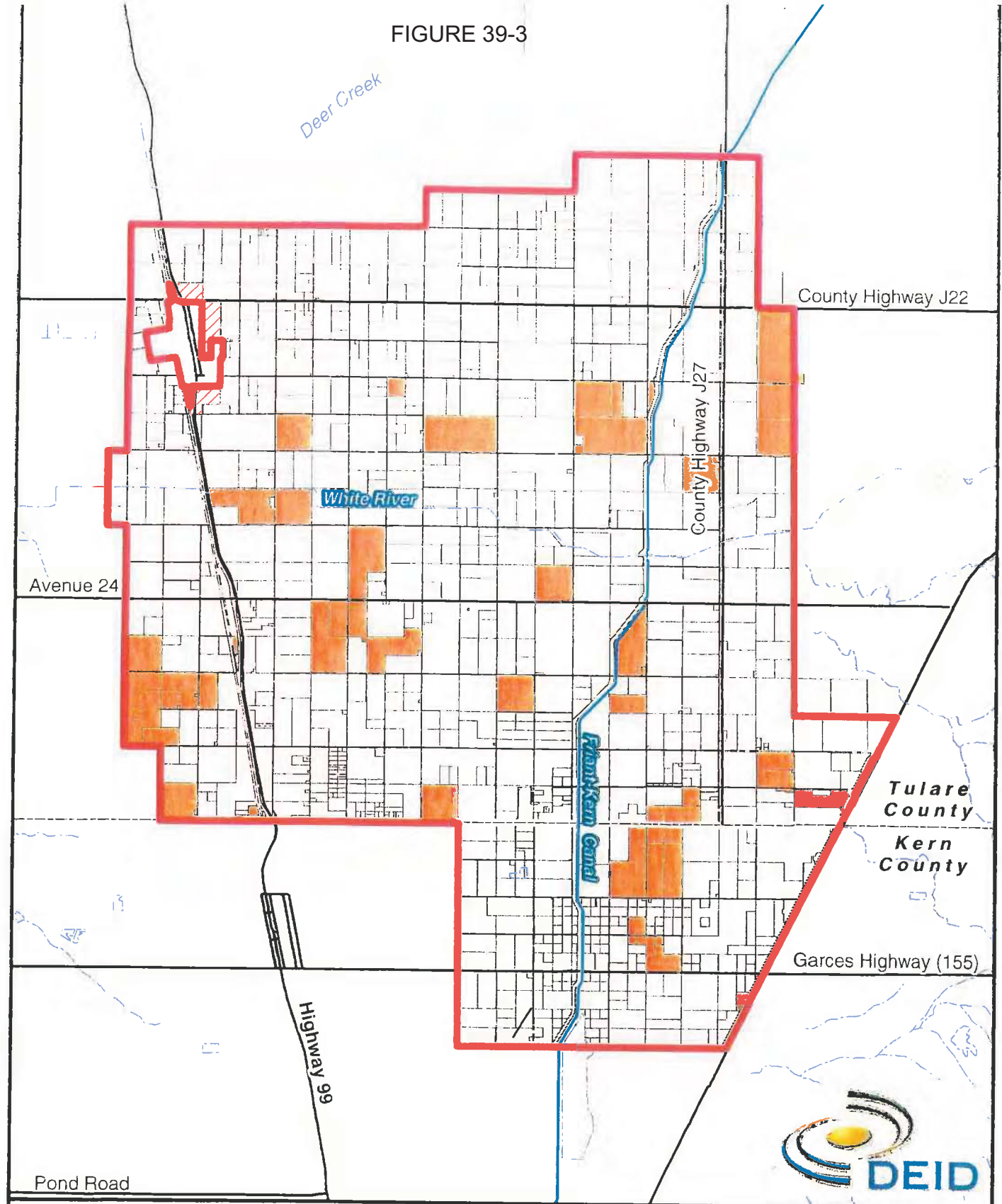
Delano-Earlimart Irrigation District  
 Surface Water Deliveries vs. Average District DTW in Wells



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 20160412 - DEID Study\Data

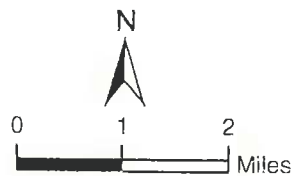


FIGURE 39-3



**Legend**

- Roads
- - - County Boundary
- Waterways
- - - Streams/Rivers
- Friant-Kern Canal
- ▭ Parcels
- Excess Land
- ▨ Detachments
- ▭ DEID Boundary

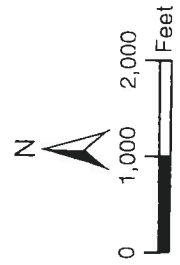
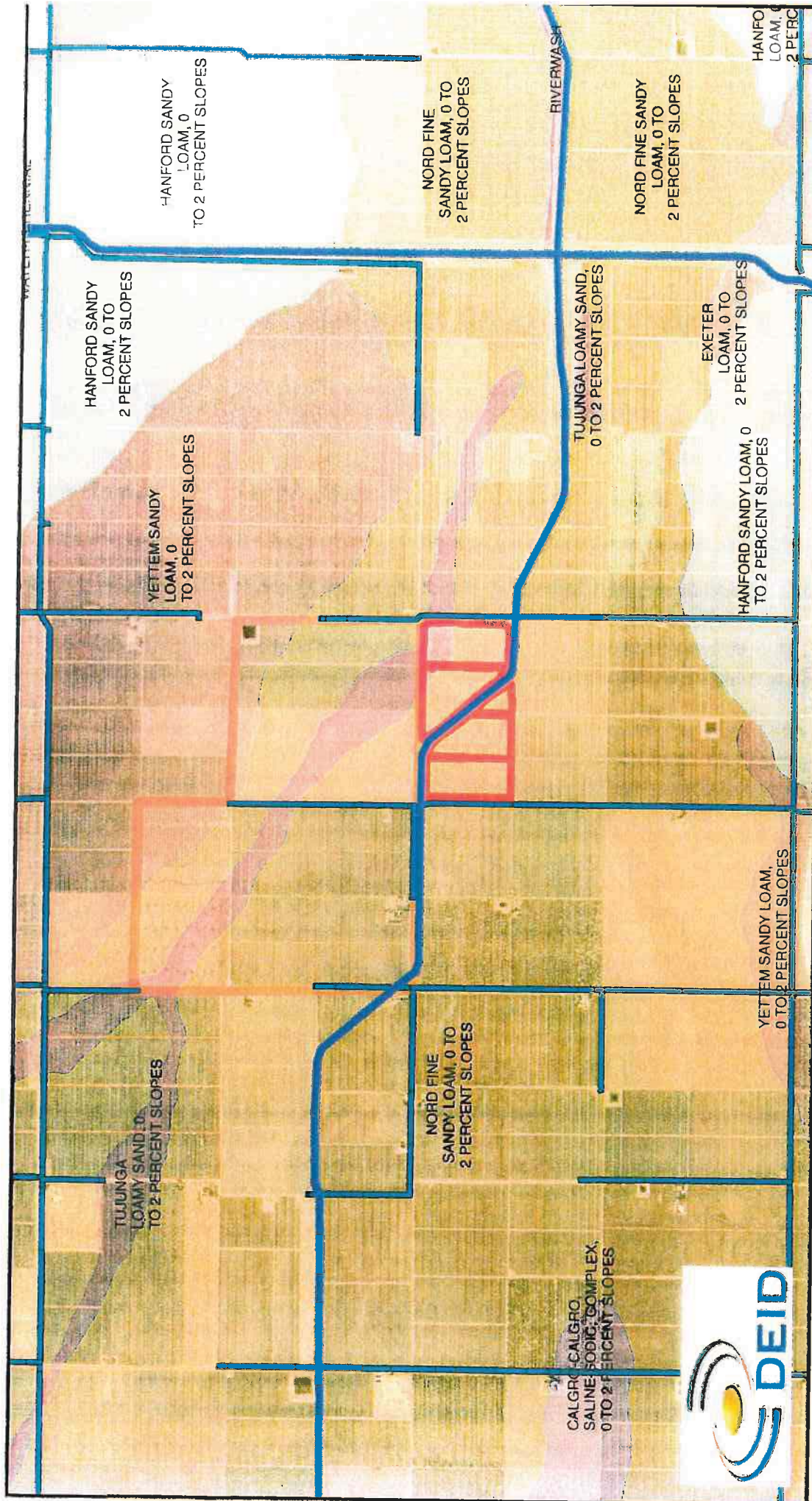


*Delano-Earlimart  
Irrigation District  
Excess Land  
Figure 9*





Figure 39-4



*Delano-Earlimart  
Irrigation District  
Turnipseed Basins  
Figure 13*

**Legend**

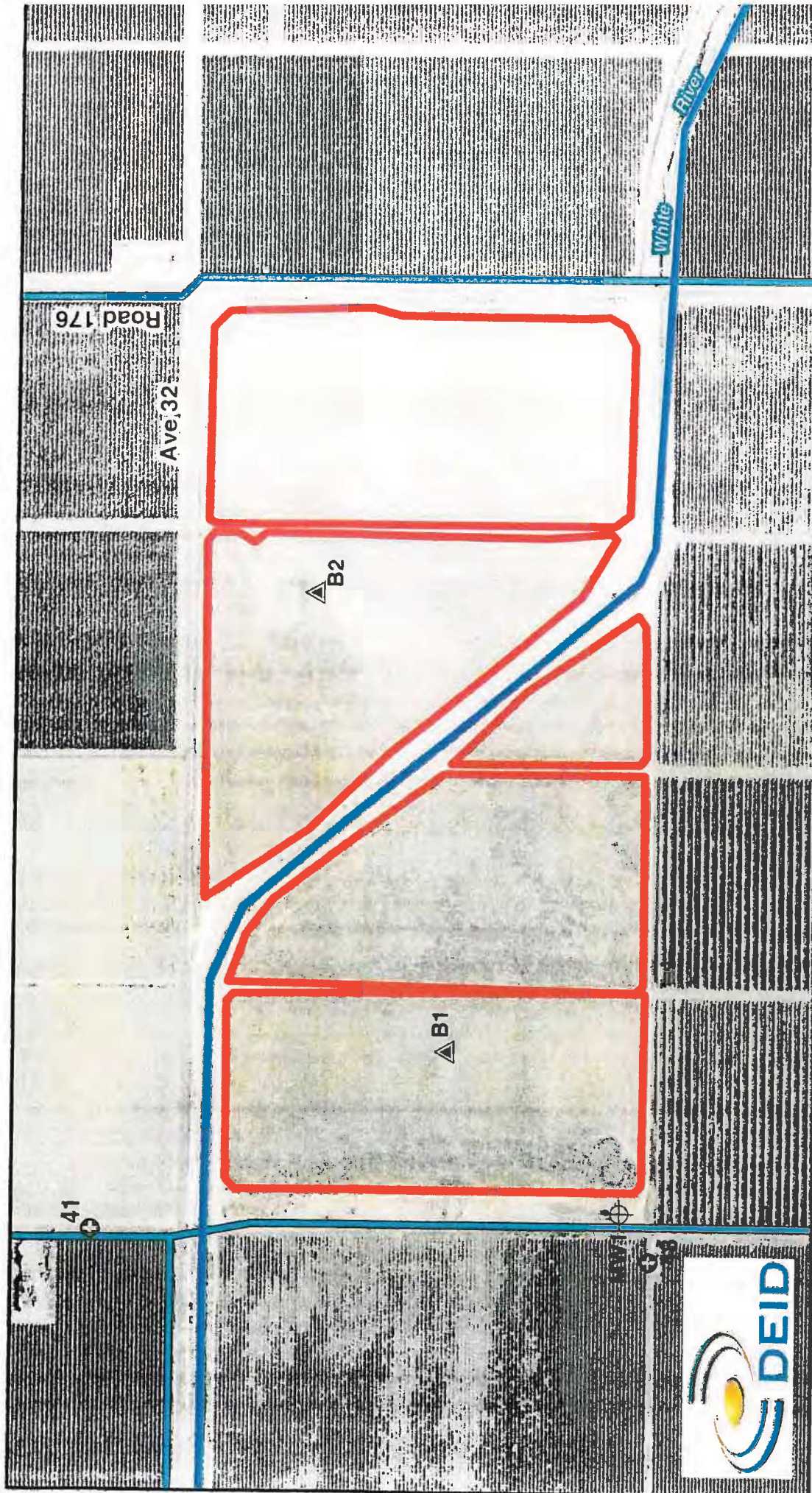
- Lateral Pipelines
- Road
- Existing Turnipseed Basins
- Expanded Turnipseed Basins

EST. 1988  
**PROVOST & PRITCHARD**  
ENGINEERING GROUP

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Figure 39-5



**Legend**

- Existing Turnipseed Basins
- Lateral Pipelines
- Road
- Boring Site
- Monitor Well
- Well Measured by DEID

