San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
79	Tulare ID Upstream Recharge Basin		5 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The Tulare Irrigation District (Tulare ID) proposes to collaborate with the Kaweah Delta Water Conservation District to obtain agricultural acreage upstream of the district for use as a recharge basin. The basin would be designed to recharge surplus San Joaquin and Kaweah River water when available and for extraction during dryer years.

Performance Criteria
1. Construct an upstream recharge basin capable of storing 13,000 acre-feet of water.
2. Based on available hydrogeologic information for the region, percolation rates are expected to be approximately 0.5 feet per day.
3. Increase district's ability to efficiently recharge water.

Design Criteria
1. Reclamation Cost Estimating Guidelines

Description
The Tulare ID expects a loss of 15-20% of reliable water supply as a result of water being diverted for salmon restoration on the San Joaquin River. Although not directly bordering the Friant-Kern Canal, the Tulare ID diverts water from the Friant-Kern in a series of canals that run through the Kaweah Delta Water Conservation District. As a way to offset the loss of reliable water supply, Tulare ID proposes to collaborate with the Kaweah Delta Water Conservation District to obtain agricultural acreage upstream of the district for use as a recharge basin.

The Tulare ID currently has limited capacity to store excess water for use in future years. The intent of this project is to allow the district to capture surplus San Joaquin and Kaweah River water in years when it is available. The district would like to be in front of anticipated development in certain critical locations for groundwater recharge. To this end, the district proposes to purchase approximately 150 acres of land in the Kaweah Delta Water Conservation District and construct a groundwater recharge basin on that land. Due to the southwesterly flow of groundwater in the area, water recharged on this land will flow underneath the Tulare ID for use by private wells in years when surface water supplies are sparse.

Based on available hydrogeologic information in the region, the district staff estimates that the average percolation rate is about 0.50 feet per day at the proposed recharge site. Assuming that once in every 5 years the district experiences a wet year that would allow for groundwater recharge to occur, and that during that year the district would have approximately 60 days of excess water to recharge, the district estimates that 4,000 acre-feet of water could be recharged in normal years and 13,000 acre-feet in wet years. This will, in effect, create a new water source for the district and assist the district in meeting the Water Management Goal.

Recommendation for Water Management Goal
This project would allow Tulare ID a way of capturing excess water available in the Friant-Kern Canal during wet years to make up for water lost in dryer years . If recharge is 4,000 acre-feet in normal years and recharge in wet years offset a lack of recharge during dry years, this could represent a 10-15% increase per year in water supply availability over Tulare ID's Class 1 contract amount of 30,000 acre-feet.

Construction Considerations
Construction considerations will need to be assessed once a more detailed feasibility study has been completed.

Schedule (Beginning Dates)
Planning Jan-2008
Agreements Dec-2008
Design Jan-2009
Property Jan-2009
Construction Jan-2010
Operational Jan-2011

Real Estate Requirements
- **Fee Purchase** 150 acres.
- **Access Rights** None
- **Permanent and Temporary Easements** Temporary easements may be required for construction. Permanent easements may be required for control structures associated with the basin.
- **Flowage Easements** Flowage easements may be required depending on the location of the improvement.

Coordination with Other Options
This option would combine with options 60 or 61, which would increase the capacity of the Friant-Kern Canal and allow for additional short-duration flood waters to be available to contracting districts. This option may also be coordinated with other proposed Tulare ID improvements, including options 38 (Tulare ID/Lindsay-Strathmore exchange program, 49 (diversion capacity expansion project), 50 (SCADA expansion project), and 51 (farm efficiency study), 81 (conjunctive use recharge basin), and 82 (water use efficiency basin). In addition, this option could work as a component of a multi-agency groundwater banking program.

Operational and Maintenance Requirements
- **Operations**

Water for diversion to the upstream recharge basin will be available when short-duration flood waters are released into the Friant-Kern Canal. The rate of diversion and levels in the basin will be controlled and monitored by a SCADA system.
- **Maintenance**

Routine maintenance may be required on the control structures to ensure they are in good condition and working properly.

Monitoring Requirements
Water levels within the recharge basin will need to be monitored for capacity such that appropriate decisions can be made about water allocation when water is available or needed for withdrawal.

Future Requirements for Design
A feasibility study needs to be performed to assess the upstream recharge basin. 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 improvements has potential to generate dust and may impact normal operation of water delivery.

- **Permanent (Operation-Related)**

Depending on the location of each of the improvements to be made, the District may need to provide mitigation for site specific species of animals and/or plants. This will be addressed by following the necessary CEQA and/or NEPA documentation for the project.

Sub-Options considered but Rejected

None.

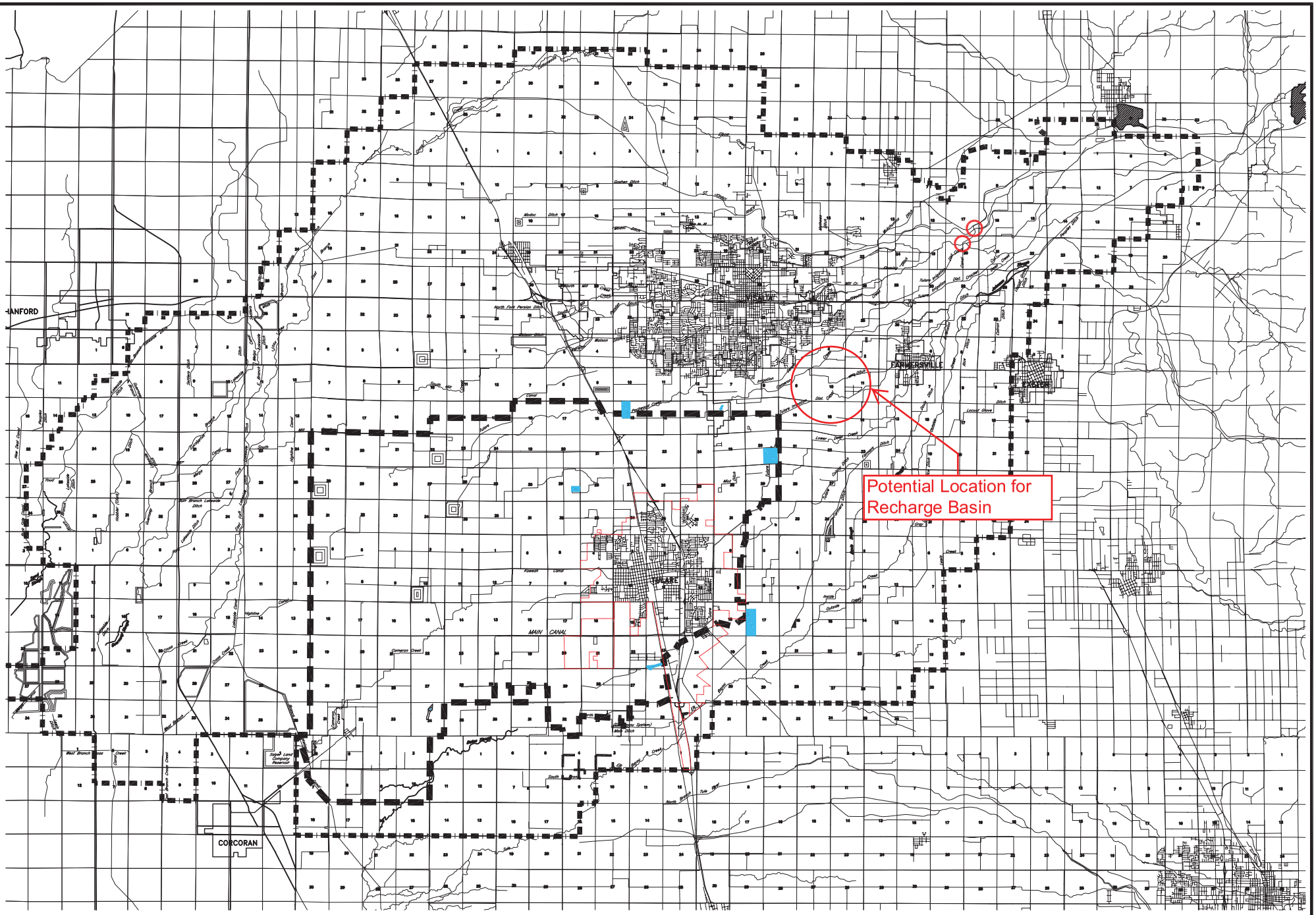
Figures

79-1 Service Area Map

Attachments

References

79-1 Tulare Irrigation District, Water Management Goal Project Description: *Upstream Recharge Basin*



LEGEND

KAWEAH DELTA WATER CONSERVATION DISTRICT

TULARE IRRIGATION DISTRICT

Figure 79-1: Service Area Map

NORTH

TULARE IRRIGATION DISTRICT

KAWEAH DELTA WATER CONSERVATION DISTRICT / TULARE IRRIGATION DISTRICT BOUNDARY MAP

1350 W. SAN JOAQUIN AVE.
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San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
80	Tulare ID Conjunctive Use Recharge Basin		5 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The Tulare Irrigation District (Tulare ID) proposes to enhance its ability to absorb excess water by building a conjunctive use recharge basin. This improvement would be utilized by the district for groundwater storage over a larger time scale, such that excess water from wet years can be stored for availability during dryer years. By improving the ability to store water, the district would be able to capture surplus San Joaquin River flows to compensate for lost surface water due to river restoration efforts on the San Joaquin River and reduce the occurrence of overdraft.

Performance Criteria
1. Construct a conjunctive use recharge basin capable of recharging 4,000 acre-feet of water.
2. Based on available hydrogeologic information for the region, percolation rates are expected to be approximately 0.5 feet per day.
3. Increase districts ability to capitalize on excess water.

Design Criteria
1. Reclamation Cost Estimating Guidelines

Description
The Tulare ID is a conjunctive use district, meaning that district water operations attempt to maximize the use of wet-year surface supplies via both direct and in-lieu recharge for later extraction during dry years. The goal of the district is to offer a viable and affordable supply of surface water such that farmers rely on surface water. In this way, reliance on groundwater is diminished and the district will have fewer occurrences of overdraft.

The district expects a loss of 15-20% of reliable water supply as a result of restoration on the San Joaquin River. This project is meant to help compensate for the loss of surface water to the District by allowing the district to better capitalize on short-duration San Joaquin River flood flows in the Friant-Kern Canal. Excess water would be stored in the ground and made available for farmer extraction wells in dryer years.

The conjunctive use recharge basin would involve purchasing property within the district to recharge groundwater. The district has estimated that purchase of 150 acres of land would yield a net surface area of 130 acres usable for groundwater recharge. The water intended for storage within the basin would become available during wet years when excess flood waters are released into the Friant-Kern Canal. Based on available hydrogeologic information for the region, percolation rates are expected to be approximately 0.5 feet per day. The district estimates that there will be approximately 60 days with excess water once every 5 years and that the proposed conjunctive use basin would be able to recharge approximately 4,000 acre-feet of water. As a result, the average annual recharge would be approximately 800 acre-feet per year.

Recommendation for Water Management Approach
This project would allow Tulare ID a way of capturing excess water available in the Friant-Kern Canal during wet years to make up for water lost in dryer years . If the average annual recharge is approximately 800 acre-feet per year, this represents a 2-3% increase per year in water supply availability over Tulare ID's Class 1 contract amount of 30,000 acre-feet.

Construction Considerations
Construction considerations will need to be assessed once a more detailed feasibility study has been completed.