**DEID**

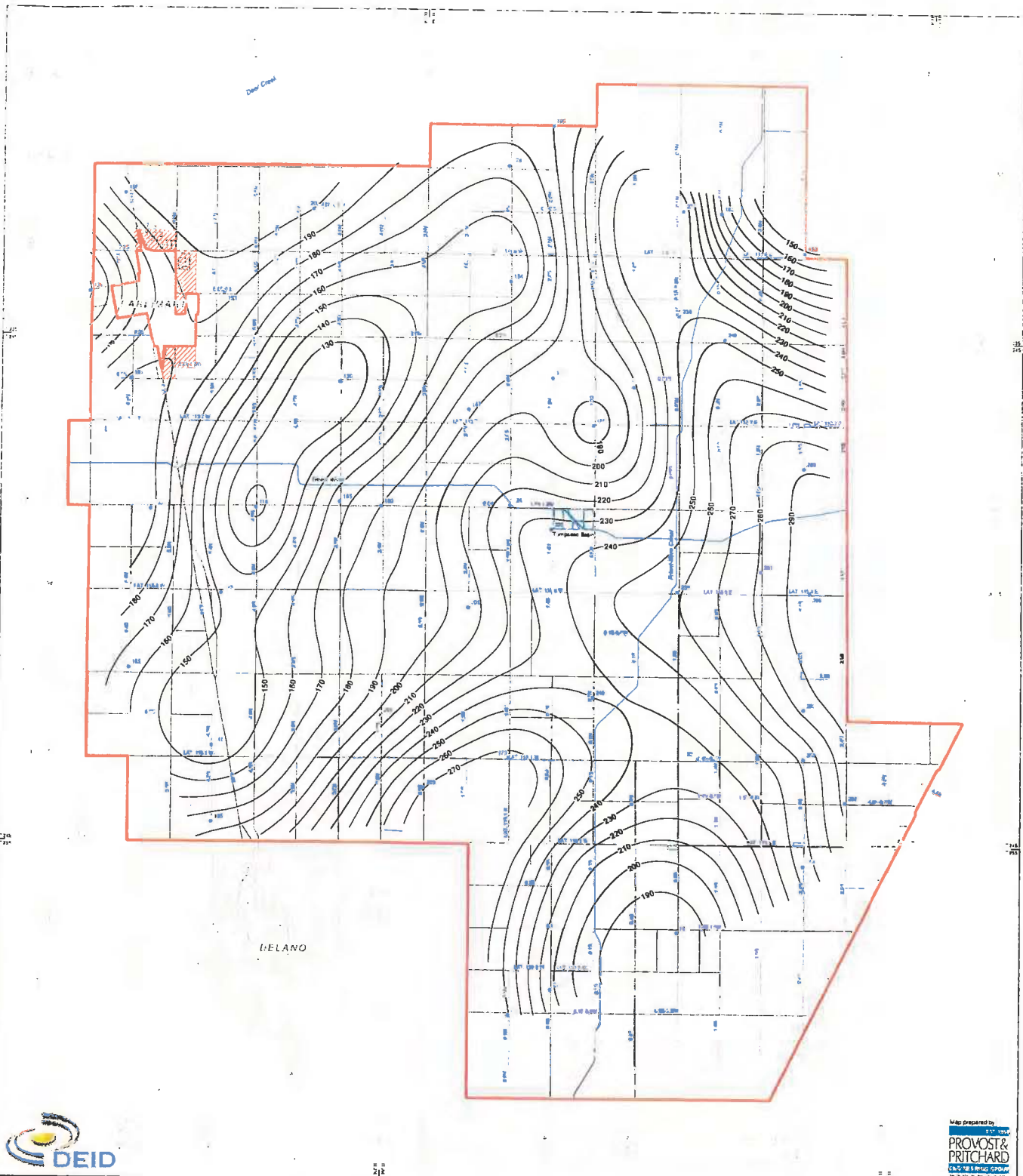
**Delano-Earlimart  
Irrigation District  
Borings & Monitor Well  
Figure 12**

EST. 1986  
**PROVOST &  
PRITCHARD**  
ENGINEERING GROUP

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Map prepared by  
**PROVOST & PRITCHARD**  
 CIVIL ENGINEERING GROUP  
 1000 W. 11th Street, Suite 200  
 Delano, CA 92341  
 Phone: (951) 261-1100  
 Fax: (951) 261-1101

# Delano-Harlimart Irrigation District

0 0.5 1 Miles  
 1 inch equals 3,000 feet



- Legend**
- DEID Boundary
  - Pipeline
  - Road
  - County Boundary
  - River

Elevation of Water in Wells  
 Spring 2005

- 250 DEID Measured Well w/ Spring 2005 Reading
- 10 foot contour of WSE in wells

Map: 11/01/05 07  
 T:\C-11\Irrigation\2014\2014\2014\2014\Fig. 39-6 1/2 50' WSE.rvt

Figure 7

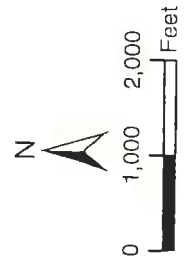
Figure 39-6



Figure 39-7



*Delano-Earlimart  
Irrigation District  
Proposed Turnipseed Facilities  
Figure 14*



- Legend**
- Proposed Extraction Well
  - ⊕ Existing DEID Measured Well
  - Existing Lateral Pipelines
  - Proposed Extraction Water Pipe
  - Existing Turnipseed Basins
  - Proposed Turnipseed Basins



**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 41	<b>Structural Option Name</b> Fresno ID Water Development and Recovery Facility		<b>Revision Date</b> 18 Feb 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		Dennis Dorratcague
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal  
Total Construction Cost: Not available at this time.  
Annual O&M Cost: Unknown  
Project life: Unknown

**Objective of Option**

To meet the water management goal of the San Joaquin River (SJR) settlement by developing a water banking facility to capture and store surplus SJR and Kings River flows. Water will be recovered and used to offset losses of Central Valley Project supply to river restoration.

**Performance Criteria**

- 1 Recover 14,000 acre-feet of dry year water supply.
- 2
- 3
- 4

**Design Criteria**

- 1
- 2
- 3
- 4

**Description**

The Kings County Water District (KCWD) currently operates a 450-acre facility known as the Apex Ranch Water Banking Facility. The existing facility includes low height earthen dams constructed within the Old River (a braid of the Kings River no longer utilized for irrigation deliveries) to pond water for recharge. The KCWD recharges a portion of its Kings River supply at this facility.

The Fresno Irrigation District (FID) will expand the existing Apex Ranch Water Banking facility by 220 acres for recharge and recovery (**Figures 41-1, 41-2 and 41-3**). Much of this land will be purchased to allow FID to recover groundwater banked within the Old River channel; however, a portion of it will be used as additional recharge area outside of the Old River channel. FID will use its excess Kings River and SJR water supplies for recharge. Surplus SJR supply will be diverted from the Friant-Kern Canal into the Kings River for delivery to the project site along with Kings River supply. The project will provide an estimated 14,000 acre-feet of dry-year yield. Banked water will be extracted and delivered to meet KCWD demands downstream of the project. In exchange, KCWD will make a like amount of its Kings River water supply available to FID. **Do we know how much water can be stored and at what rate it can be stored?**

As in the existing Apex Ranch project, check dams along the Old River would retain surface waters, allowing percolation to the underground. Recovery wells would be constructed at strategic locations for recovery of the stored water as available and as needed. The project will expand the existing Apex Ranch Water Banking Facility by constructing 3 new dams in the Old River, a new diversion turnout, installation of a conveyance pipeline, and construction of 8 additional recovery wells and 11 monitor wells of varying depths.

FID has entered into an agreement with the Kings County Water District for development of the project.

#### **Construction Considerations**

Constructing the project within the abandoned Old River channel could require diversion channels around the construction site if unregulated flood flows enter the channel during the earthen dam construction. Fill for the earthen dams will likely be imported to the project site. This will require significant hauling operations and coordination with adjacent landowners for access.

#### **Schedule**

##### **Completion Dates:**

Planning: 3/08  
Agreements: 10/08  
Design: 12/08  
Property: 6/08  
Construction: 6/09  
Operational: 1/11

#### **Real Estate Requirements**

- **Fee Purchase** Approximately 220 acres will need to be purchased for recharge and recovery purposes.
- **Access Rights** It is anticipated that access rights will be required along the Old River channel at the project site to gain access to the channel for construction purposes.
- **Permanent and Temporary Easements** It is expected that permanent easements will be required along the new conveyance pipeline alignment and at the new extraction and monitoring well sites if they are on adjacent landowners' property.
- **Flowage Easements** Easements may be required to bypass flood flows during construction activities.

#### **Coordination with Other Options**

This option could be enhanced through Option 54 which would allow recovered groundwater from the proposed Apex Ranch expansion to be transferred from FID to other Friant Division contractors by pumping it from the Kings River into the Friant-Kern Canal (FKC). Options 58 and 59 could be used in conjunction with Option 54 to deliver recirculated SJR water to the proposed Apex Ranch expansion for storage when irrigation demand is lacking. Option 34 could also enhance this option by providing excess Class 1 supply in normal and wet years for recharge in the Apex Ranch expansion in exchange for dry year deliveries made available through SJR/Kings River exchanges. This option could also be a component of a regional, multi-agency groundwater banking program.

This option does not preclude other options from being undertaken, although it does reduce the amount of SJR surplus water available for use in other options. However, unlike the groundwater recharge and banking facilities in the southern end of the Friant Division, this option is not hindered by the restrictions in the Friant-Kern Canal. The Kings River wasteway, where FID would take delivery of excess San Joaquin River flows, is located above the first choke point on the FKC and the turnouts of all the other large conjunctive use districts on the FKC.

#### **Operational and Maintenance Requirements**

##### **Operations**

In above normal water years, FID will divert its excess Kings River and SJR supply into the Peoples Ditch off of the Kings River just below Highway 99. The water would then be delivered to the Old River for

percolation upstream of the new earthen dams either by diversion directly off of the Peoples Ditch or by diversion into the Riverside Ditch and then into the Old River channel. In dry years, extracted San Joaquin River water will be made available to FID through an exchange with KCWD. Water will be extracted with project wells and delivered via pipeline to the Peoples Ditch for use by the KCWD in exchange for a like amount of KCWD's Kings River supply behind Pine Flat Dam for use by the FID.

- **Maintenance**

Routine earthwork maintenance and pump and motor maintenance will be required. Extraordinary maintenance and repair could be required after large flooding events.

- **Monitoring Requirements**

Eleven monitoring wells have been proposed for the project. Impacts to adjacent landowners and aquifer status and characteristics should be monitored.

### **Future Requirements for Design**

The FID has completed conceptual design of the proposed project. A feasibility study, including a subsurface investigation and conveyance capacity analysis, will likely be required. Environmental documentation will also be required, as well as a determination of any permits needed to construct the facility within the abandoned channel. As mentioned below, this project will require evaluation with respect to USBR transfer and groundwater banking policies.

### **Potential Environmental Impacts**

- **Temporary (During Construction)**

The abandoned Old River channel may require 404 dredge and fill and 401 water quality permits to minimize environmental impacts during construction.

- **Permanent (Operation-Related)**

The recharge operation involves the diversion of excess San Joaquin River supplies into the Kings River as has historically been done in above normal water years; however, it will be stored in a groundwater banking facility outside the Friant Division for later extraction and delivery to KCWD, a temporary Friant Division contractor, in exchange for Kings River supply for FID. This operation will have to be reviewed in light of the USBR policies on groundwater banking and transfers/exchanges. Normal banking facility issues such as impacts to adjacent landowners and conversion of agricultural land to recharge facilities will need to be addressed as well.

### **Sub-Options considered but Rejected**

None.

### **Drawings**

### **Figures**

- 41-1 Vicinity Map
- 41-2 Project Location Map
- 41-3 Attachment B – Proposed Facilities Apex West

### **Attachments**

### **References**

- 41-1 Project Description and Cost Estimate
- 41-2 Personal Communication with Laurence Kimura, Assistant General Manager, Fresno Irrigation District, January-February 2008.