Schedule (Beginning Dates)
Planning Jan-2008
Agreements Dec-2008
Design Jan-2009
Property Jan-2009
Construction Jan-2010
Operational Jan-2011

Real Estate Requirements
- **Fee Purchase** 150 acres
- **Access Rights** None
- **Permanent and Temporary Easements** Temporary easements may be required for construction. Permanent easements may be required for control structures associated with the basin.
- **Flowage Easements** Flowage easements may be required depending on the location of the improvement.

Coordination with Other Options
This option would combine with options 60 or 61, which would increase the capacity of the Friant-Kern Canal and allow for additional short-duration flood waters to be available to contracting districts. This option may also be coordinated with other proposed Tulare ID improvements, including options 38 (Tulare ID/Lindsay-Strathmore exchange program, 49 (diversion capacity expansion project), 50 (SCADA expansion project), and 51 (farm efficiency study), 80 (upstream recharge basin), and 82 (water use efficiency basin). In addition, this option could work as a component of a multi-agency groundwater banking program. A Tulare alignment of Option 55, Trans Valley Canal, could potentially make Recaptured water available for recharge within this option.

Operational and Maintenance Requirements
- **Operations**

Water for diversion to the conjunctive use basin will be available only when short-duration flood waters are released into the Friant-Kern Canal. The rate of diversion and levels in the basin will be controlled and monitored by a SCADA system.
- **Maintenance**

Routine maintenance may be required on the control structures to ensure they are in good condition and working properly.

Monitoring Requirements
Water levels within the conjunctive use basin will need to be monitored for capacity such that appropriate decisions can be made about water allocation when water is available or when dry years result in shortages within the district.

Future Requirements for Design
A feasibility study needs to be performed to assess the conjunctive use basin. 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 improvements has potential to generate dust and may impact normal operation of water delivery.

- **Permanent (Operation-Related)**

Depending on the location of each of the improvements to be made, the District may need to provide mitigation for site specific species of animals and/or plants. This will be addressed by following the necessary CEQA and/or NEPA documentation for the project.

Sub-Options considered but Rejected

None.

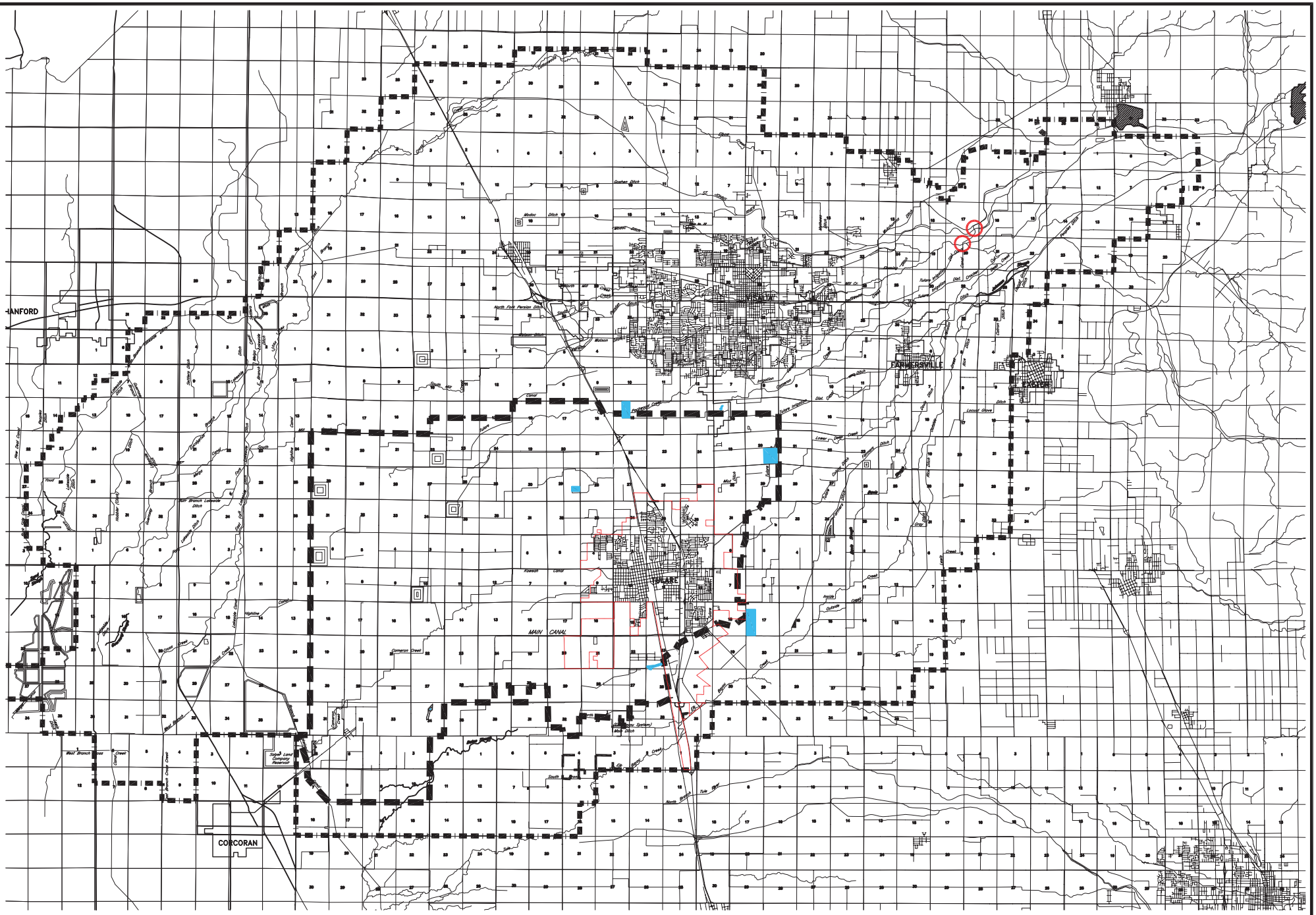
Figures

80-1 Service Area Map

Attachments

References

80-1 Tulare Irrigation District, Water Management Goal Project Description: *Conjunctive Use / Banking Basin*



LEGEND

KAWEAH DELTA WATER CONSERVATION DISTRICT

TULARE IRRIGATION DISTRICT

Figure 80-1: Service Area Map

NORTH

TULARE IRRIGATION DISTRICT

KAWEAH DELTA WATER CONSERVATION DISTRICT / TULARE IRRIGATION DISTRICT BOUNDARY MAP

1350 W. SAN JOAQUIN AVE.
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San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
81	Tulare ID Water Use Efficiency Basin		5 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The Tulare Irrigation District (Tulare ID) proposes to purchase agricultural land located in the middle of its irrigation canal system and utilize the land as an efficiency basin. This improvement will help the district deliver water to farmers as water is requested and at the proper flow rate and volume. By increasing efficiency, the district will reduce the amount of water that is inefficiently applied to crops and reduce the amount of water spilled out of the district or unintentionally lost to seepage in regulation basins. The conserved supply may be used to mitigate the water supply impacts due to the implementation of restoration flows.

Performance Criteria
1 Improve temporary storage facilities within district such that water distribution is more efficient and less water is lost due to spillage.
2 Increase districts ability to capitalize on excess water.

Design Criteria
1 Reclamation Cost Estimating Guidelines

Description
The Tulare ID has approximately 300 miles of canals within the district's distribution system. The district expects a loss of 15-20% of reliable water supply as a result of restoration of the San Joaquin River. In efforts to compensate for this expected loss, the district would like to improve some of its infrastructure, including adding a water use efficiency basin. At this stage, the district has provided only preliminary information for this water management effort.

Currently, the Tulare ID diverts its surface water supplies from the Friant-Kern Canal and Kaweah River system approximately 15 miles northeast of the district. Orders for water diversion are placed 24 hours in advance in anticipation of the following day's demand within the district. It has been observed that often farmers will begin irrigation before scheduled water arrivals or close irrigation gates before their scheduled stopping times. These occurrences create temporary water surpluses or shortages in the district canal system. With the release point 15 miles away, quick adjustments to balance the system are not possible. As a result, water is either spilled out of the district or unintentionally lost in seepage basins

The Tulare Irrigation District (Tulare ID) would like to purchase agricultural land located in the middle of the irrigation canal system to utilize as an efficiency basin. The basin will be designed with SCADA monitoring and control systems. When irrigation demand downstream of the basin goes offline, the basin will begin to store excess water while adjustments are made upstream. When users then start requesting water, basin supplies will be recovered and sent downstream.

The proposed water use efficiency basin would cover 15 acres of land. The preferred location is at the intersection of the Packwood Creek and Cameron Creek. The basin would be designed to allow 11 cfs to be absorbed for duration of 8 hours. This would be sufficient time for system changes to be made in order to balance water supply and demand. The district estimates that 500 acre-feet of water could be recovered in normal years, and up to 1,500 acre-feet during wet years.

Recommendation for Water Management Approach
This project would allow Tulare ID to improve the efficiency of their distribution system, and reduce the amount of water that is inefficiently applied to crops and reduce the amount of water spilled out of the district or unintentionally lost to seepage in regulation basins. If the average annual recharge is approximately 500 acre-feet per year, this represents a 1-2% increase per year in water supply availability over Tulare ID's Class 1 contract amount of 30,000 acre-feet.

Construction Considerations
Construction considerations will need to be assessed once a more detailed feasibility study has been completed.

Schedule (Beginning Dates)
Planning Jan-2008
Agreements Jun-2008
Design Jun-2008
Property (inc. R/W) Jan-2008
Construction Jan-2009
Operational Jun-2010

Real Estate Requirements
- **Fee Purchase** 15 acres
- **Access Rights** None
- **Permanent and Temporary Easements** Temporary easements may be required for construction. Permanent easements may be required for control structures associated with the basin.
- **Flowage Easements** Flowage easements may be required depending on the location of the improvement.

Coordination with Other Options
This option may also be coordinated with other proposed Tulare ID projects that will help the district compensate for loss in reliable water supply. Other Tulare ID options include options 38 (Tulare ID/Lindsay-Strathmore exchange program, 49 (diversion capacity expansion project), 50 (SCADA expansion project), and 51 (farm efficiency study), 80 (upstream recharge basin), and 81 (conjunctive use recharge basin).

Operational and Maintenance Requirements
- **Operations**

Water diverted to the water use efficiency basin will be controlled by a Watermaster that orders the release of water from the Friant-Kern Canal. These orders will likely be placed 24 hours in advance and be dependent on the flow levels in the canal.
- **Maintenance**

Routine maintenance may be required on the control structures to ensure they are in good condition and working properly.
- **Monitoring Requirements**

Water levels within the water use efficiency basin will need to be monitored for capacity such that appropriate decisions can be made about water allocation when surplus or shortage situations occur.

Future Requirements for Design
A feasibility study needs to be performed to assess the water use efficiency basin. Flow data, topographic mapping, subsurface investigations, and groundwater levels may be required for design. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

Potential Environmental Impacts

- **Temporary (During Construction)**

Construction of improvements has potential to generate dust and may impact normal operation of water delivery.

- **Permanent (Operation-Related)**

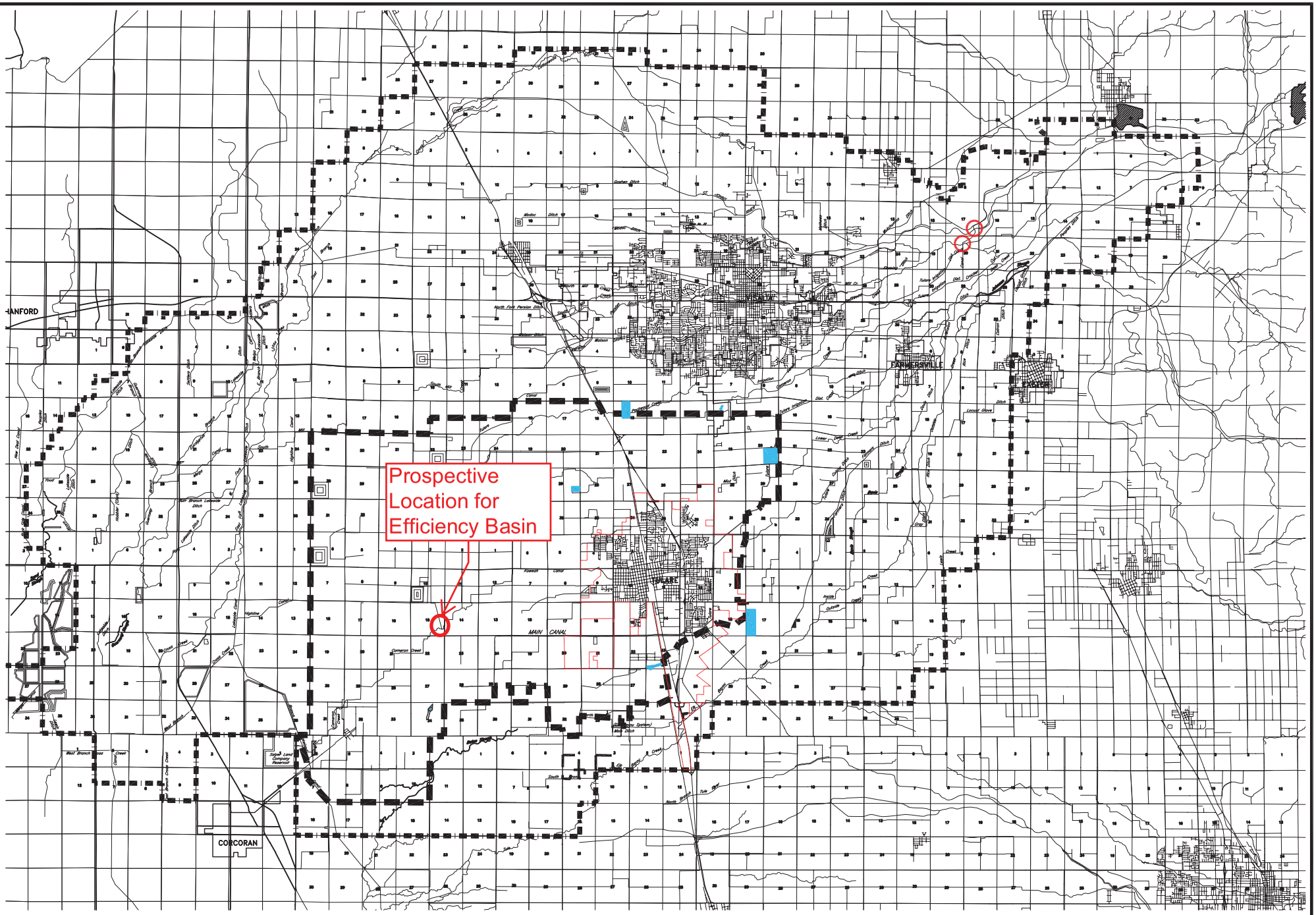
Depending on the location of each of the improvements to be made, the District may need to provide mitigation for site specific species of animals and/or plants. This will be addressed by following the necessary CEQA and/or NEPA documentation for the project.

Sub-Options considered but Rejected
None.

Figures
81-1 Service Area Map
81-2 Project Location Map

Attachments

References
81-1 Tulare Irrigation District, Water Management Goal Project Description: *Water Use Efficiency Basin*
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)



LEGEND

KAWEAH DELTA WATER CONSERVATION DISTRICT

TULARE IRRIGATION DISTRICT

Figure 81-1: Service Area Map

NORTH

TULARE IRRIGATION DISTRICT

KAWEAH DELTA WATER CONSERVATION DISTRICT / TULARE IRRIGATION DISTRICT BOUNDARY MAP

1350 W. SAN JOAQUIN AVE.
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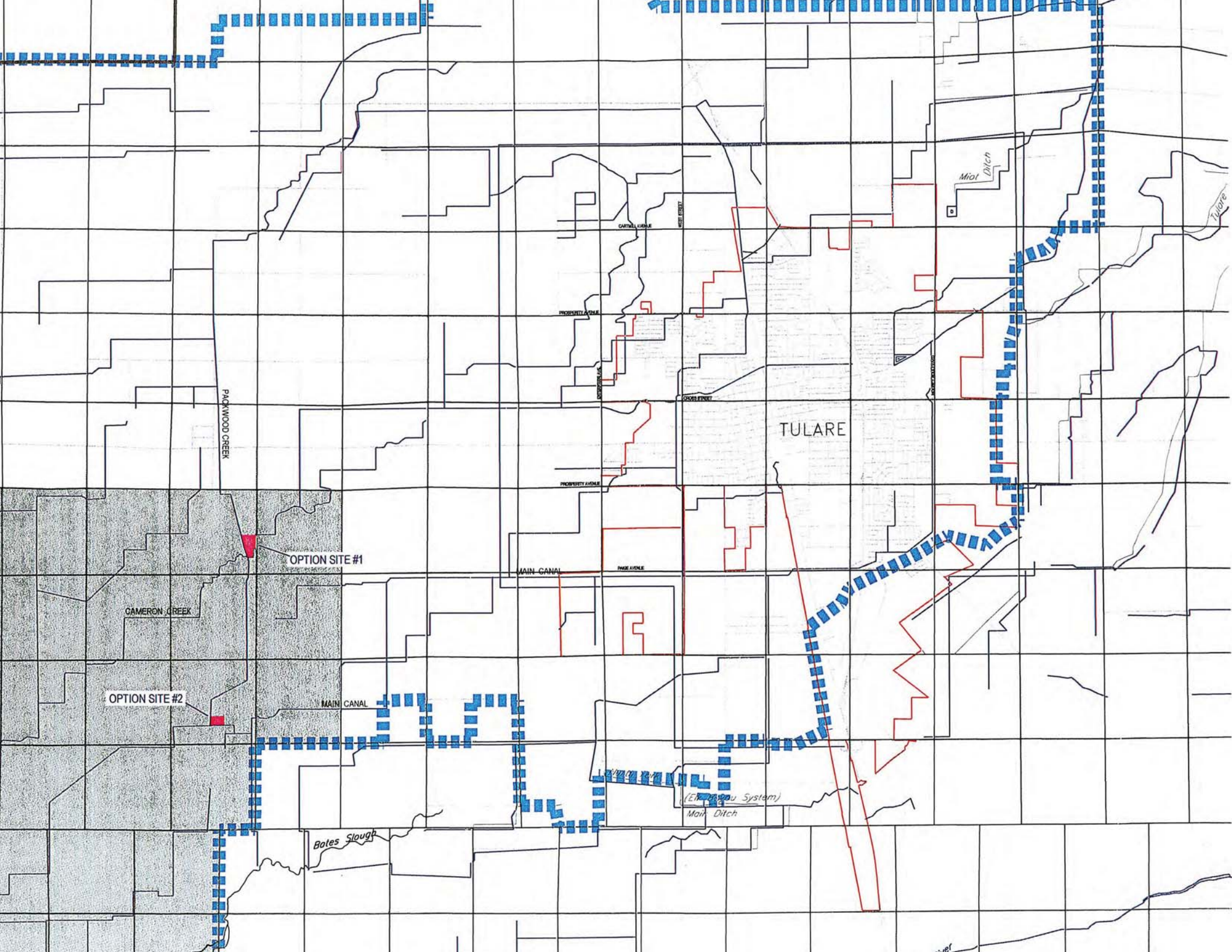

OPTION SITE #1
OPTION SITE #2
CAMERON CREEK
PACKWOOD CREEK
MAIN CANAL
MAIN CANAL
Bates Slough
Main Ditch
Miot Ditch
TULARE
CARTMILL AVENUE
WEST STREET
PROSPERITY AVENUE
CROSS STREET
PROSPERITY AVENUE
PAIGE AVENUE

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
83	City of Fresno Northwest Recharge Project		25 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The City of Fresno proposes to construct a 40-acre recharge facility and necessary conveyance facilities in the northwest portion of the city. The goal of the project is to help offset loss of water supply due to river restoration in the San Joaquin River by increasing the City's water storage capability.

Performance Criteria
1 Offset the loss of CVP supply due to river restoration in the San Joaquin River by construction of a 40-acre facility to recharge excess surface water.
2 Improve water supply reliability

Design Criteria
1 Reclamation Cost Estimating Guidelines

Description

The City of Fresno's Water Division manages and operates the City's water system. The City delivers drinking water to about 122,000 urban residential, commercial, and industrial customers in over 110 square miles of the City of Fresno and some County Islands within the City's Sphere of Influence.

Fresno's primary source of water is groundwater. Using nearly 250 wells, the Water Division pumps about 146 MGD (217 cfs) out of the aquifer beneath the City. Rainfall and stream flow replace about half of the water pumped each year. The other half comes from entitlements held by the City of Fresno for surface water from Millerton Lake and Pine Flat Reservoirs. Fresno's contract for water from Millerton lake is for 60,000 acre-feet of Class 1 Central Valley Project (CVP) water per year. The contract with Pine Flat Lake is for Class 2 water at a ratio of 21% of the water delivered to the Fresno Irrigation District.

The City takes its entitlement water from Millerton Lake and Pine Flat Lake and delivers it through canals to either a series of flood control basins or to "Leaky Acres", a city-owned intentional recharge facility. Leaky Acres currently percolates surface water supplies into the ground at a rate of 55 acre-feet per day. The city also operates a number of other recharge basins in conjunction with the Fresno Metropolitan Flood Control District, but these other basins are generally not available year-round. Without this surface water, more groundwater would be pumped than is replaced naturally, causing long-term overdraft.

This project proposes to construct a 40-acre recharge facility, and necessary conveyance facilities, in the northwest portion of the City of Fresno. The location of the proposed facility is not known. The goal of the project is to offset water lost to river restoration on the San Joaquin River through capture of flood, surplus, or other water supplies available to the City.

The City of Fresno estimates that water recovery for this project is 3,000 acre-feet during dry years, 6,000 acre-feet during normal years, and 6,000 acre-feet during wet years. It is not known how these numbers were calculated and it does not appear that extraction wells have been proposed.

Recommendation for Water Management Approach

This project may offer a water management alternative that would allow the City of Fresno to bank surplus San Joaquin River water during wet years for use during dryer years. The banked water can be used to offset the City of Fresno's loss of Central Valley Project Water.

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

Schedule (Beginning Dates)
Planning: June-2008
Agreements: Oct-2008
Design: Oct-2008
Property: Aug-2008
Construction: Jan-2009
Operational: June-2009

Real Estate Requirements
- **Fee Purchase** 40 acres.
- **Access Rights** None
- **Permanent and Temporary Easements** Permanent easements will be required for access to conveyance facilities. Temporary easements will be required for construction.
- **Flowage Easements** Flowage easements will be required for spreading grounds.

Coordination with Other Options
This option could be coordinated with other City of Fresno options to mitigate the loss of water to river restoration on the San Joaquin River and could be a component of a multi-agency groundwater banking program.