Figure 41-1 Vicinity Map

Get Google Maps on your phone  
Text the word "GMAPS" to 466453

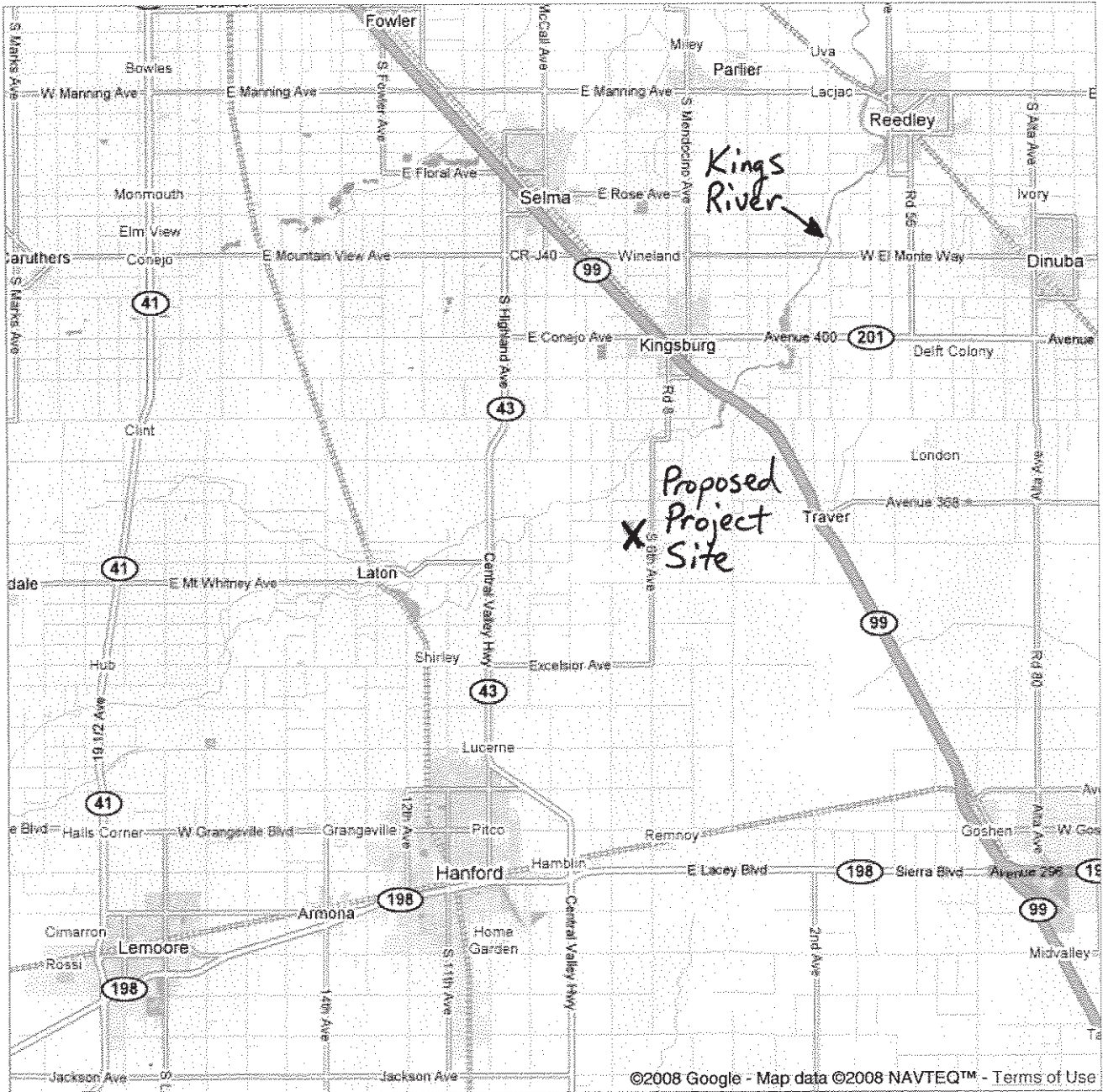
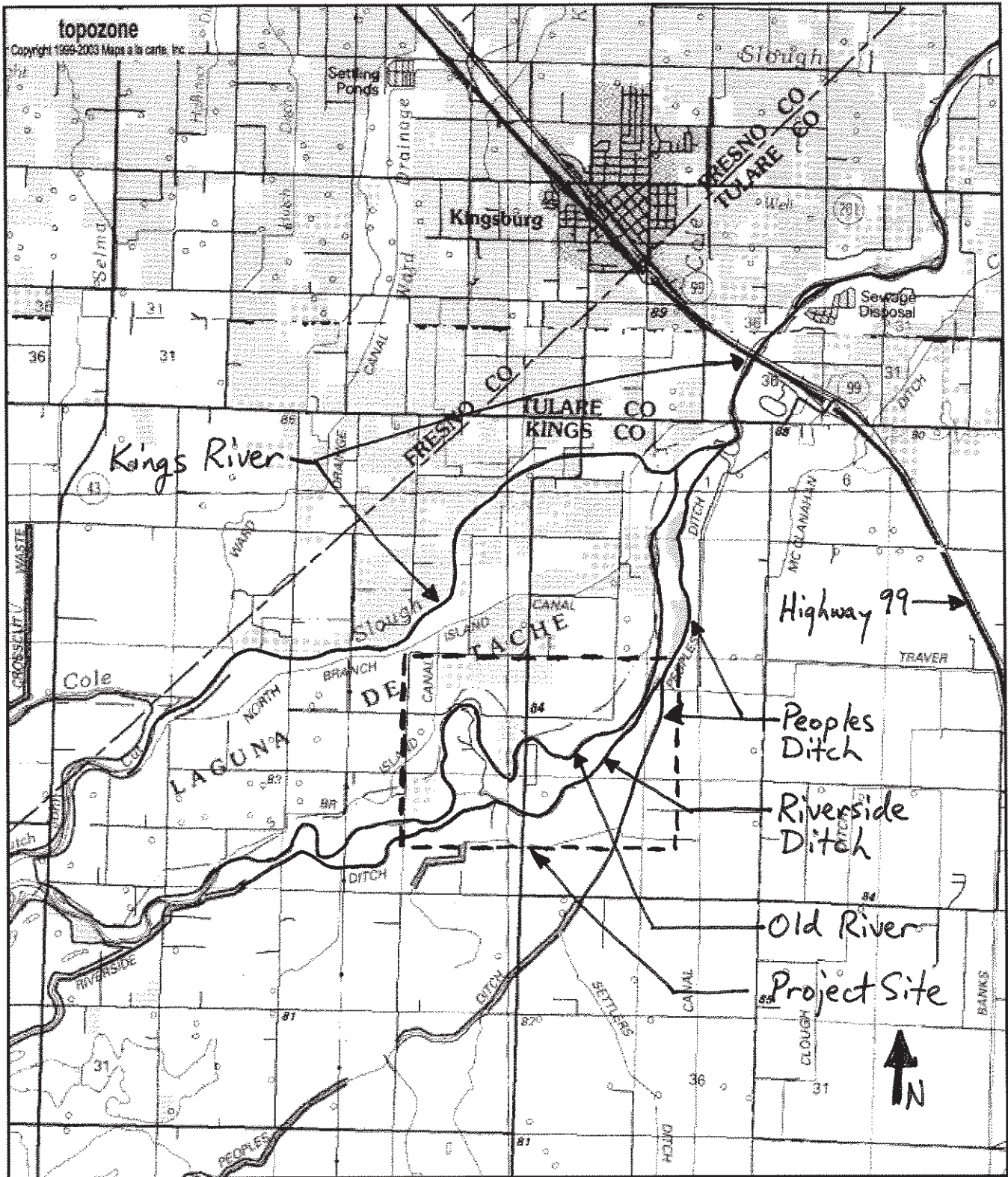




Figure 41-2 Project Location Map





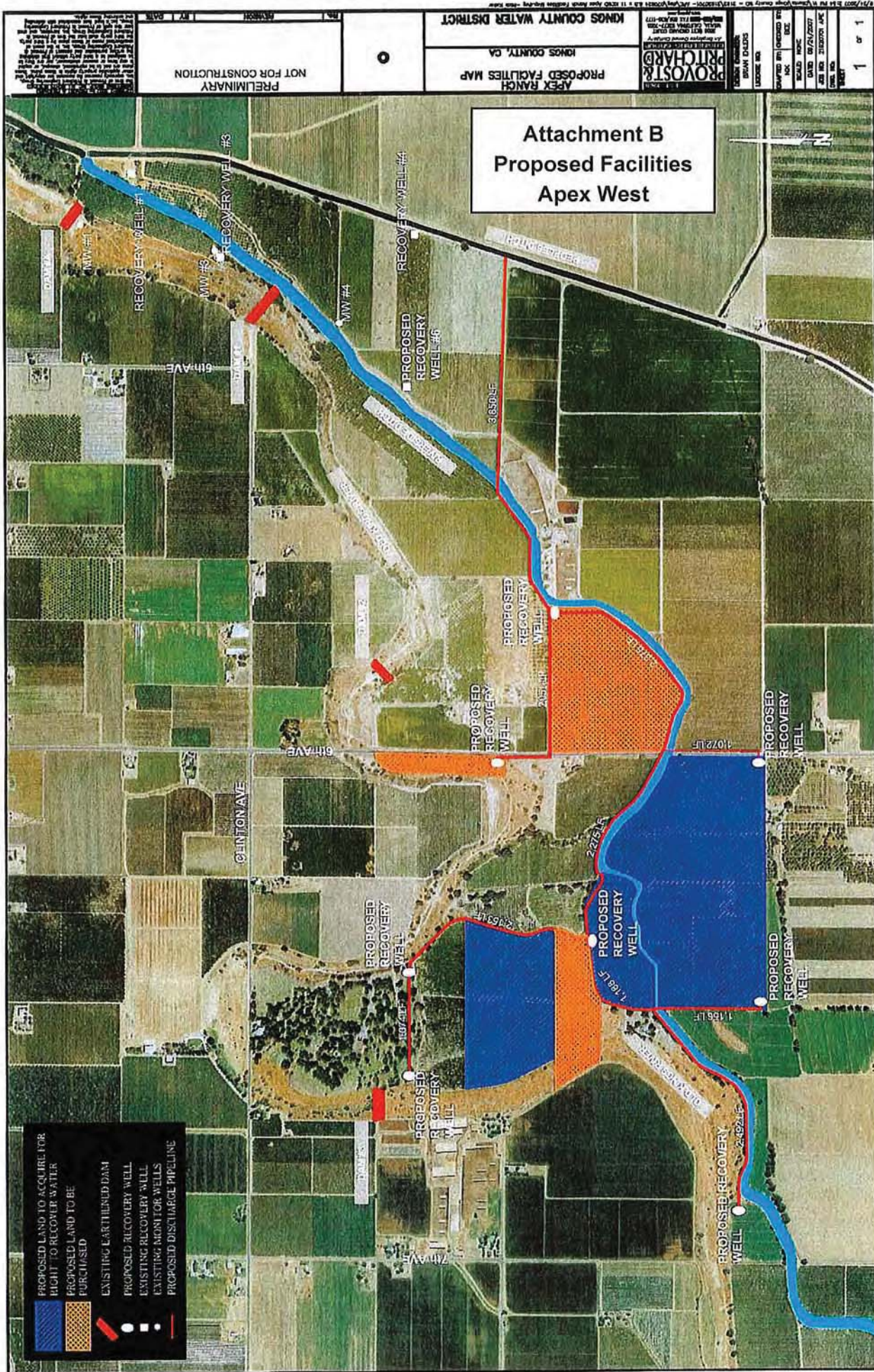


Figure 41-3



**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 42	<b>Structural Option Name</b> MID Proposed Project - Madera Irrigation District Water Supply Enhancement Project		<b>Revision Date</b> 20 Dec 2007
<b>Reach Number</b> NA	<b>River Mile</b> NA	<b>Program Goal</b> Water Management	<b>Phase</b> NA
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	Heather Shannon		
<b>Engineering</b>			

**Costs (March 2007):**

Cost Level: Pre-appraisal (for this initial work in 2007)  
 Total Construction Cost: Not available at this time.  
 Annual O&M Cost: Not available at this time.  
 Project life: 20-40 years (see **Attachment 42-1**)

**Objective of Option**

- Increase water supply reliability within the study area.
- Provide groundwater resource protection by reducing the groundwater degradation (groundwater overdraft) to the greatest extent possible within the study area.

To the extent possible, implementation of the project option that satisfies the planning objectives may provide secondary benefits, including the following:

- Provide water contributions to San Joaquin River restoration efforts.
- Improve San Joaquin River water quality.
- Facilitate conjunctive water management in the San Joaquin Valley to reduce groundwater overdraft, outside the study area.
- Contribute to habitat conservation plan goals, recovery of endangered species, and/or recreation opportunities.

**Performance Criteria**

- 1 Increase the capacity or extent of conveyance to deliver surface water, when available, to areas in need.
- 2 Increase the capacity of existing conveyance to deliver excess surface water, when available, to areas identified for groundwater recharge.
- 3 Increase the capacity of existing conveyance to deliver banked water to identified areas in need.
- 4 Increase imported water supplies, by establishing long-term transfer agreements between water districts or reduce water demand by planting less-water intensive crops, taking existing land out of production (fallowing), or using more efficient irrigation methods.

**Design Criteria**

- 1 California Well Standards, Bulletin 74-90, CDWR
- 2 Reclamation Cost Estimating Guidelines
- 3 Canal construction design criteria
- 4 Lift station construction design criteria

## **Description**

The MID proposed project would use a combination of distribution system improvements and groundwater recharge measures. This alternative would include a series of conveyance system upgrades and delineation of natural direct groundwater recharge areas within the project area. The primary project area has been identified by MID as an area that would encompass 13,646 acres south of the Fresno River and north of the San Joaquin River in southwestern Madera County (see **Figure 42-1**). The project area location is about 5 miles southwest of the City of Madera and about 10 miles northwest of the City of Fresno.

MID purchased the 13,646-acre parcel of land needed for the project for \$40.3 million following certification of the California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) in September 2005. Currently, the project area contains 2,744 acres of land used for irrigated crops; 10,878 acres of native grasslands used for grazing; 24 acres of agricultural support areas; more than 30 miles of earthen ditches; 27 irrigation wells (with associated piping); 15 monitoring wells; and 7 cattle wells (EIR, 2005).

According to MID, this project Alternative would create a water bank with a total storage capacity of approximately 250,000 acre-feet. MID proposed project details are summarized in the following subsections, and were modified from the Final EIR report for the Madera Irrigation District Water Supply Enhancement Project (2005). MID has specified that 10 percent of the recharged or banked surface water would be left behind each season to reduce the rate of groundwater overdraft and account for losses to the aquifer, while the remaining 90 percent of banked water would be recovered and used to provide water supply reliability during the irrigation season. Accordingly, over time, the intent would be to alleviate groundwater overdraft in the project area.

In addition, this Alternative would integrate approximately 2,600 acres of row crops and vineyards into an in-lieu recharge program. This conversion to surface water irrigation would further reduce groundwater demands in the study area.

### Project Facilities

The project facilities for this Alternative would include upgrading MID's distribution system, adding additional recharge areas and installing new recovery wells. These facilities would be used to recharge and bank San Joaquin River and Fresno River surface water underground and to recover the banked water when needed. Important features and other project characteristics are summarized in **Attachment 42-2**.

MID proposes construction of this Alternative in two phases. Phase 1 would involve reconditioning and extending existing canals to begin groundwater recharge activities as soon as possible. Phase 2 would involve expanding recharge areas, developing wells and piping to recover banked water, and installing pumps to deliver the recovered water to users. Phase 1 and Phase 2 facilities are summarized below.

### Phase 1 Facilities

During Phase 1 of this Alternative, MID would increase the capacity of existing MID conveyances to deliver surface water to the project primarily using natural swales as recharge areas. Phase 1 also includes the following:

- Reconditioning and extending existing canals to provide at least 200 cubic feet per second (CFS) of conveyance capacity to the project, including improvements to the Section 8 and 24.2 canals.
- Constructing approximately 55 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide recharge; pilot testing indicates that these basins would likely not be required.
- Applying recharge flows to approximately 700 acres of swales.
- Integrating approximately 2,600 acres of on-site row crops and vineyards into an in-lieu recharge program in which surface water would be periodically served in lieu of groundwater pumping.

State the flow capacity for infiltration and pumped extraction in Phase I.