Operational and Maintenance Requirements
- **Operations**

Surplus flows will be conveyed to the recharge basin site through new and/or existing infrastructure for recharge.
- **Maintenance**

Routine maintenance will be required to ensure that conveyance facilities are working and in good condition.
- **Monitoring Requirements**

Storage levels and availability in the recharge bank will need to be monitored.

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 flood or other excess 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 facilities may impact surrounding land and associated operations.
- **Permanent (Operation-Related):**

Depending on project site conditions, environmental mitigation measures may be required. This will be addressed through permitting requirements imposed by Corps of Engineers, Regional Water Quality Control Board, and through CEQA/NEPA documentation process.

Figures

83-1 Service Area Map

Attachments

References

83-1 Project description and details supplied to the Friant Water Users Authority by Lon Martin, City of Fresno, December 6, 2007.

83-2 City of Fresno Water Division. <http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Watermanagement>

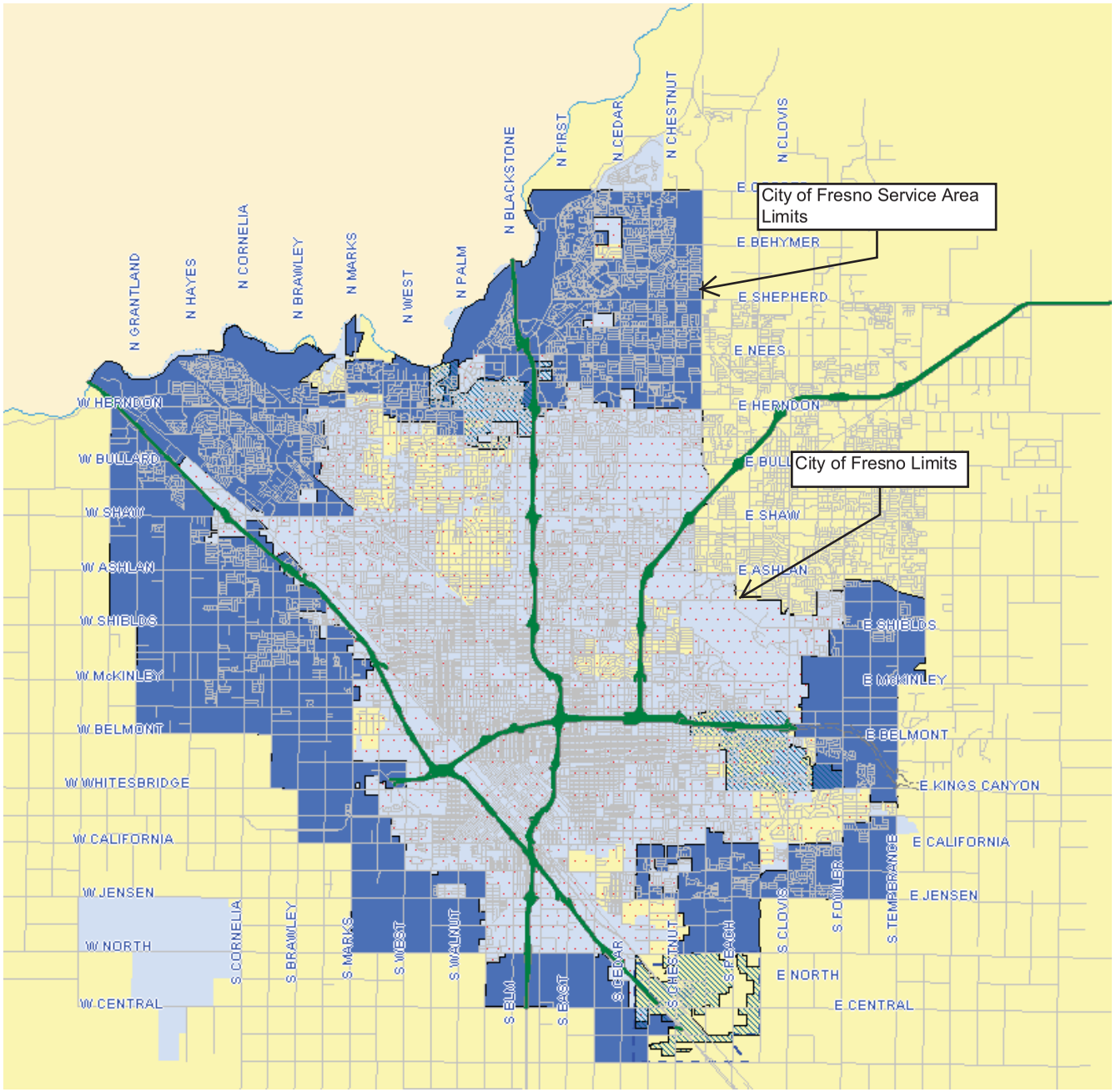


Figure 83-1: Service Area Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
85	City of Fresno Southeast Water Bank		24 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The City of Fresno proposes to construct a 400-acre recharge/water banking facility and necessary extraction and conveyance facilities in the area southeast of the city. The goal of the project is to help offset loss of water supply due to restoration of the San Joaquin River by increasing the capture of flood, surplus, and other water supplies available to the City.

Performance Criteria
1 Offset the loss of CVP supply due to restoration of the San Joaquin River by construction of a 400-acre water banking facility to capture excess surface water.
2 Improve water supply reliability

Design Criteria
1 Reclamation Cost Estimating Guidelines

Description

The City of Fresno's Water Division manages and operates the City's water system. The City delivers drinking water to about 122,000 urban residential, commercial, and industrial customers in over 110 square miles of the City of Fresno and some County Islands within the City's Sphere of Influence.

Fresno's primary source of water is groundwater. Using nearly 250 wells, the Water Division pumps about 146 MGD (217 cfs) out of the aquifer beneath the City. Rainfall and stream flow replace half of the water pumped each year. The other half comes from entitlements held by the City of Fresno for surface water from Millerton Lake and Pine Flat Reservoirs. Fresno's contract for water from Millerton lake is for 60,000 acre-feet of Class 1 Central Valley Project (CVP) water per year. The contract with Pine Flat Lake is for Class 2 water at a ratio of 21% of the water delivered to the Fresno Irrigation District.

The City takes its entitlement water from Millerton Lake and Pine Flat Lake and delivers it through canals to either a series of flood control basins or to "Leaky Acres", a city-owned intentional recharge facility. Leaky Acres currently percolates surface water supplies into the ground at a rate of 55 acre-feet per day. The city also operates a number of other recharge basins in conjunction with the Fresno Metropolitan Flood Control District, but these other basins are generally not available year-round. Without this surface water, more groundwater would be pumped than is replaced naturally, causing long-term overdraft. During wet years, excess flood waters are released from Millerton Lake and Pine Flat Lake and are available to the City of Fresno, but the City cannot effectively capture and use the water with its current infrastructure.
This project proposes to construct a 400-acre recharge/water banking facility, and necessary extraction and conveyance facilities, in the area southeast of the City of Fresno. The location of the proposed facility is not known. The goal of the project is to offset water lost to restoration of the San Joaquin River through capture of flood, surplus, or other water supplies available to the City. Water banking at this facility may be made available to surrounding districts if exchange/banking agreements are made.

The City of Fresno estimates that water recovery for this project is 10,000 acre-feet during dry years, 30,000 acre-feet during normal years, and 30,000 acre-feet during wet years. It is not known how these numbers were calculated.

Recommendation for Water Management Approach

This project may offer a water management alternative that would allow the City of Fresno or surrounding water districts to bank water during wet years for use during dryer years. The banked water can be used to offset the City of Fresno's loss of Central Valley Project Water to river restoration.

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

Schedule (Beginning Dates)
Planning: June-2008
Agreements: June-2009
Design: June-2009
Property: June-2009
Construction: Jan-2010
Operational: June-2011

Real Estate Requirements
- **Fee Purchase** 400 acres.
- **Access Rights** None
- **Permanent and Temporary Easements** Permanent easements will be required for access to conveyance facilities. Temporary easements will be required for construction.
- **Flowage Easements** Flowage easements will be required for surface water spreading grounds.

Coordination with Other Options
This option could be coordinated with other City of Fresno options to mitigate the loss of water to river restoration on the San Joaquin River and could be a component of a multi-agency groundwater banking program.

Operational and Maintenance Requirements
- **Operations**

Surplus flows will be conveyed to the banking facility through new and/or existing infrastructure for recharge and recovered with new extraction wells. Control structures will be operated remotely to divert or extract water to or from the water bank depending on availability of supply and system demand.
- **Maintenance**

Routine maintenance will be required to ensure that conveyance facilities and extraction facilities are working and in good condition.
- **Monitoring Requirements**

Storage levels and availability in the water bank will need to be monitored.

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 flood or other excess 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 facilities may impact surrounding land and associated operations.

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

Depending on project site conditions, environmental mitigation measures may be required. This will be addressed through permitting requirements imposed by Corps of Engineers, Regional Water Quality Control Board, and through CEQA/NEPA documentation process.

Sub-Options considered but Rejected

None

Figures

85-1 Service Area Map

Attachments

References

85-1 Project description and details supplied to the Friant Water Users Authority by Lon Martin, City of Fresno, December 6, 2007.

85-2 City of Fresno Water Division. <http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Watermanagement>

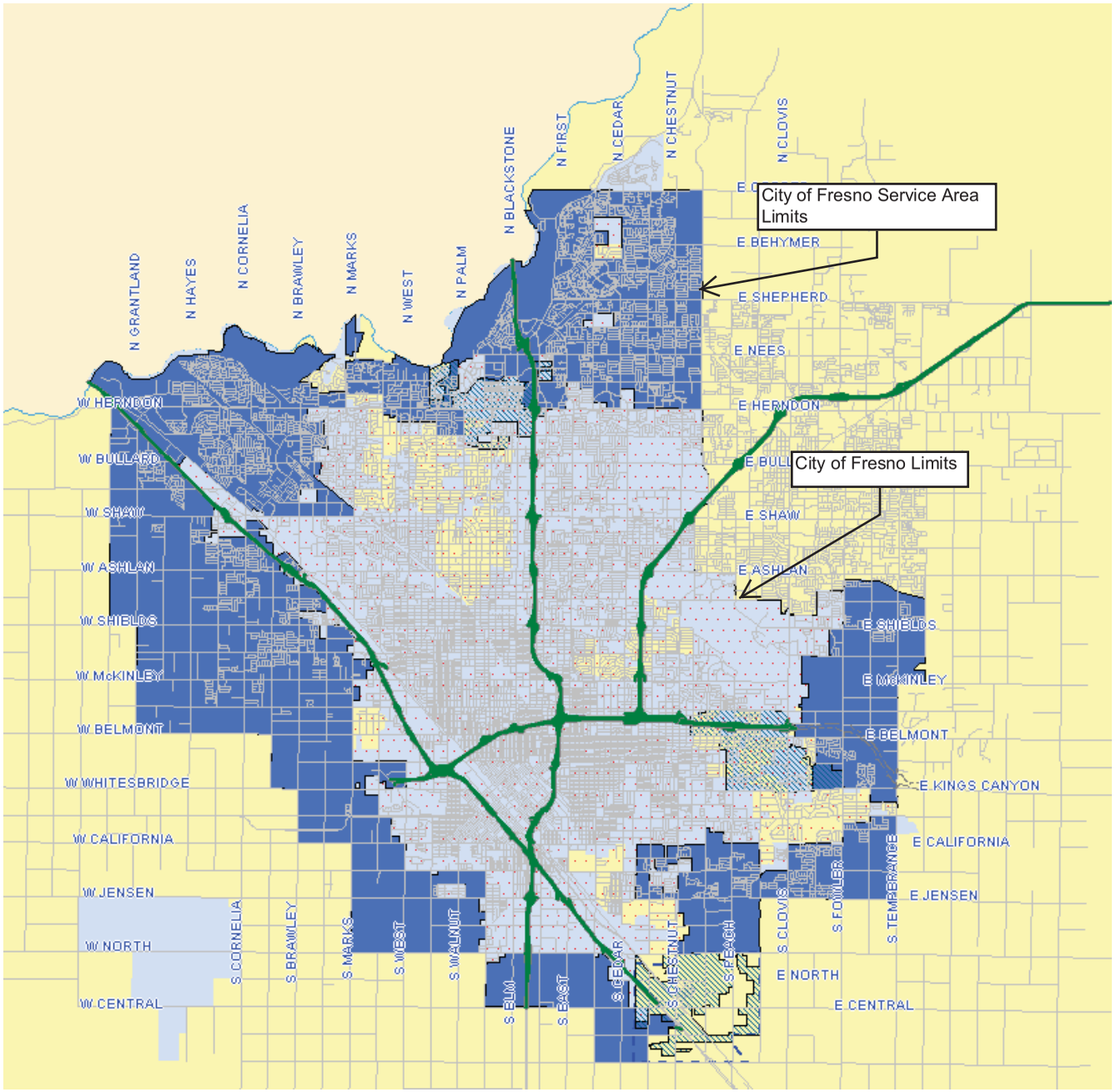


Figure 85-1: Service Area Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
86	City of Fresno Southwest Recharge Project		24 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The City of Fresno proposes to construct a 40-acre recharge facility, and necessary conveyance facilities, in the southwest portion of the city. The goal of the project is to help offset loss of water supply due to river restoration in the San Joaquin River by increasing the City's water storage capability.

Performance Criteria
1 Offset the loss of CVP supply due to river restoration in the San Joaquin River by construction of a 40-acre facility to recharge excess surface water.
2 Improve water supply reliability

Design Criteria
1 Reclamation Cost Estimating Guidelines

Description

The City of Fresno's Water Division manages and operates the City's water system. The City delivers drinking water to about 122,000 urban residential, commercial, and industrial customers in over 110 square miles of the City of Fresno and some County Islands within the City's Sphere of Influence.

Fresno's primary source of water is groundwater. Using nearly 250 wells, the Water Division pumps about 146 MGD (217 cfs) out of the aquifer beneath the City. Rainfall and stream flow replace about half of the water pumped each year. The other half comes from entitlements held by the City of Fresno for surface water from Millerton Lake and Pine Flat Reservoirs. Fresno's contract for water from Millerton lake is for 60,000 acre-feet of Class 1 Central Valley Project (CVP) water per year. The contract with Pine Flat Lake is for Class 2 water at a ratio of 21% of the water delivered to the Fresno Irrigation District.

The City takes its entitlement water from Millerton Lake and Pine Flat Lake and delivers it through canals to either a series of flood control basins or to "Leaky Acres", a city-owned intentional recharge facility. Leaky Acres currently percolates surface water supplies into the ground at a rate of 55 acre-feet per day. The city also operates a number of other recharge basins in conjunction with the Fresno Metropolitan Flood Control District, but these other basins are generally not available year-round. Without this surface water, more groundwater would be pumped than is replaced naturally, causing long-term overdraft.

This project proposes to construct a 40-acre recharge facility, and necessary conveyance facilities, in the southwest portion of the City of Fresno. The location of the proposed facility is unknown. The goal of the project is to offset water lost to river restoration on the San Joaquin River through capture of flood, surplus, or other water supplies available to the City.

The City of Fresno estimates that water recovery for this project is 3,000 acre-feet during dry years, 6,000 acre-feet during normal years, and 6,000 acre-feet during wet years. It is not known how these numbers were calculated and it does not appear that extraction wells have been proposed.

Recommendation for Water Management Approach

This project may offer a water management alternative that would allow the City of Fresno to bank surplus San Joaquin River water during wet years for use during dryer years. The banked water can be used to offset the City of Fresno's loss of Central Valley Project Water.

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

Schedule (Beginning Dates)
Planning: June-2008
Agreements: Oct-2008
Design: Oct-2008
Property: Aug-2008
Construction: Jan-2009
Operational: June-2009

Real Estate Requirements
- **Fee Purchase** 40 acres.
- **Access Rights** None
- **Permanent and Temporary Easements** Permanent easements will be required for access to conveyance facilities. Temporary easements will be required for construction.
- **Flowage Easements** Flowage easements will be required for spreading grounds.

Coordination with Other Options
This option could be coordinated with other City of Fresno options to mitigate the loss of water to river restoration on the San Joaquin River and could be a component of a multi-agency groundwater banking program.

Operational and Maintenance Requirements
- **Operations**

Surplus flows will be conveyed to the recharge basin site through new and/or existing infrastructure for recharge.
- **Maintenance**

Routine maintenance will be required to ensure that conveyance facilities are working and in good condition.
- **Monitoring Requirements**

Storage levels and availability in the recharge bank will need to be monitored.

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 flood or other excess 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 facilities may impact surrounding land and associated operations.
- **Permanent (Operation-Related):**

Depending on project site conditions, environmental mitigation measures may be required. This will be addressed through permitting requirements imposed by Corps of Engineers, Regional Water Quality Control Board, and through CEQA/NEPA documentation process.

Figures

86-1 Service Area Map

Attachments

References

86-1 Project description and details supplied to the Friant Water Users Authority by Lon Martin, City of Fresno, December 6, 2007.

86-2 City of Fresno Water Division. <http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Watermanagement>

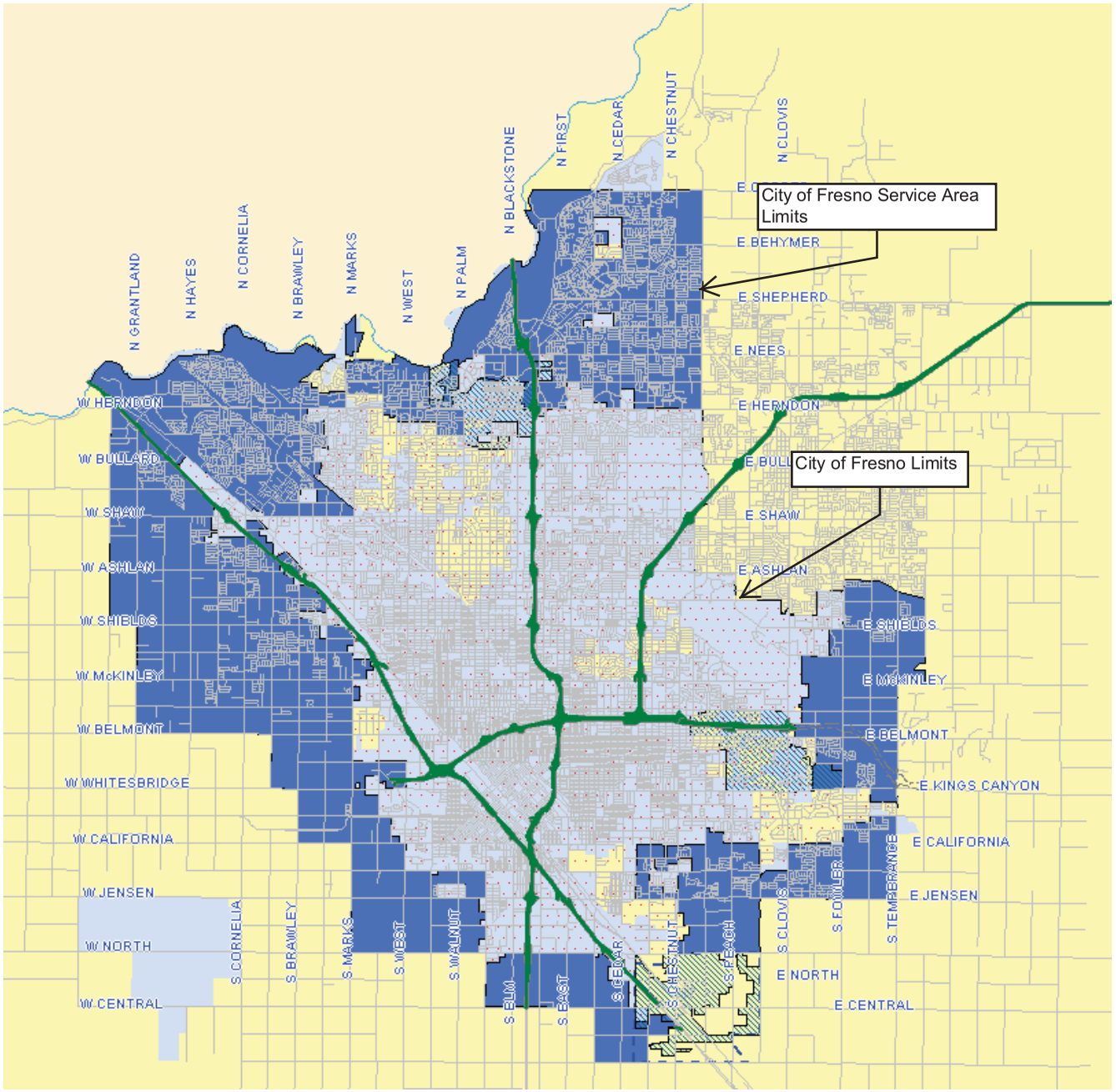


Figure 86-1: Service Area Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
87	City of Fresno Westside Water Bank and Tertiary Treatment at Fresno/Clovis Regional Wastewater Reclamation Facility with intertie to San Joaquin River		25 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The City of Fresno proposes to construct a 600 acre water bank and a 36 MGD tertiary level treatment system at the Fresno/Clovis Regional Wastewater Reclamation Facility. In addition, related facilities will be constructed including a transmission pipeline from the reclamation facility to the water bank, a transmission pipeline and intertie from the water bank to the San Joaquin River, a structure to divert flood flows in the San Joaquin River into the water bank, and 40 extraction wells.

Performance Criteria
1. Offset the loss of CVP supply due to river restoration in the San Joaquin River through reuse of recycled water currently lost to the City.
2. Provide reclaimed wastewater and recovered groundwater to meet the restoration hydrographs and reduce the required releases at Friant Dam.
3. Capture surplus San Joaquin River flows for recharge and subsequent recovery.
4. Improve quality of regional water supply

Design Criteria
1. Reclamation Cost Estimating Guidelines

Description

On an average day, the Fresno-Clovis Regional Wastewater Treatment Plant operated by the City of Fresno, California, receives 68 million gallons of wastewater. The treatment facility is located at the intersection of Jensen and Cornelia roads in southwest Fresno. See **Figure 87-1**. Wastewater generated from homes and businesses in the metro area travels through 1700 miles of sanitary sewer lines to the treatment facility. Treatment consists of two major steps; primary and secondary treatment, and a process to treat solids removed in the process at the plant.

The Fresno-Clovis Regional Wastewater Treatment Facility has capacity to treat 80 million gallons per day (MGD) of wastewater. Secondary-treated or reclaimed wastewater is directed to 1660 acres of ponds to percolate into the ground. A portion of the reclaimed wastewater is also supplied directly to nearby farmers to irrigate fodder and fiber crops, such as alfalfa and cotton.