### Phase 2 Facilities

During Phase 2, MID would expand the recharge areas, if needed, and develop facilities to recover the banked water and convey it using existing MID canals and ditches for local use. Phase 2 includes the following:

- Evaluate construction of up to 1,000 acres of new on-site recharge basins and canals (on historical row crop land), as required to supplement Phase 1 facilities and achieve 200 cfs of recharge capacity. Pilot testing indicates that these basins would likely not be required.
- Using up to approximately 15 existing wells (as available) for recovery.
- Installing up to 49 new wells, with electric- or propane-powered pumps, and recovery pipelines (in stages over several years) to provide 200 cfs of pumpback capacity into the MID service area.

Total 76,000 cubic yards of soil would be moved as part of the canal extension and enlargement.

### **Construction Considerations**

The MID Proposed Project would be constructed according to the project schedule, outlined in the Schedule section.

Construction of Phase 1 and Phase 2 facilities would require the following equipment:

- Water truck to control fugitive dust emissions,
- Excavator and dump trucks,
- 12 person team to install pipe,
- Native material for backfill,
- Gang truck or two or more pick up trucks for pipe laying, and
- Backhoe/front end loader.

The construction of recharge basins would potentially involve the berming of recharge area boundaries along topographic contours.

Construction of recovery wells would require special equipment including a drill rig and portable steel mud pit. The drilling water would be trucked and stored in a portable tank, around which two small berms would be constructed to control accidental spills on to the surrounding land, as required by Occupational Safety and Health Administration (OSHA).

Construction of recovery pipelines would require trenching and temporary removal of soil that would be pushed back once construction is complete. Once the trench is cut, the soil would be sidecast until construction is complete. The backfilled soil would be compacted using a vibrating sheepsfoot roller.

Construction of lift stations would include excavation of the site, erection of forms, installation of steel reinforcement, placement of concrete, placement of backfill around the structure, and compaction of backfill material.

The canal upgrades would require groundwater dewatering during construction to Canal Section 8 and 24.2.

### **Schedule**

The traditional federal planning process is outlined in **Attachment 42-2**, as was devised for the Appraisal Study (March, 2005).

According to the FEIS (September, 2005), the construction schedule for the project would begin immediately following permits and approvals for the project. MID would begin by recharging up to 150 cfs of available water via existing conveyances and swales, contingent upon water availability. The final engineering design would be completed during this first year of operation of Phase 1. The construction of Phase 1 facilities would be completed 4-6 months after the final engineering design is complete.

During the irrigation season, April through September, the proposed canal upgrades and extensions onsite would be constructed. After the irrigation season, the off-site portions of the Section 8 and 24.2 Canals would be upgraded.

Construction of Phase 2 facilities would begin after the Phase 1 facilities have been operating for one year. Of the Phase 2 facilities, recovery wells and recharge basins can be constructed any time of year, but lift stations would be limited to the winter time when canals are not required to deliver irrigation water. The Phase 2 schedule is expected to take approximately 6 to 8 months that would be spread over several years when optimal weather conditions permit construction.

#### **Real Estate Requirements**

- **Fee Purchase:** MID purchased the 13,646-acre parcel of land needed for the project for \$40.3 million following certification of the California Environmental Quality Act (CEQA) Environmental Impact Report (EIR) in September 2005.
- **Access Rights:** MID owns the land and therefore has permanent access to operate and maintain the land and any additional facilities constructed on the land.
- **Permanent and Temporary Easements:** MID is seeking to establish conservation easements on the project area to preserve upland habitats, which include California annual grassland; alkali grassland; vernal pools; Great Valley iodine brush scrub; freshwater marsh; alkali rain pool; riparian woodland; cultivated lands; and ponds (artificial wetlands).
- Some temporary and permanent construction easements may be needed during the construction of Phase 1 facilities, which includes canal improvements. These easements presented in Chapter 2 of the Final EIR for the MID Water Supply Enhancement Project (September, 2005) include the following:
  - 50-foot permanent easement or fee simple ownership (4.6 acres permanent easement or fee simple ownership)
  - 50-foot temporary construction easement (4.6 acres temporary easement)
  - 50-foot temporary construction easement (10.6 acres).
- **Flowage Easements:** No flowage easements have been identified

#### **Coordination with Other Options**

There are a total of four alternatives that are being proposed, one of which is the project alternative presented above. This alternative would involve upgrading the existing conveyance system within the project area and delineating natural direct groundwater recharge areas within the project area.

The second alternative is the Mendota-Pool-Supplied Project, which would use a combination of distribution system improvements and direct groundwater recharge measures to meet the project objectives.

The third alternative is the Revised Recharge Basin Layout, which would also use a combination of the distribution system improvements and direct groundwater recharge, siting recharge basins entirely on land that is currently actively farmed.

The fourth alternative is the No Action Alternative, which assumes that Madera Ranch grasslands would be converted to agricultural use.

#### **Operational and Maintenance Requirements**

Due to the concerns of adjacent property owners that water levels could rise and flood root zones, pumping costs could increase as the water table declines during the recovery events, the MID Board approved an

Oversight Committee to perform the following functions as outlined in the Final EIR (September, 2005):

- Prepare principles for monitoring and operational constraint of the Project,
- Develop and ensure implementation of a detailed monitoring and operation constraint plan (MOCP),
- Protect adjacent landowners from unacceptable impacts by reviewing monitoring results and making recommendations for adjustments to operations if data suggest unacceptable impacts may occur,
- Make recommendations for adjustment to the monitoring program as appropriate, and
- Prepare annual monitoring reports.

### **Operations**

Water would be delivered to the ditches, swales, and recharge basins through the upgraded Section 8 Canal. Parshall flumes and weirs would be installed to regulate and measure flows from the conveyances.

The water recharge operations would be controlled in the same way that current water operations are conducted. Ditch riders would monitor flow in the canals, ditches, swales, and recharge basins to ensure that specified water levels in the recharge areas are maintained.

Water recovered from existing wells and new wells installed in the vicinity would be constrained by the MOCP. Recovered water would be pumped into collection pumping, through the Project pipeline and into the enlarged Section 8 Canal.

### **Maintenance**

The canal maintenance would be consistent with what MID is currently doing, which involves cleaning out the canals and ditches every few years. The recharge facilities would be cleaned out every few years to prevent too much sediment from accumulating at the bottom. The recovery wells are expected to withstand 5 years of operation before needing maintenance or repair. Pumps on the recovery wells are expected to operate for at least 10 years before needing maintenance or repair. The recovery wells would most likely be reworked on a 20-year cycle. The anticipated life of the recovery pipelines is approximately 50 years, but occasional repair may be required if excessive leakage is experienced. Minimal maintenance on Madera Ranch roads and corridors would be required. After a wet winter, portions of the roads could wash out or become impassable, which could potentially require additional maintenance.

### **Monitoring Requirements**

#### *Water Levels*

Monitoring of water levels would take place on-site and off-site and the recharge operations would be adjusted to prevent off-site water levels from rising within 20 feet of the ground surface. If the off-site water levels were to rise within 20 feet of the ground surface, the recharge operations would be stopped and not re-started until it is approved by the Oversight Committee.

Water levels would be monitored on site in a network of wells that include recovery wells, wells near the Madera Ranch boundary, and select irrigation wells. The Oversight Committee would determine the number of wells and the locations of the wells to be monitored. The wells that would be installed as part of the Project would be constructed within existing roads or lands already disturbed by other Project components (e.g. recharge basins).

The Oversight Committee is responsible for developing protocols to adjust operations, pre-approving methods for interpreting the monitoring data collected during recharge and recovery, and developing plans to compensate for adverse effects.

#### *Water Quality*

The MID currently conducts daily operations which include surveillance of conveyance facilities to ensure that accidental spills of hazardous materials that may occur near the facilities are discovered and addressed to prevent contamination of MID's water. This monitoring program would continue with the construction

of new facilities and expand to monitor the new facilities as well. MID also would implement a program to monitor water quality to ensure that water stored in the Project is not impaired and to see that it meets the objectives as defined by the Central Valley Regional Water Quality Control Board Water Quality Control Plan (WQCP) (Central Valley Regional Water Quality Control Board 1998). The sampling and analysis of recovered water from the Madera Ranch area would focus on ensuring that total dissolved solids (TDS) remain appropriate for irrigation purposes. The sampling and analysis would also test drinking water from wells within 1 mile of the Project site for fecal coliform, TDS, and select components of TDS as specified by the Oversight Committee.

#### *Water Accounting*

MID would monitor flows where it enters the Madera Ranch and where it leaves Madera Ranch. MID would also monitor flows to specific recharge areas and from recovery wells for operational purposes.

Precipitation, wind, pan evaporation, and temperature would be monitored and used to calculate the net precipitation and evaporation.

The flow into the recharge areas minus the evaporation and evapotranspiration would be monitored to estimate the percentage of water stored in the Project area.

#### *Subsidence Monitoring*

Historical records indicate that no more than one foot of subsidence has occurred on Madera Ranch, which has been subjected to pumping for more than 100 years. However, historical records indicate that subsidence has occurred west of the Project site. In order to address subsidence, MID plans to utilize high accuracy Global Positioning System (GPS) monitoring of multiple locations within the Madera Ranch before and during Project operation.

#### **Future Requirements for Design**

Additional analysis and review of flow data, subsurface investigations, and groundwater levels should be completed before proceeding forward with the design.

A Final EIR was completed for the Madera Irrigation District Water Supply Enhancement Project in September, 2005.

#### **Potential Environmental Impacts**

All of the temporary and permanent impacts below are discussed in the Final EIR for the MID Water Supply Enhancement Project (September 2005).

##### **Temporary (During Construction)**

- Temporary degradation of visual character or quality from construction-related activities
- Short-term increase in PM10 emissions from construction activities
- Temporary disturbance of California annual grassland and alkali grassland during Project construction.
- Loss or disturbance of iodine bush scrub due to Project construction.
- Potential construction-related loss or disturbance of lesser saltscale, heartscale, subtle orache, vernal pool smallscale, recurved larkspur, and Hoover's cryptantha.
- Potential for construction-related mortality of special-status vernal pool crustaceans.
- Potential for construction-related mortality of San Joaquin tiger beetle, California tiger salamander, western spadefoot toad, western pond turtles, blunt-nosed leopard lizard, California horned lizard, silvery legless lizard, northern harrier, California horned lark, grasshopper sparrow, and western burrowing owl.
- Potential construction-related disturbance of nesting Swainson's hawk, white-tailed kite, and Cooper's hawk.

- Potential for construction-related harm to loggerhead shrike.
- Potential for construction-related foraging habitat loss for tricolored blackbird.
- Increase in wind and water erosion rates during and shortly after project construction.
- Exposure of residences to noise from grading activities, construction activities, well drilling operations, engines at wells, and engines at lift stations.
- Potential disruption of emergency-response routes.
- Temporary disruption of irrigation service as a result of construction.
- Temporary construction-related increase in traffic volumes on local and regional roadways.
- Potential increase in construction-related traffic volume delay and hazard on local and regional roadways.
- Degradation of water quality resulting from construction runoff.
- Water quality impacts from construction-related dewatering.
- Potential growth-inducing impacts related to construction.
- 

**Permanent (Operation-Related)**

- Degradation of visual character or quality from construction of new permanent features.
- Loss of agricultural land designated as prime farmland of statewide importance.
- Conflict with local zoning designations.
- Conflict with Williamson Act definition of compatible land uses.
- Increase in pollutant emissions as a result of operations and maintenance.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is in nonattainment under an applicable Federal or State Ambient Air Quality Standard (including releasing emissions that exceed quantitative thresholds for ozone precursors).
- Seasonal flooding of California annual grassland, alkali grassland, and Great Valley iodine bush scrub habitats.
- Permanent removal of California annual grassland and alkali grassland during Project construction.
- Seasonal flooding of vernal pools and alkali rain pools.
- Permanent removal of vernal pools and alkali rain pools during Project construction.
- Potential for operation- and maintenance-related mortality of special-status vernal pool crustaceans.
- Potential for operation- and maintenance-related mortality of San Joaquin tiger beetle, California tiger salamander, western spadefoot toad, blunt-nosed leopard lizard, California horned lizard, silvery legless lizard, northern harrier, California horned lark, grasshopper sparrow, and western burrowing owl.
- Potential for operations- and maintenance-related harm and harassment of giant garter snake.
- Potential loss of foraging area for greater sandhill crane, golden eagle, ferruginous hawk, prairie falcon, merlin, mountain plover, long-billed curlew, and short-eared owl.
- Potential for Project-related impacts on San Joaquin kit fox.
- Potential for Project-related impacts on Fresno kangaroo rat.
- Potential for Project-related mortality of San Joaquin pocket mouse.
- Physical modifications to historic Main No. 2 and Section 8 canal.
- Physical modification of 24.2 Canal.
- Physical disturbance of currently undiscovered cultural resources.
- Potential exposure of people or structures to substantial adverse effects resulting from liquefaction.
- Potential subsidence caused by groundwater overdraft.
- Potential risks to property caused by Project construction on an expansive soil.
- Potential loss of a substantial amount of topsoil from land grading operations.
- Increase in long-term wind and water erosion rates.
- Potential destruction of a unique pedologic feature.
- Potential soil salinization from elevated groundwater levels.
- Potential destruction of a sensitive paleontological resource.

- Conflict with applicable land use plans, policies, or regulations, including land use designations or zoning ordinances.
- Land use/operational conflicts between existing and proposed land uses.
- Conflict with recreational land uses.
- Potential exposure or disturbance of hazardous materials or wastes.
- Potential creation of a public hazard from risk of drowning.
- Potential creation of a public hazard from risk of berm failure.
- Potential creation of a public hazard from risk of wildland fire.
- Potential for increase in adult mosquito populations.
- Increased demand for utilities.
- Potential damage to the roadway surface during Project construction.
- Potential impacts on groundwater or surface water quality from recharge or recovery operations.
- Potential erosion due to reversal of flows in 24.2 Canal and Cottonwood Creek/Main Canal #2.
- Reduced surface water availability in Madera County or the area of origin.
- Adverse impacts on the area of origin or water from amendments to existing water rights.
- Substantial impacts to surrounding groundwater wells as a result of recovery operations.
- Substantially alter the existing drainage pattern or contribute to existing local or regional flooding.
- Potential growth-inducing impacts related to operations.