This project proposes to construct a 36 MGD tertiary-level treatment system at the existing treatment facility. Tertiary-treated water would be discharged into a water bank for recharge. The benefits of a tertiary treatment facility would allow water to potentially be discharged directly back into the San Joaquin River, or perhaps blended with previously banked groundwater and then discharged into the river. Water could potentially be added at a pre-determined temperature as well.

In addition to expanding the wastewater treatment facility, the City of Fresno would like to increase the size of their groundwater bank and build associated infrastructure to increase their ability to transfer water among the San Joaquin River, the treatment facility, and the groundwater bank. The addition to the groundwater bank would involve construction of a 600-acre spreading grounds west of the City of Fresno (location unknown). Infrastructure improvements would involve a transmission pipeline to convey water from the wastewater treatment facility to the groundwater bank, another to convey water from the groundwater bank to the San Joaquin River, and a third to convey water from the San Joaquin River to the groundwater bank. Finally, the City would like to add 40 extraction wells at the site of the new groundwater bank to allow the water to be pumped and delivered to the San Joaquin River based on restoration requirements.

The City of Fresno estimates that water recovery for this project is 40,300 acre-feet during dry years, 50,000 acre-feet during normal years, and 60,000 acre-feet during wet years. It is not known how these numbers were calculated.

Recommendation for Water Management Approach

If recycled water can be discharged directly back into the San Joaquin River or blended with groundwater and discharged into the river, this project could potentially be used to meet water management goals by off-setting all, or a portion, of the City of Fresno's water supply contribution to the restoration flows and reducing the required releases at Friant Dam. If water cannot be discharged directly to the river, this project may not provide benefit for water management purposes since effluent from the treatment plant is already discharged into the ground. A 36 MGD (or 56 cfs) tertiary-treatment facility could potentially provide an equivalent amount of water back to the San Joaquin River. Also, information provided by the City of Fresno about this project indicates that discharges into the San Joaquin could potentially be temperature controlled. Although specifics of how this might work are not known, if cold-temperature discharges are possible, this has potential to help with restoration of Chinook salmon in the San Joaquin River. The proposed diversion structure and transmission pipeline from the San Joaquin River and the 600 acre banking facility will allow the City to capture additional surplus flows for recharge and subsequent recovery to meet customer demands and the San Joaquin River restoration hydrographs.

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

Schedule (Beginning Dates)
Planning: June-2012
Agreements: June-2013
Design: June-2013
Property: June-2013
Construction: June-2014
Operational: June-2015

Real Estate Requirements
- **Fee Purchase** 600 acres for spreading grounds.
- **Access Rights** Access rights must be acquired to access and maintain pipelines.
- **Permanent and Temporary Easements** Permanent easements will be required for access to pipelines. Temporary easements will be required for construction.
- **Flowage Easements** Flowage easements will be required for spreading grounds.

Coordination with Other Options
This option could be coordinated with other City of Fresno options to mitigate the loss of water to river restoration on the San Joaquin River and could be a component of a multi-agency groundwater banking program. In addition, this option should be coordinated with restoration activities to determine the potential to integrate into the restoration hydrographs.

Operational and Maintenance Requirements

- **Operations**

The new tertiary-treatment addition would be coordinated with the existing facility operations. It is not known what additional utilities or other needs may be necessary.

- **Maintenance**

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

- **Monitoring Requirements**

Storage levels and availability in the groundwater bank, and potentially temperature, will be monitored in the extraction wells.

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 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 facilities may impact surrounding land and associated operations.

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

Depending on project site conditions, environmental mitigation measures may be required. This will be addressed through permitting requirements imposed by Corps of Engineers, Regional Water Quality Control Board, and through CEQA/NEPA documentation process.

Sub-Options considered but Rejected

None

Figures

87-1 Regional Map

Attachments

References

87-1 Project description and details supplied to the Friant Water Users Authority by Lon Martin, City of Fresno, December 6, 2007.

87-2 City of Fresno Water Division. <http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Watermanagement>

Figure 87-1: Regional Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
92	Arvin-Edison WSD Out-of-District Groundwater Bank		24 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not Applicable
Agreements: Not available at this time.
Annual Costs during Dry Years: Not available at this time.

Objective of Option
Arvin-Edison Water Storage District proposes to obtain long-term approval for a "2 for 1" water banking program whereby Arvin-Edison will bank water in Rosedale-Rio Bravo Water Storage District (RRB) and leave behind 1 acre-foot of water for each acre-foot of water that RRB returns to Arvin-Edison. Arvin-Edison would also like to establish a framework for agreements with other districts as opportunities arise. This will help meet the water management goal by allowing Arvin-Edison to capture surplus San Joaquin River flows in the Friant-Kern Canal for extraction during dryer years.

Performance Criteria
Finalize an agreement between Arvin-Edison WSD and Rosedale-Rio Brave WSD to store surface water supplies capable of creating a 10,000 acre-foot dry year supply for Arvin-Edison. Pursue agreements with other water districts as opportunities arise.

Design Criteria

Description
Arvin-Edison Water Storage District (Arvin-Edison) is located in the southern portion of the San Joaquin Valley, southeast of Bakersfield, past the terminus of the Friant-Kern Canal (FKC). Due to the absence of surface streams and low annual precipitation, the district is dependent entirely on water brought in from outside sources and groundwater reserves.

Arvin-Edison has previously made agreements with outside entities to expand existing or create new groundwater banking programs. These programs allow Arvin-Edison to convert erratic or unpredictable wet-year supplies into schedulable dryer-year supplies by storing water underground in an area outside of Arvin-Edison for later return. Wet year supplies in the Friant-Kern Canal are often available at high flows and for relatively short duration. During wet years, Arvin-Edison cannot fully capitalize on excess surface supplies due to limitations in its infrastructure. Banking programs outside Arvin-Edison utilize available capacity in other districts' infrastructure, thus limiting to some extent the requirement for new infrastructure within Arvin-Edison.

Arvin-Edison currently has a banking partnership with Rosedale-Rio Bravo Water Storage District (RRB) whereby they bank excess flood waters beneath RRB and RRB returns the water to Arvin-Edison when needed. See **Figures 92-1, 92-2, and 92-3**. Arvin-Edison would like to enter into a long-term agreement with RRB that will allow them to continue to bank excess water supplies there. Historically, the terms of

the agreement between Arvin-Edison and RRBWSD have typically been based upon imbalanced exchanges, such as a 2:1 ratio, whereby Arvin-Edison leaves behind 1 acre-foot of water in RRB for each acre-foot of water that RRB returns to Arvin-Edison. RRB otherwise pays all the costs to convey, bank, and return the supplies to Arvin-Edison.

Arvin-Edison would like to enter into a long-term 2 for 1 banking agreement with RRB for a 10,000 acre-foot dry period supply, where RRB pays all the costs to convey, bank, and return Arvin-Edison supplies. RRB would utilize existing banking facilities for the program with no new construction involved. Arvin-Edison requires approval from the USBR for such a program.

The district is also exploring other banking options that may have openings for Arvin-Edison participation, including RRB/Irvine Ranch WD's Strand Ranch Integrated Banking Project, Kern-Delta WD/MWD Banking Project (See **Figure 92-4**), Semitropic WSD Stored Water Recovery Project, Semitropic/Rosamond CSD/Mojave Groundwater Bank, and the Madera Ranch Groundwater Bank.

Recommendation for Water Management Approach
This option is an institutional proposal and would not require any construction. The increase in surface water reliability would help Arvin-Edison mitigate for a loss in reliable water supply in the Friant-Kern Canal by providing a location to store surplus San Joaquin River waters available in the Friant-Kern Canal during wet years that may be recovered and distributed during dryer years. This storage location may also be considered for broader water management possibilities, such as storing excess CVP water and Recaptured water here that may be delivered to multiple Friant districts during dryer years. With the minimal data available at this time, it is uncertain the capacity of the known groundwater banks or potential infrastructure improvements that may be necessary to store additional water.

Construction Considerations
No construction required for this option.

Schedule
Agreements: July-2008 to July-2009
Operational: Aug-2010

Real Estate Requirements
- **Fee Purchase** None
- **Access Rights** None
- **Permanent and Temporary Easements** None
- **Flowage Easements** None

Coordination with Other Options
This option could be coordinated with water management alternatives to store excess flood waters available in the Friant-Kern Canal during wet years for use during dryer years. Storage in Rosedale-Rio Brave WSD could also be utilized to store Recaptured water brought from the California Aqueduct. This should also be coordinated with other Arvin-Edison projects, including options 57, 89, 90, 91, 93, and 94. It should be noted that Arvin-Edison is seeking capacity in the Madera ID and Semitropic WSD groundwater banking programs which are Options 42 and 100, respectively. Option 42 would avoid the capacity constraints of the FKC which may require enlargement (Option 61) to accommodate additional groundwater banking in Arvin-Edison. Option 100 may require additional east-west conveyance and/or interconnections with Friant districts to be viable, such as Options 69 and 70. This option could serve as the framework for a multi-district regional groundwater banking program.

Operational and Maintenance Requirements
- **Operations**

Water will be diverted from Arvin-Edison's turnout on the Friant-Kern Canal into an intertie connection to

RRBWSD's distribution system. When needed, water will be delivered back from RRBWSD through the same intertie into the Arvin-Edison Intake Canal. Other conveyance routes are possible depending on current capacity restrictions. See **Figure 92-3**.

- **Maintenance**

Existing facilities will need to be maintained in working order.

- **Monitoring Requirements**

Monitoring will likely require accurate water measurements and record-keeping by RRB, as well as RRB being required to maintain adequate groundwater level and quality monitoring to assure that negative impacts are eliminated or mitigated and positive impacts are documented.

Future Requirements for Design

A feasibility study needs to be performed to assess this alternative. The alternative formulation report needs to be completed to assess whether this project will work in accordance with the water management goal. Exchange agreements between districts needs to be prepared.

Potential Environmental Impacts

- **Temporary (During Construction):**

None

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

The long-term groundwater banking program will likely require appropriate CEQA/NEPA environmental documentation. Agreements involving transfers of contracts, if applicable, will also require environmental documentation.

Sub-Options considered but Rejected

None

Figures

92-1 Region Map
92-2 Kern Fan Monitoring Committee, Showing Location of RRB Recharge Facilities
92-3 System Schematic Map
92-4 Kern Delta WD Proposed Banking and In-Lieu Facilities

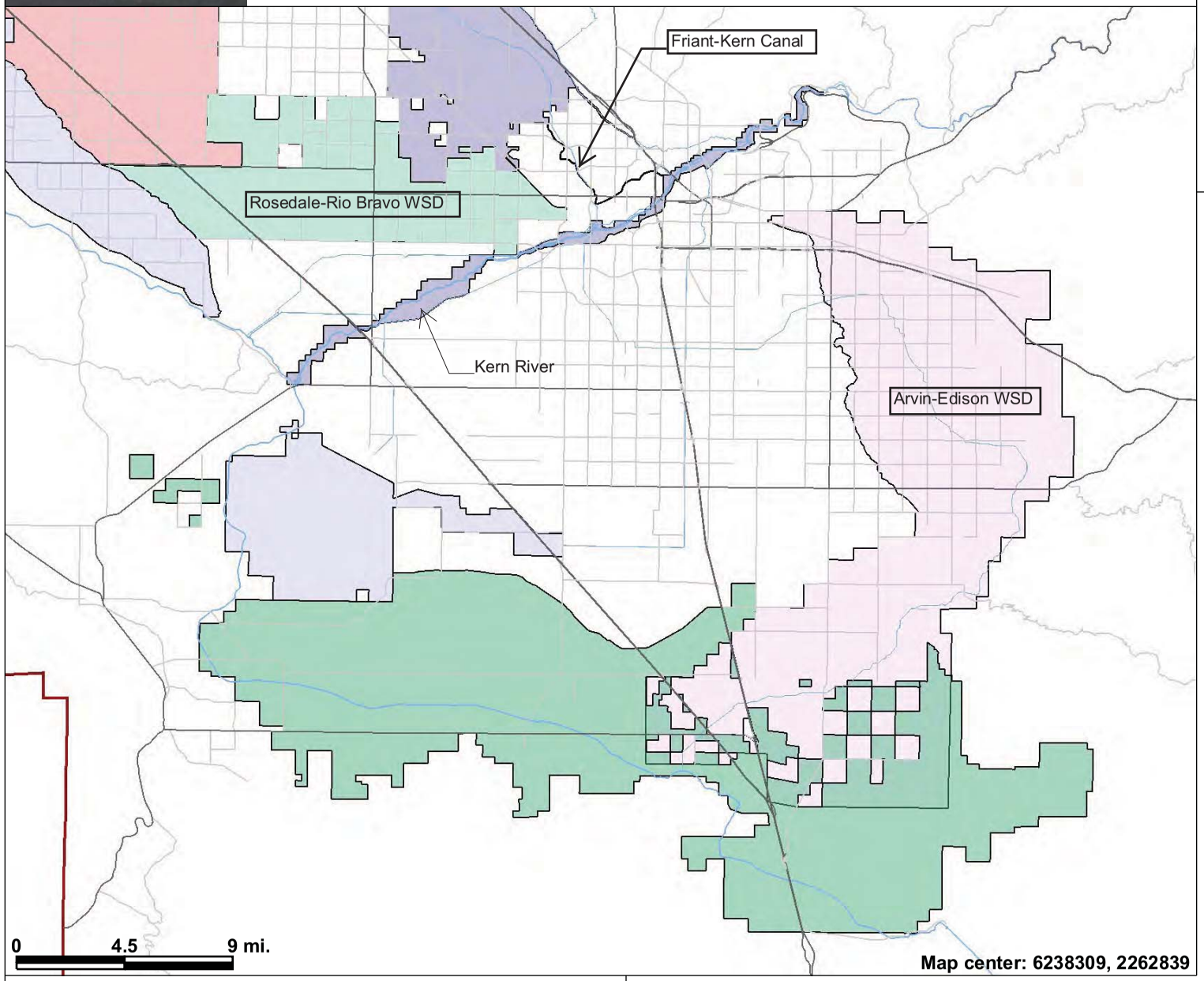
Attachments

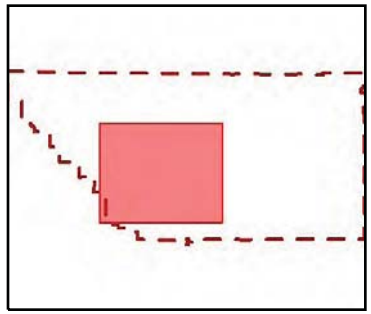
References

92-1 Arvin-Edison Water Storage District, *Response to John Roldan's RFI, San Joaquin River Restoration Water Management Goal Projects, Out-of-District Groundwater Bank*, March 7, 2008

92-2 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)

Kern County Online Mapping



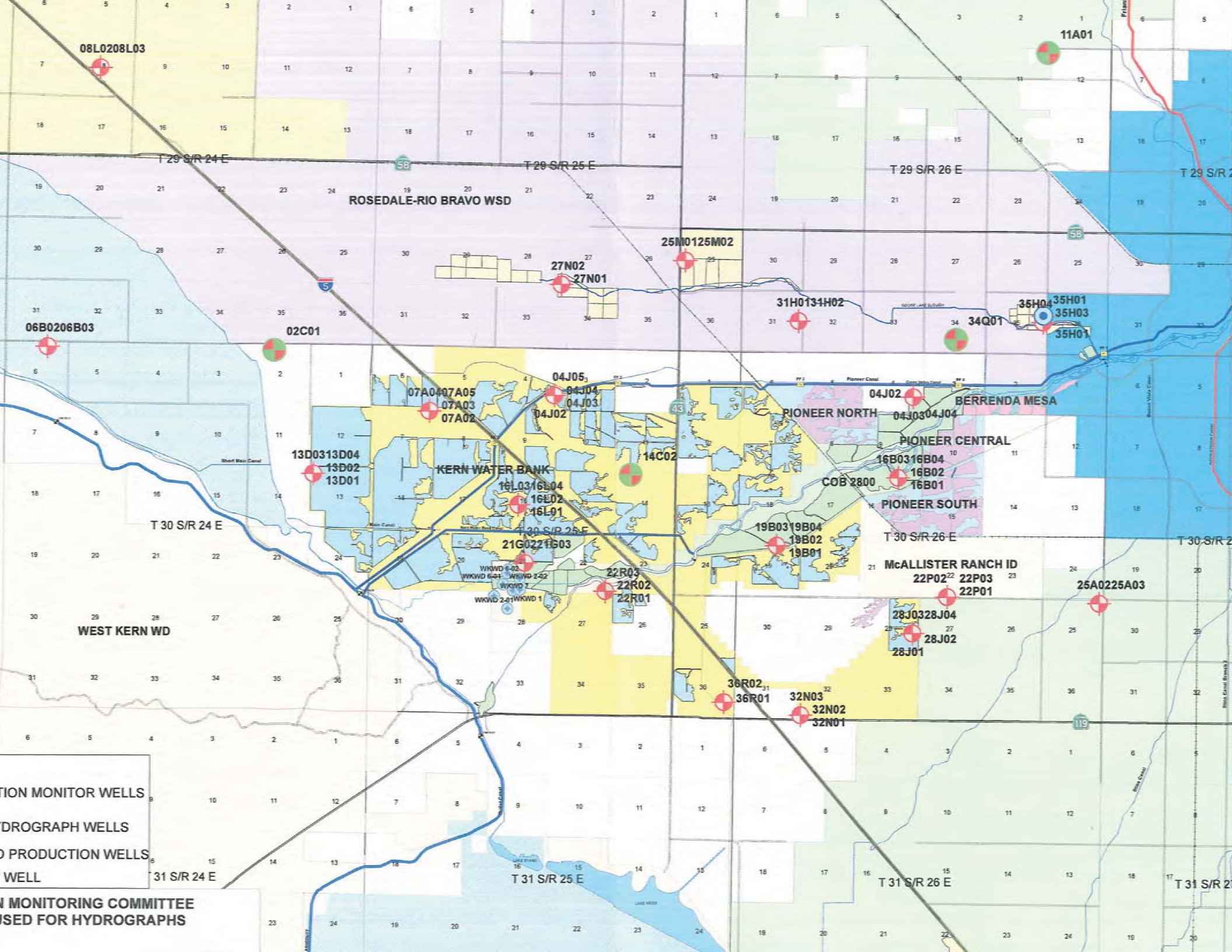


Legend

- Roads
- Arterial
- Highway
- Ramp
- County of Kern
- Water Course
- water_storage_dist
- Arvin-Edison Water Storage District
- Belridge Water Storage District
- Buena Vista Water Storage District
- North Kern Water Storage District
- Rosedale-Rio Bravo Water Storage District
- Semitropic Water Storage District
- Wheeler Ridge-Maricopa Water Storage District

Scale: 1:400,001

Figure 92-1: Region Map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T 29 S/R 24 E
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ROSEDALE-RIO BRAVO WSD
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27N01
31H0131H02
35H04
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BERRENDA MESA
PIONEER NORTH
04J03
04J04
PIONEER CENTRAL
13D0313D04
13D02
13D01
KERN WATER BANK
14C02
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WKWD 7
WKWD 2-01
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WEST KERN WD
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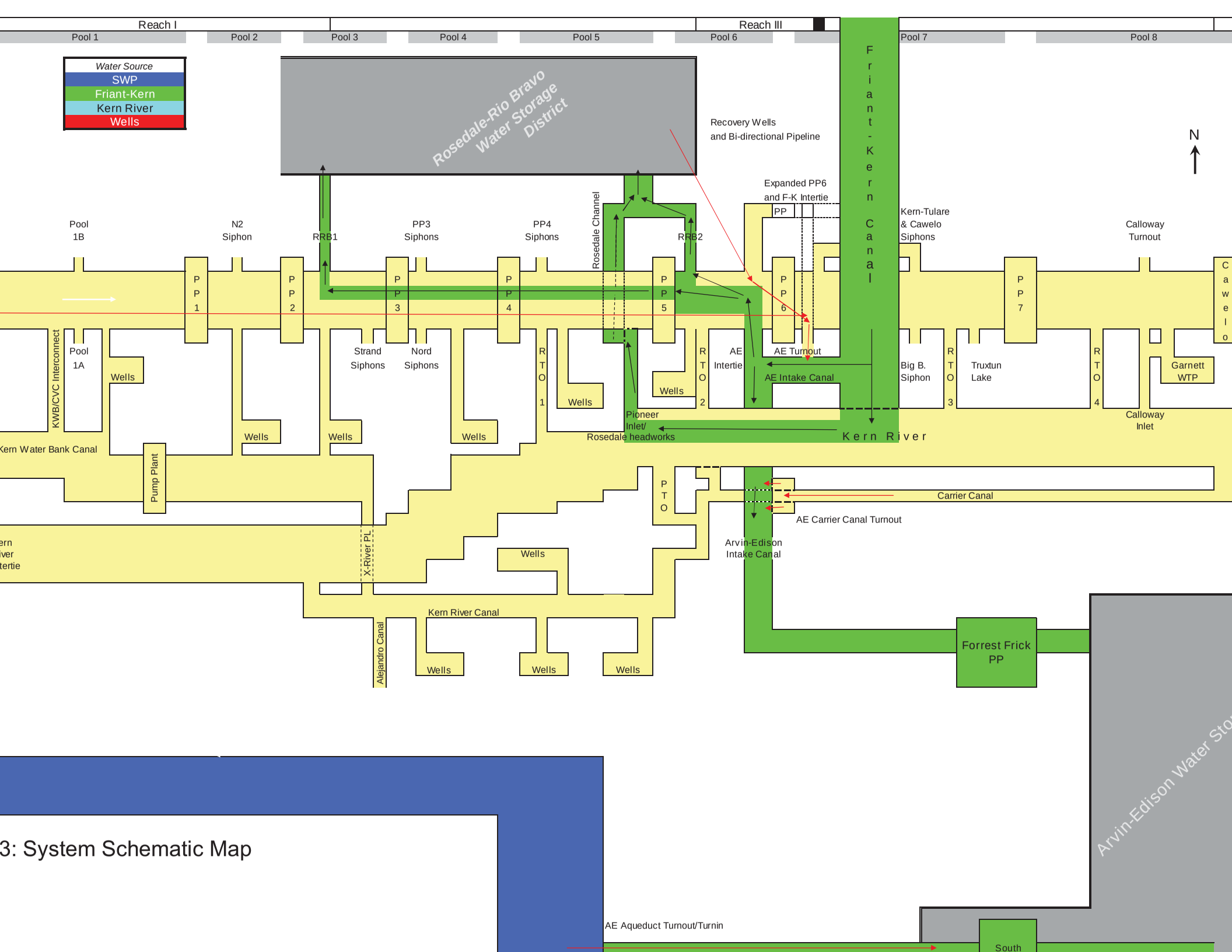
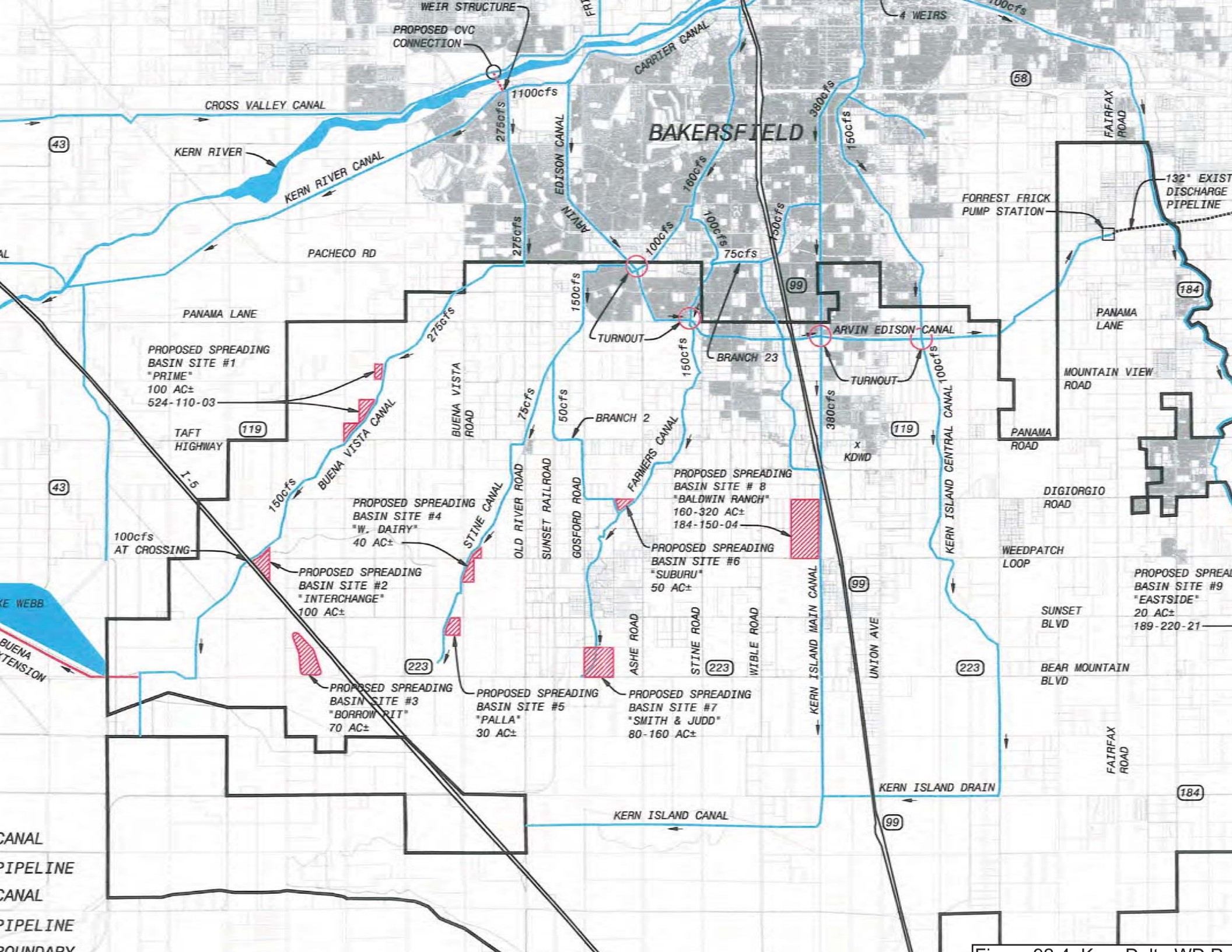
D PRODUCTION WELLS
WELL
N MONITORING COMMITTEE
USED FOR HYDROGRAPHS