**Sub-Options considered but Rejected**

Several alternatives were considered during studies for this project. The results of the studies can be found in \_\_\_\_\_.

**Reference**

Reclamation. 2007. Madera Irrigation District Water Supply Enhancement Project Appraisal Study. United States Department of the Interior, Bureau of Reclamation. March  
 Madera Irrigation District (MID). 2005a. Feasibility Study of the Preferred Alternative, Water Supply Enhancement Project. Prepared by B-E.  
 MID. 2005b. Draft Environmental Impact Report. Prepared by Jones and Stokes. June.  
 MID. 2005c. Final Environmental Impact Report. Prepared by Jones and Stokes. September.

**Figures**

42-1 Primary Project Area

**Attachments**

42-1 Important Features and MID Proposed Project Characteristics  
 42-2 Traditional Federal Planning Process



Madera Water Supply and Groundwater Enhancement Project Study Area

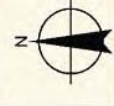
Chowchilla Water District

Madera Ranch Project Area

Madera Irrigation District

Gravelly Ford Water District

Figure 42-1 Project Area



Projection: UTM Zone 10 NAD83  
Map Prepared: July 2006





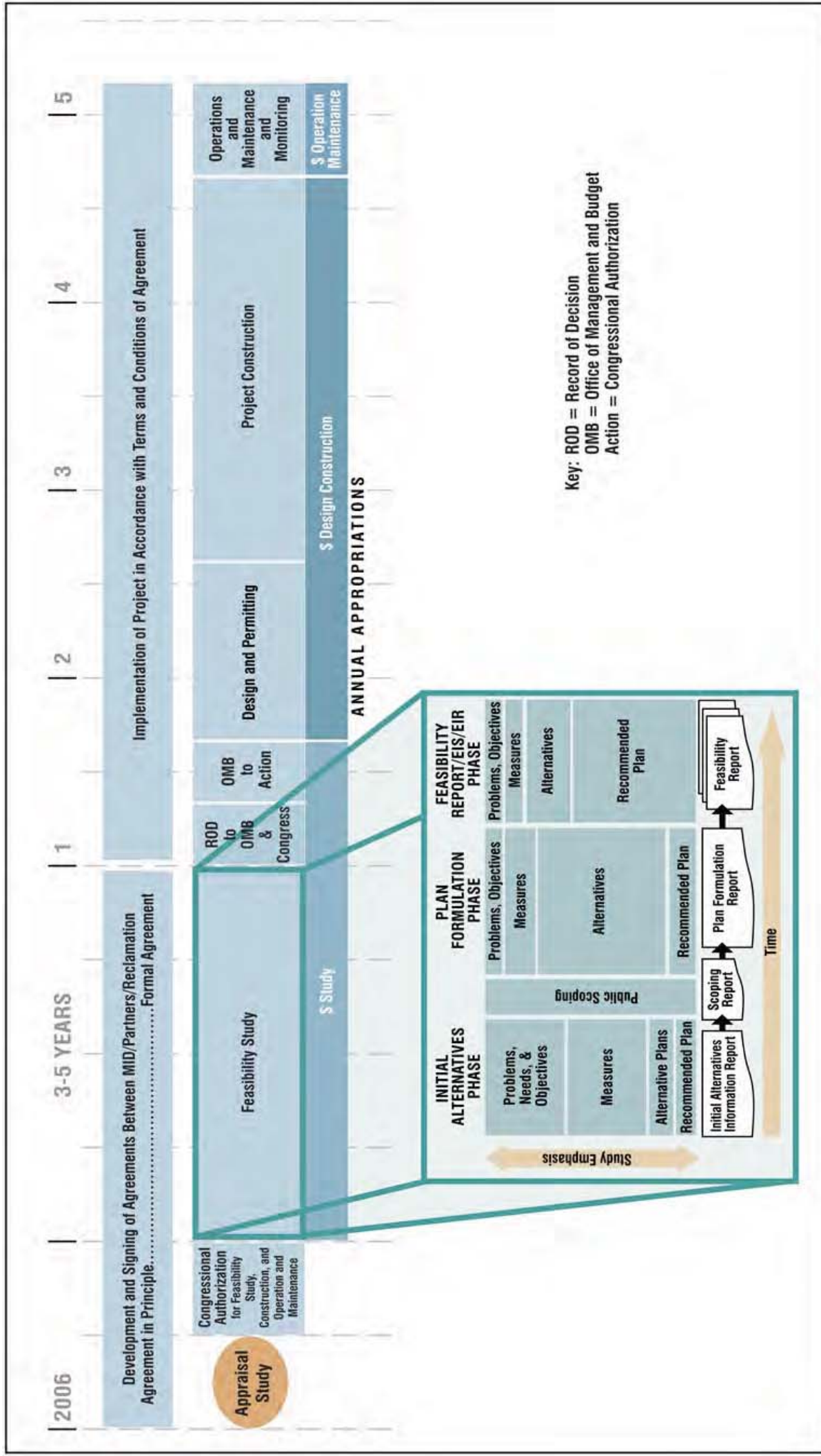
**Figure 47-4: Depth to Water in Wells – Spring 2004**

Owner/operator	Madera Irrigation District
Source of recharge water	San Joaquin River and Fresno River surface water entitlements
Water conveyance	Gravity delivered through existing MID canals
Total capacity	Up to 250,000 acre-feet
Annual capacity	Up to 55,000 acre-feet per year
Instantaneous capacity	Approximately 200 cubic feet per second
Percentage of water left behind for overdraft recovery	Ten percent
Swale recharge areas	Approximately 700 acres
Recharge basin area	Up to 1,000 acres (less than 8 percent of ranch), only if needed to supplement swales
In-lieu surface water delivery recharge areas	Approximately 2,600 acres
Percentage of Madera Ranch remaining in current state	Approximately 90 percent
Wells for recovery of stored surface water	Up to 49 new wells
Recovery and stored water use	Pumped back into MID and surrounding areas for agricultural use

Note: Pilot testing indicates that recharge basins are unlikely to be required.

Key: MID - Madera Irrigation District





Attachment 42-2 Traditional Federal Planning Process



**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 48	<b>Structural Option Name</b> Saucelito ID Distribution System Evaluation		<b>Revision Date</b> 25 Jan 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	John Roldan		Dennis Dorratcage
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Appraisal  
Total Study Cost: Not available at this time.  
Annual O&M Cost: Unknown  
Project life: Unknown

**Objective of Option**

To fully develop the District's conjunctive use potential through expanded recharge facilities in order to capture Recovered Water Account supplies and other San Joaquin River flood flows to mitigate the loss of water to San Joaquin River restoration.

**Performance Criteria**

- 1
- 2
- 3
- 4

**Design Criteria**

- 1
- 2
- 3
- 4
- 5

**Description**

In January, 2001, the Saucelito Irrigation District (District) participated in a regional study of groundwater resources. The effort included preliminary investigations of and provided recommendations for further study of potential groundwater recharge areas. Figure 48-1 shows the Deer Creek Target Area and Figure 48-2 shows the soil permeabilities within the District. The District believes it is imperative to develop new recharge facilities to maximize its use of San Joaquin River flood flows and fully realize its conjunctive use potential in order to mitigate the impacts of the San Joaquin River settlement.

The proposed study will identify potential locations for additional groundwater recharge within the District's boundaries, including, but not limited to, the Deer Creek Target Area. The proposed study includes site identification, access and land use negotiations, soil testing, detailed information evaluation, and assessment of existing delivery/distribution facilities.

It is expected that surplus San Joaquin River flows such as Section 215 and Recovered Water Account water will be used for the direct recharge efforts; however, alternate supplies could become available through exchange because of the District's expanded conjunctive use capability.

**Construction Considerations**

Due to the need to work in the proximity, and often directly on, adjacent landowners' property to construct recharge basins and distribution pipelines, it will be necessary to coordinate with landowners on construction activities, especially excavation and hauling operations that may inconvenience or disrupt their daily operations. The level of interruption will be increased if levee material is needed for the recharge basins and must be imported from another site or significant excavation is required to construct the basins and soil must be exported from the site.

**Schedule**

Feasibility Study: 7/08 – 6/10 (Refer to Figure 48-3)

**Real Estate Requirements**

- **Fee Purchase** Acreage will need to be purchased for the proposed recharge basins; however, the acreage needed or available is unknown at this time.
- **Access Rights** Temporary landowner access rights may be required during the construction of the recharge basins and distribution facilities.
- **Permanent and Temporary Easements** Permanent easements are expected due to the potential construction of new pipelines.
- **Flowage Easements** None expected.

**Coordination with Other Options**

This option would enhance Option 34, Orange Cove ID Conjunctive Use Partnership. By increasing its conjunctive use potential, the District could exchange its dry year Class 1 water for normal and wet year Class 1 supplies from a Class 1 only district such as Orange Cove ID. In the dry years, the growers within the District would rely on the groundwater recharged in previous normal and wet years.

This option could be enhanced through Options 55 and 56, Trans-Valley Canal and Multi-District Bidirectional Conveyance Project, which could make State Water Project and Cross Valley Canal supplies available for recharge and exchange within the Friant Division. Option 53 could also provide access to State Water Project and Cross Valley Canal supplies through an FKC-CVC Intertie, FKC pump-back facilities and exchange agreements with Friant contractors on the southern end of the FKC. In much the same way, this option could also provide a location to store any San Joaquin River water recirculated through Options 58 and 59. It could also be a component of a regional, multi-agency groundwater banking program. It should be noted that place of use issues must first be overcome to enable State Water Project supplies to be a viable source of water for this project.

This option does not preclude other options from being undertaken, although it does reduce the amount of SJR surplus water available for use in other options. However, Options 60 and 61, capacity correction and increase of the FKC, would ease the restriction of flood water conveyance to all the proposed groundwater projects served by the FKC, thus increasing the available surplus San Joaquin River supply.

The District is close to the Pixley ground-water bank proposed in Option 47 and the Deer Creek Tule River Authority (DCTRA) basin in Option 33. The mutual effects of these three projects must be taken into account when evaluating each of them. If the District identifies a potential site in the Deer Creek Target Area, it could be developed as an expansion of the DCTRA facility due to its close proximity to the existing DCTRA recharge basin. Separate ownership with joint operation of the facilities could also be considered to decrease operating costs.

**Operational and Maintenance Requirements**

- **Operations**

Recharge supply will be delivered through the Friant-Kern Canal and into the District's distribution system through its turnouts. It will then be conveyed to the proposed recharge basins. While it will require additional training to incorporate the new recharge basins into the existing operations, it should not require

the addition of new staff, especially if SCADA control and monitoring is incorporated into the project.

- **Maintenance**

Routine maintenance will be required on all proposed project facilities. New recharge basins and levees will require weed and pest control, occasional silt removal, discing, and grading. New pipelines should initially require little maintenance. The need for additional staff is not anticipated.

- **Monitoring Requirements**

The feasibility study will install 8 monitoring wells (Figure 48-4) and recommend an appropriate monitoring program based on site conditions. It will likely be developed to provide information on impacts to adjacent landowners from recharge, total volume of water stored, rates of groundwater migration into and out of the project area, and aquifer characteristics.

### **Future Requirements for Design**

The proposed feasibility study will identify and evaluate sites for recharge basin development. The study will consist of identifying potential recharge basin sites, installing monitoring wells, collecting and compiling hydrogeologic data for specific sites, evaluating access and delivery capability to the sites, and negotiating and developing land use agreements. The following benefits are anticipated from the study: 1) Development of hydrogeologic data for potential project sites; 2) Establishment of future recharge basin sites having the necessary characteristics that will maximize recharge efforts; and 3) Continued implementation of the regions' Groundwater Management Plan objectives through the pursuit of additional recharge facilities and opportunities.

### **Potential Environmental Impacts**

- **Temporary (During Construction)**

The significant amount of earthwork required to construct the recharge basins may impact sensitive species. In addition, normal construction concerns such as dust control, increased truck traffic and air pollution, road closures, water quality impacts, etc. may need to be addressed.

- **Permanent (Operation-Related)**

Because the District is not proposing extraction wells along with its recharge basins, the proposed project would appear to have a clear groundwater benefit to the area, although high water levels caused by groundwater mounding could potentially be an issue. The impact of the conversion of productive agricultural land to recharge basins will need to be addressed as well.

### **Sub-Options considered but Rejected**

None.

### **Drawings**

### **Figures**

- 48-1 Figure 3-1 Deer Creek Target Area (Reference 48-1)
- 48-2 Figure 3-2 Soil Permeabilities (Reference 48-1)
- 48-3 Figure 3-4 Project Schedule (Reference 48-1)
- 48-4 Figure 3-3 Surface Lid Monitoring Well (Reference 48-1)

### **Attachments**

**References**

- 48-1 Keller-Wegley Engineering, *Grant Application AB303 – Local Groundwater Assistance Program Saucelito Irrigation District*, December 2007.
- 48-2 Telephone Conversation with Sean Geivet, SID Manager, January 15, 2008.



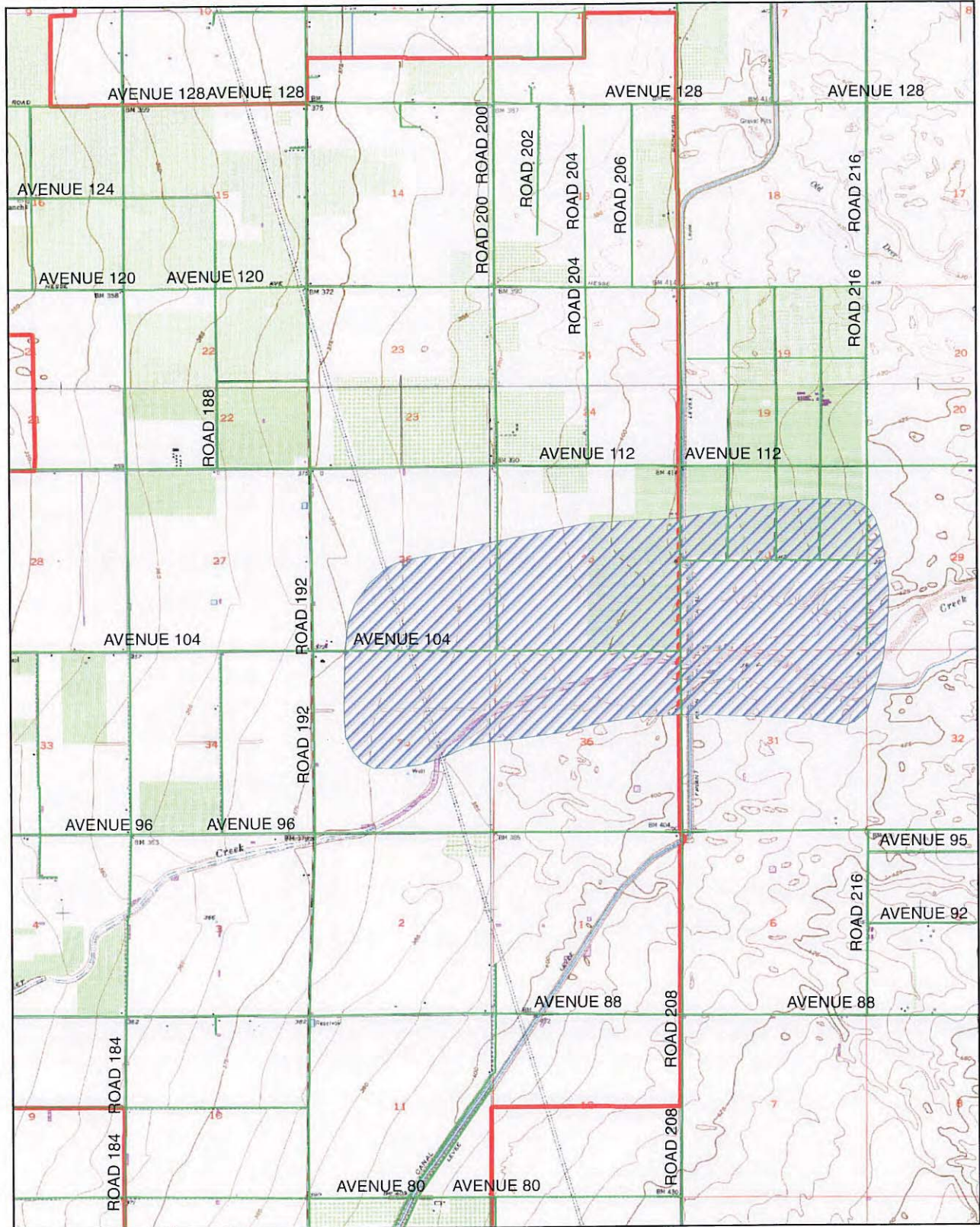
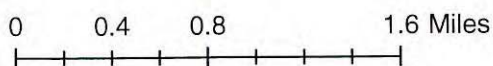


Figure 48-1

**Legend**

- Saucelito Irrigation District
- Deer Creek Target Area



**DEER CREEK TARGET AREA**  
**SAUCELITO IRRIGATION DISTRICT**



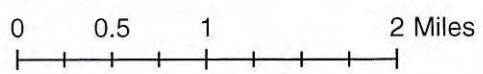
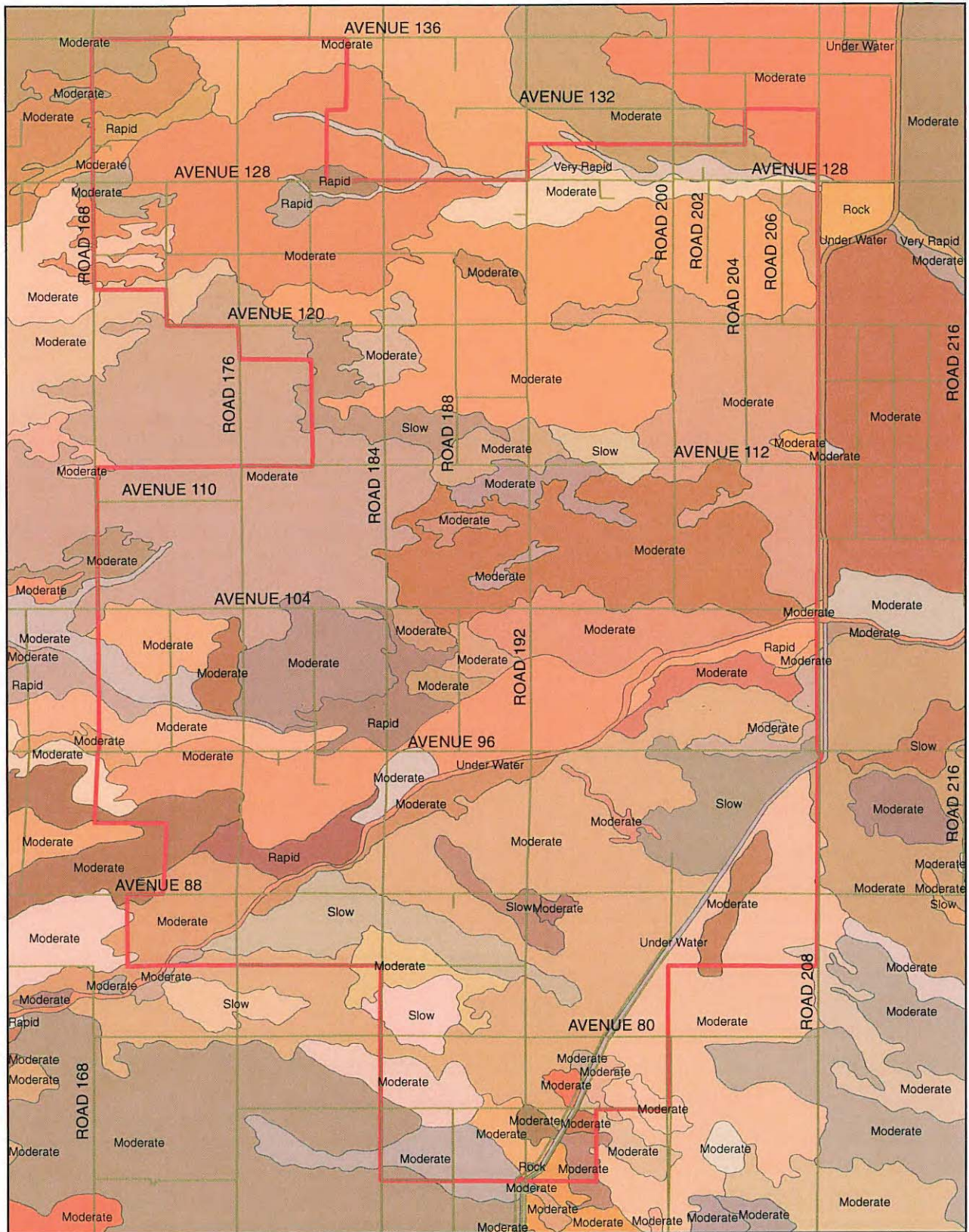



Figure 48-2

**Legend**

 Saucelito Irrigation District

**SOIL PERMEABILITIES**  
**SAUCELITO IRRIGATION DISTRICT**

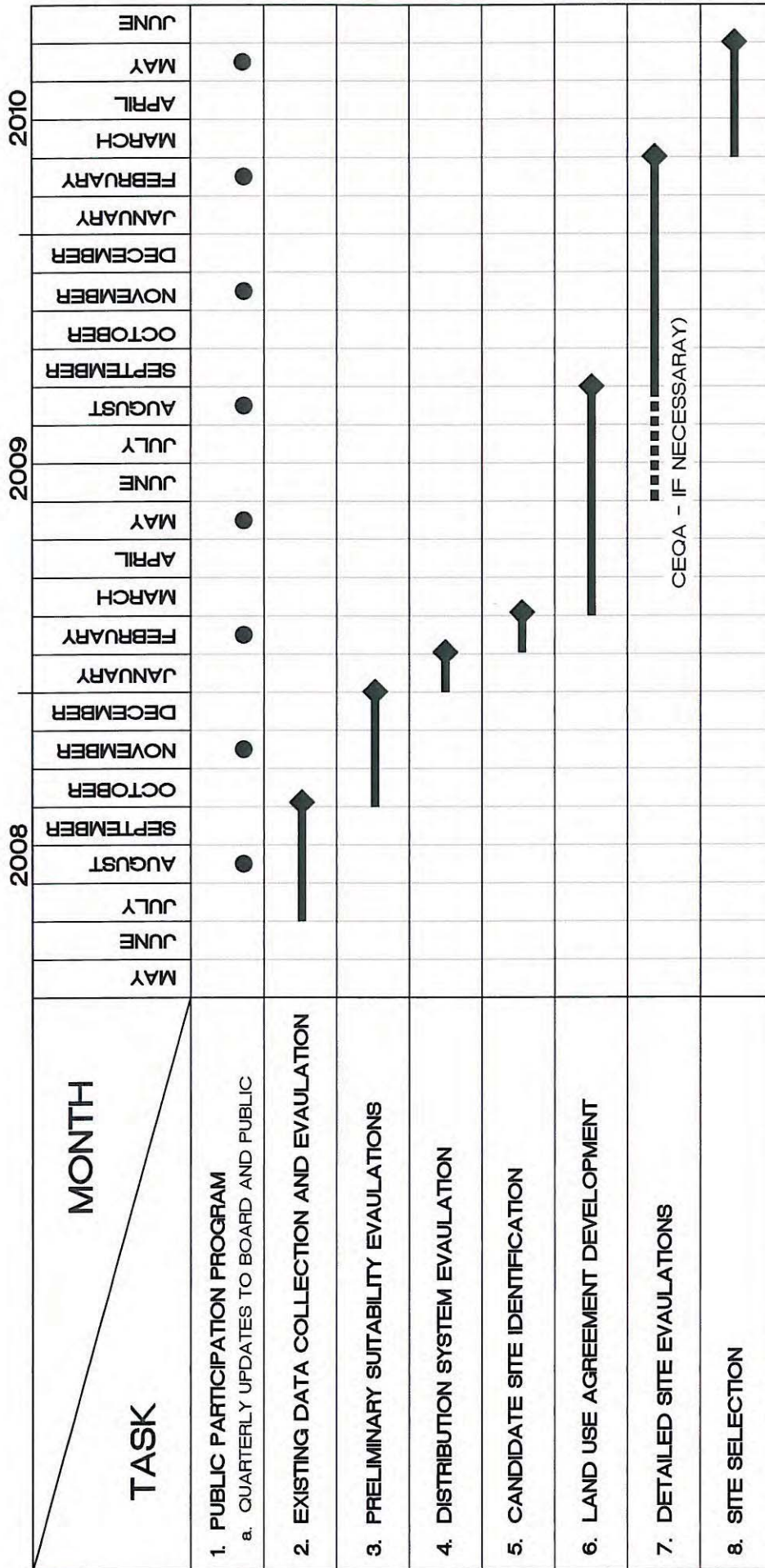


Figure 48-3

# PROJECT SCHEDULE

## AB 303 GRANT APPLICATION

### SAUCELITO IRRIGATION DISTRICT



CEQA - IF NECESSARY

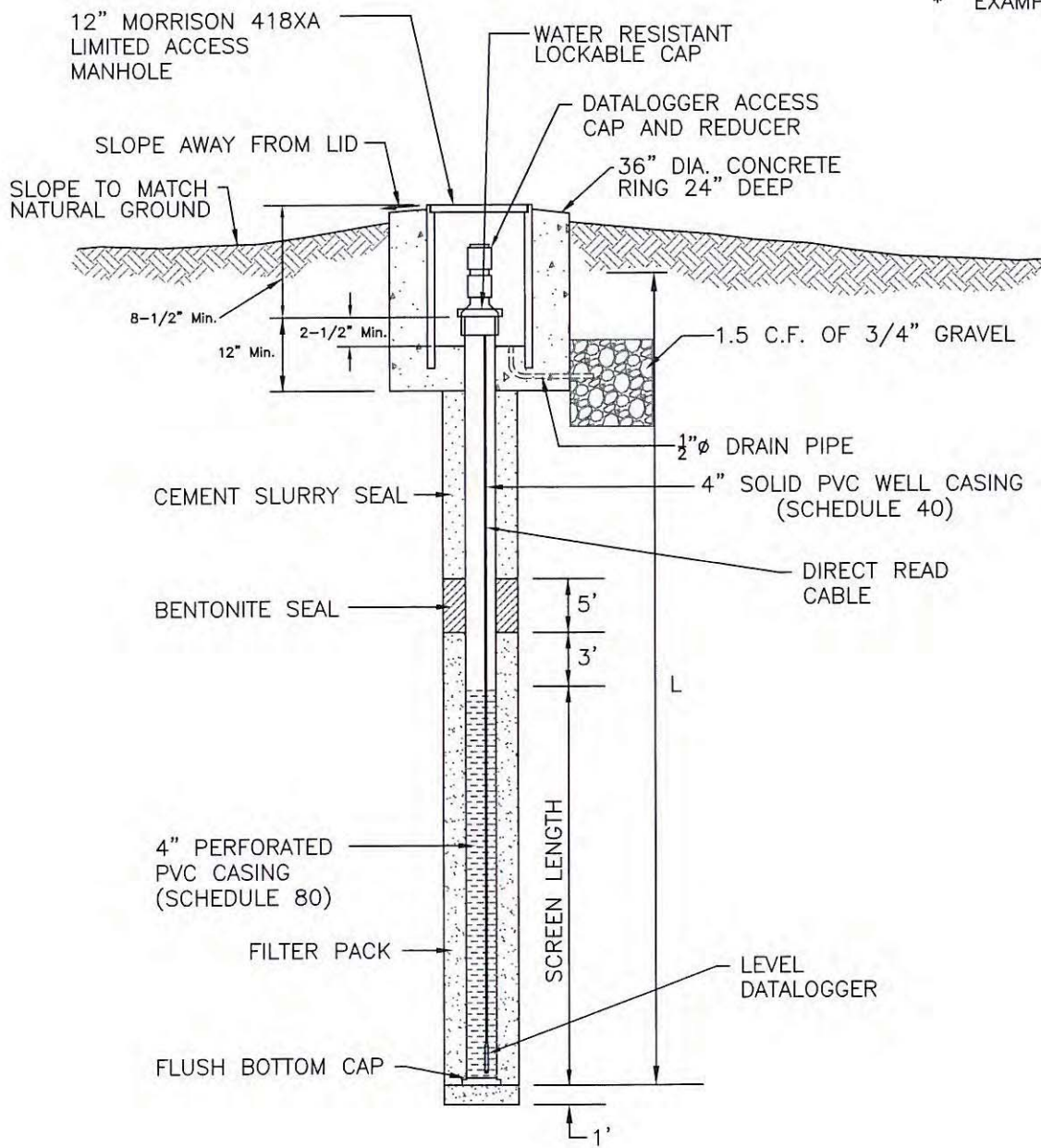
- LEGEND**
- ◆ MILESTONE/DELIVERABLE
  - MEETING
  - REVIEW PERIOD/DURATION
  - TASK CONTINUATION - AS NEEDED



MONITORING WELL DATA		
PARAMETER	MONITORING WELL NUMBER	
	MW-4	MW-5
DEPTH (L) (ft.)	110	120
SCREEN LENGTH (ft.)	60	60
LATITUDE	35°58'55.08"N	35°58'30.54"N
LONGITUDE	119°07'31.5"W	119°07'31.74"W

\*  
\*  
\*  
\*  
\*

\* EXAMPLE DATA



**SURFACE LID MONITORING WELL**  
**SAUCELITO IRRIGATION DISTRICT**

Figure 48-4





**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 60	<b>Structural Option Name</b> FKC Capacity Correction		<b>Revision Date</b> 28 Jan 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	D. Whitbeck		D. Dorratcague
<b>Engineering</b>			

**Costs (December 2007):**

Cost Level: Pre-appraisal  
Total Construction Cost: Not available at this time.

**Objective of Option**

This option seeks to correct capacity restraints that have developed within four reaches, totaling 19.25 miles, of the Friant-Kern Canal (FKC) as a result of land subsidence. It would consist of raising the FKC's concrete liner two feet and modifying all structures and appurtenances (such as turnouts and bridges) within these four reaches. This would restore the canal capacity to its original design levels.

**Performance Criteria**

- 1 Restoration of approximately 500 cfs capacity that has been lost in four "bottleneck" reaches by raising the concrete liner 2 vertical feet.
- 2 Maintain use of existing facilities and level of flood protection along the FKC.

**Design Criteria**

- 1 Reclamation Cost Estimating Guidelines

**Description**

This option involves raising the FKC's concrete lining and modifying all structures and appurtenances (such as turnouts and bridges) within four reaches of the Friant-Kern Canal (FKC). Figure 60-1 illustrates the location of the bottleneck reaches along the canal. Capacity in these reaches has been reduced over time as a result of land subsidence. By restoring conveyance capacity within the affected areas, the FKC would be able to convey and transfer greater amounts of water that would otherwise be possible. Maximizing the FKC capacity in order to accommodate the largest possible diversions during flood events would also help offset a portion of the Friant Division's water management goal through groundwater banking or recharge, as well as optimize canal delivery efficiencies.

Four reaches along the FKC have been identified as "bottleneck" reaches by the Friant Water Authority. Table 60-1 details the river mileposts for each of these reaches. Among these four reaches, a total of 19.25 miles of the FKC would require rehabilitation and lining raise. This is not the first time work has been done on the FKC. Previous rehabilitation projects have raised the lining from mileposts 99.37 to 115.94 (1976) and from mileposts 0.0 to 28.5 (1977).

A cost study was performed by the Friant Water Authority, as part of the Feinstein Report (Reference 1), to estimate the cost of capacity expansion in each of these four bottleneck reaches. See Attachment 60-1. The results of this study were transmitted via email correspondence to USBR in July, 2007. As described, the Friant Water Authority used detailed bids from contractors to the USBR for the 1976 rehabilitation of the FKC from mileposts 99.37 to 115.94 and evaluated them for unit costs of raising the concrete liner. Costs were subdivided as either dependent or independent of the amount of vertical rise and the length of rehabilitation along the canal. Per-mile of canal length

and per-foot of liner rise unit costs were estimated for costs dependent on the length or vertical raise. Independent costs, such as culvert modifications, were simply escalated to future values. In the Friant Water Authority study, costs were escalated to 2010 dollar values by using a 5% inflation factor (see Attachment 60-1). As described in the email correspondence, the final cost estimate for each bottleneck reach was estimated by determining the degree of liner extension as well as modification to existing structures that would be required.

**Table 60-1:** Location of bottleneck reaches on the Friant-Kern Canal.

<b>Bottleneck Range</b>		<b>Project Distance</b>	<b>Design Flow</b>	<b>Actual Flow</b>
<b>(FKC Milepost)</b>		<b>(miles)</b>	<b>(cfs)</b>	<b>(cfs)</b>
29.13	30.50	1.37	5,000	4,680
52.98	57.14	4.16	5,000	4,500
71.37	79.25	7.88	4,500	4,105
131.35	137.19	5.84	2,500	2,170

**19.25**

The degree of vertical liner extension was determined based on a calculated *effective* roughness coefficient (n) and the cross-sectional area necessary to alleviate the bottleneck. The effective roughness coefficient was determined by solving Manning’s equation using the designed channel geometry and the measured maximum flow. The resulting *effective* roughness was then used to calculate the amount of vertical raise necessary to increase the channel capacity to the desired flow. As a safety factor, the vertical increase was doubled. The study by the Friant Water Authority estimated the vertical raises necessary to relieve the bottlenecks were 1.07, 1.67, 1.32, and 2.20 feet in each of the four reaches, upstream to downstream, respectfully. It was decided that a blanket raise of 2 feet in all of the bottleneck reaches would be sufficient for the purposes of this pre-appraisal level analysis.

*Recommendation (Water Management Application)*

Restoring the design capacity of the Friant-Kern Canal (FKC) would allow for short-duration flood waters to be more efficiently captured and delivered to the contracting water districts. These flood waters may be used for groundwater banking within the districts as a way to help meet the water management goal. Coordination with other options is recommended, however, since the effectiveness of carrying additional water to meet the management goal will be dependent on the ability of contracting districts to divert and retain the water.

**Construction Considerations**

Construction or upgrades of facilities to bring the canal up to design capacity will require construction in the off-season months and may require coordination with landowners to insure that facility operation is maintained and water is still delivered as needed.

**Schedule**

Construction of the capacity correction would help in conveying water management flows whether they are from recirculation or flood flows. Building turnouts to deliver water to groundwater banking areas might also be required to maximize the efficiencies gained with this option.

**Real Estate Requirements**

- **Fee Purchase:** None
- **Access Rights** None
- **Permanent and Temporary Easements** Temporary easements may be required for construction access. Assuming that access to a 20-foot width on each side of the stream would be sufficient for construction, approximately 93 acres of temporary easements will be required.
- **Flowage Easements** It is anticipated that construction can be completed without decommissioning the canal, so no flowage easements would be required.

**Coordination with Other Options**

Increase of the canal capacity could be combined with any number of options that would take advantage of additional short-duration flows through the FKC. This option will help convey either flood flows or reticulated water via the Cross Valley Canal or the proposed Trans Valley Canal to meet the water management goal.

**Operational and Maintenance Requirements**

- **Operations**

Operations of check structures may be slightly different to accommodate greater flows at some times of the year.

**Maintenance**

Routine canal maintenance will be required, but it is expected that the same level of maintenance will be necessary as is currently performed.

- **Monitoring Requirements**

None.

**Future Requirements for Design**

Better flow data, particularly the anticipated frequency of large flood events so that the benefit to the water be performed. Geotechnical investigations may be required to assure that subsidence will not continue to be a factor in these bottleneck areas. Finalization of the water management plan will determine the eventual need to increase capacity in some or all of these reaches.

**Potential Environmental Impacts**

- **Temporary (During Construction)**

Construction may produce dust or add additional sediment to rivers.

- **Permanent (Operation-Related)**

None.

**Sub-Options considered but Rejected**

None.

**Figures**

60-1 Map Illustrating Capacity Correction Reaches

**Attachments****References**

- 1 Friant Water Authority, *San Joaquin River Restoration Program, Water Management Goal: Recirculation, Recapture of Restoration Flow and Mitigation of Water Supply Reductions: Potential Programs & Projects* (Feinstein Report)
- 2 Friant Water Authority, *Friant-Kern Canal Structures List, November 2007*.
- 3 Morrissey, Fergus, *Water Alternative Project Cost Summary* (spreadsheet). Friant Water Authority, File updated July 26, 2007, received November 28, 2007.
- 4 ENR's Construction Cost Indexes <[www.enr.com](http://www.enr.com)>

**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 73	<b>Structural Option Name</b> Chowchilla WD River Channel Seepage Enhancement		<b>Revision Date</b> 17 Mar 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	D. Whitbeck		J. Roldan
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal  
Total Construction Cost: Not Available

**Objective of Option**

The Chowchilla Water District proposes to construct check structures on the Ash Slough, Berenda Slough, and Chowchilla River to raise and hold the water levels in the river channels and thereby increase the groundwater seepage in the affected reaches. This option has the potential to capture and store surplus San Joaquin River flows in accordance with the Water Management Goal.

**Performance Criteria**

- 1 Increase the rate and amount of groundwater seepage on streams flowing through the Chowchilla Water District.
- 2 Improve water supply reliability by increasing groundwater levels.

**Design Criteria**

**Description**

The Chowchilla Water District (CWD) is located in the San Joaquin Valley about 30 miles north of the City of Fresno. The district has a contract with the USBR for 55,000 acre-feet of Class 1 water and 160,000 acre-feet of Class 2 water per year which is delivered from Millerton Lake in the Madera Canal. CWD has a number of natural streams that run through the district, including the Chowchilla River, Ash Slough, and Berenda Slough. See **Figure 73-1**.

CWD expects a decrease in available water supplies due to restoration of the San Joaquin River. A number of potential projects have been identified for study that may help reduce the impact of a decrease in reliable water supply.

This project proposes to study the feasibility of increasing the groundwater seepage in the Ash Slough, Berenda Slough, and the Chowchilla River. During wet years, surplus San Joaquin River flows would be diverted into the Madera Canal for subsequent release into the Chowchilla River, Ash Slough and Berenda Slough. Check structures would be constructed in the channels to maximize the holding time and elevation of the flows within the reaches in the CWD, thus maximizing the amount of groundwater recharge.

The U.S. Bureau of Reclamation (USBR) has historically diverted San Joaquin River flood flows into the three channels when spills from Friant Dam have exceeded, or have threatened to exceed, the San Joaquin River channel capacity downstream of Friant Dam (8,000 cfs). With the addition of check structures within the channels, the CWD may decide that it is beneficial to deliver Uncontrolled Season Class 2 and Section 215 supplies into the channels for recharge when available.

Recharged water may be recovered by individual CWD landowner wells or a groundwater recovery facility may be proposed. Exchange of CWD contract supplies with other Friant Division districts may be possible depending on the effectiveness of the recharge project.

*Recommendation for Water Management Approach*

At this preliminary stage of development, the feasibility of this project is uncertain; however, it appears to have the potential to meet the Water Management Goal by capturing and storing surplus San Joaquin River flows. The effectiveness of the project and the resulting benefits to CWD and other Friant Districts will need to be determined.

**Construction Considerations**

Construction considerations would be assessed once a more detailed feasibility study has been completed.

**Schedule**

Feasibility Study: Jun-2008 to Dec-2008

Agreements and Funding: Jan-2009 to Jan-2010

Engineering and Design: Jan-2009 to Jan-2010

Land Acquisition: Feb-2010 to Dec-2010

Construction: Jan-2011 to Dec-2011

Operational: Jan-2011

**Real Estate Requirements**

- **Fee Purchase** Land acquisition may be required if a groundwater recovery facility is proposed.
- **Access Rights** It is likely that access agreements will be needed with landowners adjacent to the stream channels for construction of the check structures, monitoring facilities, and any recovery wells proposed.
- **Permanent and Temporary Easements** Permanent operation and maintenance easements may be required for the check structures, monitoring facilities and any recovery wells proposed.
- **Flowage Easements** Easements or permits may be required to conduct routine recharge activities within the channels.

**Coordination with Other Options**

This option could be coordinated with other Chowchilla Water District options as a way of banking or storing water to make up for water lost for river restoration on the San Joaquin River. It may also be a component of a regional groundwater banking program.

**Operational and Maintenance Requirements**

- **Operations:** The USBR would release flows into the Madera Canal for diversion into the Chowchilla River, Ash Slough and Berenda Slough. Check structures within the channels would be operated to maximize the holding time of the flood flows within the reaches in the Chowchilla WD. SCADA equipment would likely be used to monitor and control the recharge facilities.
- **Maintenance:** Unknown
- **Monitoring Requirements:** Monitoring of groundwater levels may be required to determine the effectiveness of the project and its impact on adjacent landowners. In addition, monitoring of instream flows would be required to prevent localized flooding.

**Future Requirements for Design**

A detailed feasibility study needs to be performed to assess the proposed project, including completion of the alternative formulation report to assess whether this project will work in accordance with the water management goal. Flow data, topographic mapping, subsurface investigations, and groundwater levels may

be required for design. Rights to divert or use excess water may need to be verified. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

**Potential Environmental Impacts**

- **Temporary (During Construction):** Unknown
- **Permanent (Operation-Related):** Project operations would require close coordination with flood operations on the streams to avoid flooding impacts.

**Sub-Options considered but Rejected**

None

**Figures**

73-1 Service Area Map

**Attachments**

**References**

73-1 Chowchilla Water District, *Water Management Projects & Studies*, November 11, 2007.





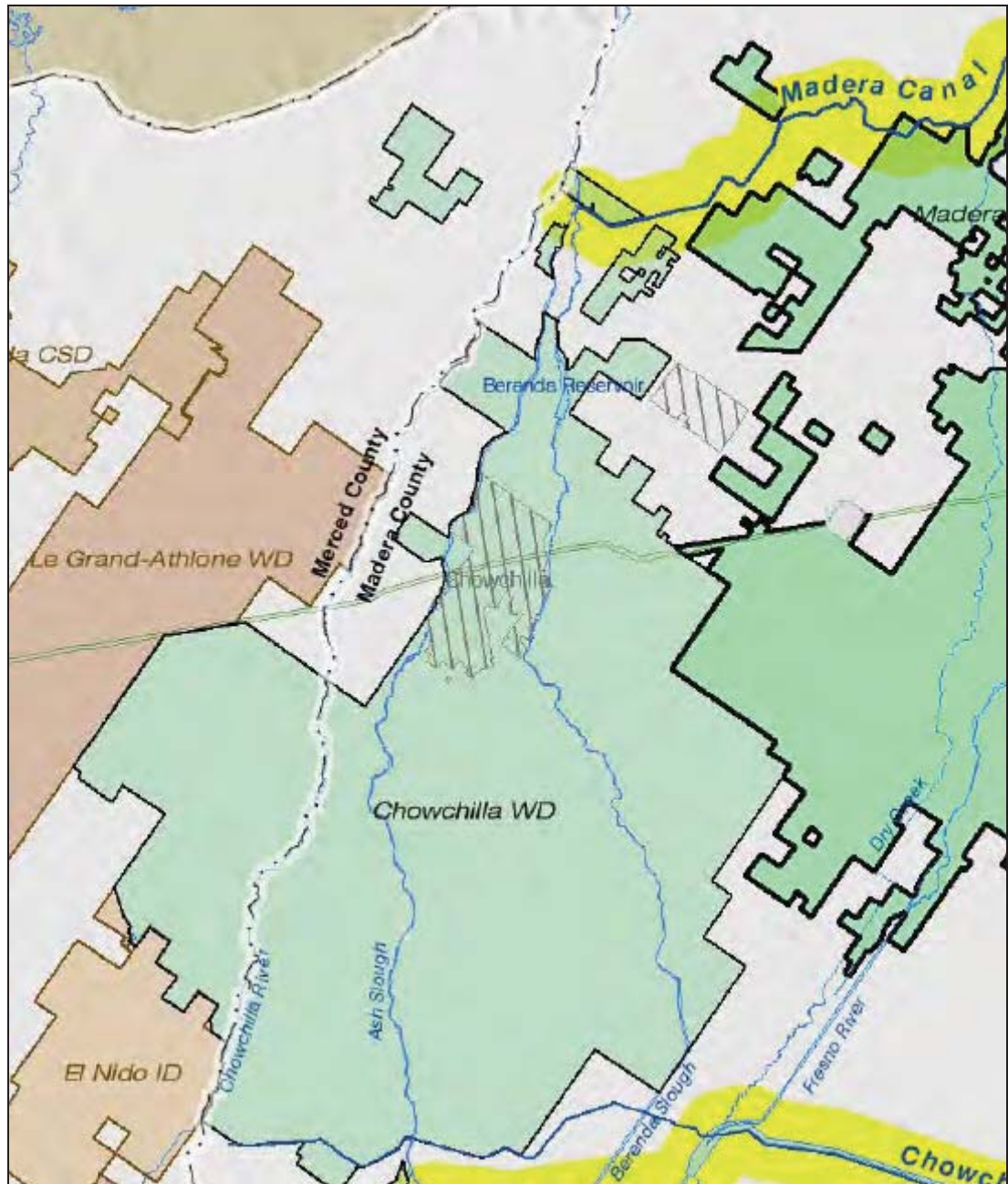
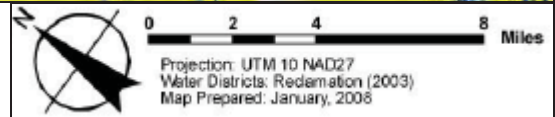


Figure 73-1: Service Area Map





**San Joaquin River Restoration  
Structural Option Description  
Pre-Appraisal Level**

<b>Option No.</b> 77	<b>Structural Option Name</b> Chowchilla WD Groundwater Recharge Ponds and Recovery Wells		<b>Revision Date</b> 17 Mar 2008
<b>Reach Number</b> N/A	<b>River Mile</b> N/A	<b>Program Goal</b> Water Management	<b>Phase</b> II
<b>Task</b>	<b>Responsible Author</b>		<b>Peer Reviewer</b>
<b>Option Description</b>	D. Whitbeck		J. Roldan
<b>Engineering</b>			

**Costs (October 2007):**

Cost Level: Pre-appraisal  
Total Construction Cost: Not Available

**Objective of Option**

The Chowchilla Water District proposes to construct 10 to 20 groundwater recharge ponds and 20 to 40 groundwater recovery wells within the district. The ponds would be used to bank surplus San Joaquin River flows and other stream flows available to the CWD in wet years and the recovery wells to recover the banked water during dryer years. The result would be increased utilization of surplus San Joaquin River flows in accordance with the Water Management Goal.

**Performance Criteria**

- 1 Increase the districts ability to bank excess flood waters by constructing recharge ponds.
- 2 Increase the districts ability to recover groundwater by adding recovery wells.
- 3 Improve water supply reliability by increasing groundwater levels.

**Design Criteria**

**Description**

The Chowchilla Water District (CWD) is located in the San Joaquin Valley about 30 miles north of the City of Fresno. The CWD has a contract with the USBR for 55,000 acre-feet of Class 1 water and 160,000 acre-feet of Class 2 water per year from the San Joaquin River which is delivered from Millerton Lake in the Madera Canal. CWD also has a number of streams that run through the district, including the Chowchilla River, Ash Slough, and Berenda Slough. During wet years, excess flood flows are available in these four water courses, but the CWD is unable to capture the excess flows for use in dryer years because of storage capacity limitations.

CWD expects a decrease in available water supplies due to river restoration on the San Joaquin River. A number of potential projects have been identified for study that may help reduce the impact of a decrease in reliable water supply.

This project proposes to construct 10 to 20 groundwater recharge ponds and 20 to 40 groundwater recovery wells within the district. DWR well logs will be analyzed to determine the potential groundwater recharge sites and recovery well sites. The ponds would be used to absorb excess flood water in wet years and the recovery wells to recover the water during dryer years. The CWD's existing distribution system will be evaluated to determine if it is adequate to serve the proposed groundwater recharge basins. The result would be increased water banking and groundwater levels that will help meet the Water Management Goal.

*Recommendation for Water Management Approach*

At this preliminary stage of development, the feasibility of this project is uncertain ; however, it appears to have the potential to meet the Water Management Goal by capturing and storing surplus San Joaquin River

flows. The effectiveness of the project and the resulting benefits to CWD and other Friant Districts will need to be determined.

#### **Construction Considerations**

Construction considerations would be assessed once a more detailed feasibility study has been completed.

#### **Schedule**

Feasibility Study: Jun-2008 to Dec-2008

Agreements and Funding: Jan-2009 to Jan-2010

Engineering and Design: Jan-2009 to Jan-2010

Land Acquisition: Feb-2010 to Dec-2010

Construction: Jan-2011 to Dec-2012

Operational: Jan-2012 (Start up of completed basins)

#### **Real Estate Requirements**

- **Fee Purchase** It is expected that a significant amount of land will be acquired for this project; however, the amount is unknown at this time.
- **Access Rights** It is expected that landowner access rights will be required.
- **Permanent and Temporary Easements** Additional permanent easements may be required if the CWD's existing distribution system is inadequate to deliver the additional flows and new infrastructure is required.
- **Flowage Easements** Easements could be required to convey the surplus flows to the groundwater basins.

#### **Coordination with Other Options**

This option could be coordinated with other Chowchilla Water District options as a way of banking or storing water to make up for water lost for river restoration on the San Joaquin River. It may also be a component of a regional groundwater banking program.

#### **Operational and Maintenance Requirements**

- **Operations:** During wet years, surplus flows will be delivered into the CWD distribution system from the Madera Canal, Chowchilla River, Ash Slough and Berenda Slough, and conveyed to the proposed groundwater recharge basins. During dry years, the stored water will be recovered and conveyed in the CWD distribution system to meet irrigation demand.
- **Maintenance:** Routine earthwork and mechanical maintenance will be required to ensure the basins are recharging and the wells are pumping effectively.
- **Monitoring Requirements:** Groundwater monitoring may be required to determine the effectiveness of the project and impacts to adjacent landowners.

#### **Future Requirements for Design**

A detailed feasibility study needs to be performed to assess the proposed project, including completion of the alternative formulation report to assess whether this project will work in accordance with the water management goal. Flow data, topographic mapping, subsurface investigations, and groundwater levels may be required for design. Rights to divert or use excess water may need to be verified. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

#### **Potential Environmental Impacts**

- **Temporary (During Construction):** Recharge basin and pipeline construction have the potential to cause dust, noise and traffic impacts, although the rural location of the proposed projects in an agricultural area should limit the severity of these impacts. Potential impacts to species of concern may need to be evaluated.
- **Permanent (Operation-Related):** Groundwater impacts from recharge and recovery operations will need to be determined. The impact of removing farmland from production will also need to be determined.

**Sub-Options considered but Rejected**

None

**Figures**

77-1 Service Area Map

**Attachments**

**References**

77-1 Chowchilla Water District, *Water Management Projects & Studies*, November 11, 2007.



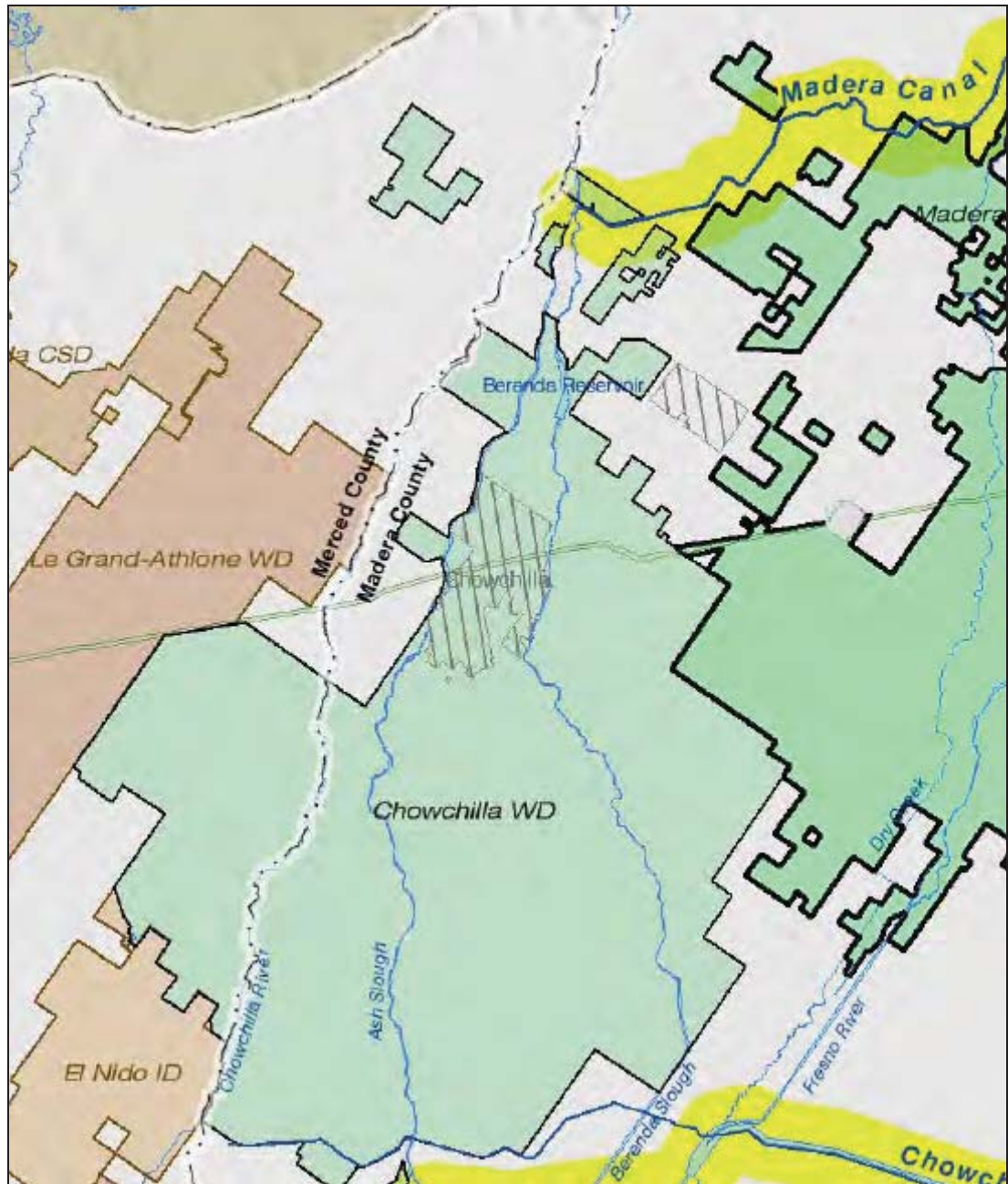


Figure 77-1: Service Area Map