Reach I
Reach III
Pool 1
Pool 2
Pool 3
Pool 4
Pool 5
Pool 6
Pool 7
Pool 8
Water Source
SWP
Friant-Kern
Kern River
Wells
Rosedale-Rio Bravo Water Storage District
Recovery Wells and Bi-directional Pipeline
Friant-Kern Canal
N
Expanded PP6 and F-K Intertie
PP
Kern-Tulare & Cawelo Siphons
Calloway Turnout
Pool 1B
N2 Siphon
RRB1
PP3 Siphons
PP4 Siphons
Rosedale Channel
RRB2
PP1
PP2
PP3
PP4
PP5
PP6
PP7
Cawelo
KWB/CVC Interconnect
Pool 1A
Wells
Strand Siphons
Nord Siphons
RTO1
RTO2
AE Intertie
AE Turnout
AE Intake Canal
Big B. Siphon
RTO3
Truxtun Lake
RTO4
Garnett WTP
Calloway Inlet
Pioneer Inlet/ Rosedale headworks
Kern River
Kern Water Bank Canal
Pump Plant
PTO
Carrier Canal
AE Carrier Canal Turnout
Arvin-Edison Intake Canal
X-River PL
Kern River Canal
Alejandro Canal
Forrest Frick PP
Arvin-Edison Water Sto
3: System Schematic Map
AE Aqueduct Turnout/Turnin
South


WEIR STRUCTURE
PROPOSED CVC CONNECTION
CARRIER CANAL
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100cfs
CROSS VALLEY CANAL
1100cfs
275cfs
EDISON CANAL
380cfs
150cfs
BAKERSFIELD
58
FAIRFAX ROAD
43
KERN RIVER
KERN RIVER CANAL
ARVIN
160cfs
100cfs
75cfs
FORREST FRICK PUMP STATION
132" EXIST DISCHARGE PIPELINE
PACHECO RD
99
184
PANAMA LANE
TURNOUT
ARVIN EDISON CANAL
BRANCH 23
PROPOSED SPREADING BASIN SITE #1
"PRIME"
100 AC±
524-110-03
BUENA VISTA ROAD
MOUNTAIN VIEW ROAD
TAFT HIGHWAY
119
BUENA VISTA CANAL
50cfs
BRANCH 2
FARMERS CANAL
x KDWD
PANAMA ROAD
I-5
KERN ISLAND CENTRAL CANAL
DIGIORGIO ROAD
PROPOSED SPREADING BASIN SITE # 8
"BALDWIN RANCH"
160-320 AC±
184-150-04
PROPOSED SPREADING BASIN SITE #4
"W. DAIRY"
40 AC±
STINE CANAL
OLD RIVER ROAD
SUNSET RAILROAD
GOSFORD ROAD
100cfs AT CROSSING
PROPOSED SPREADING BASIN SITE #6
"SUBURU"
50 AC±
WEEDPATCH LOOP
PROPOSED SPREADING BASIN SITE #2
"INTERCHANGE"
100 AC±
PROPOSED SPREAD BASIN SITE #9
"EASTSIDE"
20 AC±
189-220-21
SUNSET BLVD
ASHE ROAD
STINE ROAD
WIBLE ROAD
KERN ISLAND MAIN CANAL
UNION AVE
223
BEAR MOUNTAIN BLVD
PROPOSED SPREADING BASIN SITE #3
"BORROW PIT"
70 AC±
PROPOSED SPREADING BASIN SITE #5
"PALLA"
30 AC±
PROPOSED SPREADING BASIN SITE #7
"SMITH & JUDD"
80-160 AC±
FAIRFAX ROAD
KERN ISLAND DRAIN
KERN ISLAND CANAL
CANAL
PIPELINE
CANAL
PIPELINE

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
98	Connect FKC Turnout to Cawelo's North System (Non-Friant)		5 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
The Cawelo Water District, in association with the Integrated Regional Water Management Plan (IRWMP) Management Group, proposes to connect the Friant-Kern Canal with Cawelo's Lateral N-5 by adding a turnout near McFarland, CA, and pumping water through up to 4 miles of 36-inch diameter pipeline into Cawelo. This project would help increase water reliability to Cawelo Water District and help enhance groundwater levels and reduce the occurrences of overdraft. This project would also create an opportunity for Friant Districts to exchange surplus San Joaquin River supplies for State Water Project supplies.

Performance Criteria
Construct a 40 cfs conveyance system to deliver water from the Friant-Kern Canal to Cawelo Water District.

Design Criteria
Reclamation Cost Estimating Guidelines

Description
The Cawelo Water District is located in the southern portion of the San Joaquin valley near the terminus of the Friant-Kern Canal into the Kern River. See Figure 98-1. The district supplies water to over 45,000 acres of permanent crops and was formed in 1965 for the purpose of obtaining water supplies to supplement pumping of groundwater for irrigation. The Cawelo Water District is not a Friant contracting district and currently has a contract to receive SWP water from the California Aqueduct via the Cross Valley Canal.

The district would like to construct a direct tie-in to the Friant-Kern Canal in order to take advantage of short-duration flood flows in the Friant-Kern Canal and to increase availability of surface water supplies. The proposed tie-in would involve construction of a 40 cfs pumping plant and a 36-inch diameter pipeline that will extend 3 to 4 miles from the Friant-Kern Canal to Cawelo's Lateral N-5. See Figure 98-2. In addition, the project will involve installation of a turnout on the Friant-Kern canal, a traveling trash screen in the canal over the outlet grate, a connection to the Cawelo system, and fencing and power to the facilities.

The Cawelo Water District proposes to use Friant-Kern Water as follows. During wet years, the district will deliver 5,000 acre-feet to irrigated lands and 2,000-3,000 acre-feet to spreading ponds. Without the project, this water would be pumped from the ground. During dry years, the district will deliver water from existing sources and exchanges. The district expects that groundwater levels will be higher than previous years and will provide both increased yields and reduced pumping costs to both the district and private landowners.

Recommendation for Water Management Approach
This project has the potential to facilitate an exchange of surplus San Joaquin River supplies for State Water Project supplies. Friant Districts with little groundwater recharge capability may be able to negotiate an exchange of their Recovered Water Account supplies for a portion of Cawelo's State Water Project supplies. Potential incentives for such an exchange may be cost savings and higher quantities of water for Cawelo and a scheduled supply of water for the Friant Districts. In addition, this project may allow Friant Districts and Cawelo to transfer portions of their CVP and SWP contracts to one another to increase operational flexibility and water delivery priority in the CVP and SWP systems.

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

Schedule
Feasibility Study: Apr-2009 to Sept-2009
Agreements and Funding: July-2009 to Nov-2009
Engineering and Design: Oct-2009 to Mar-2010
Land Acquisition: Oct-2009 to Dec-2010
Construction: Jan-2010 to July-2010
Operational: July-2010

Real Estate Requirements
- **Fee Purchase** Acreage for pump station
- **Access Rights** Land rights must be acquired to access and maintain pipeline.
- **Permanent and Temporary Easements** Permanent easements will be required for access to pipeline. Temporary easements may be required for construction.
- **Flowage Easements** None assuming flows are kept underground.

Coordination with Other Options
This option would coordinate with east-west conveyance options that involve using water from the California Aqueduct as either replacement or supplementary water. SWP supplies brought into the Friant Division may need to be exchanged for Class One supplies in order to convey the water to its final destination.

Operational and Maintenance Requirements
- **Operations**

The pumping station and pipeline would be run by PLC based on anticipated demand in the district.
- **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
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. The right to divert additional water from alternate sources and the ability to transfer contracts needs 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 will generate dust and potentially impact surrounding farmers.

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

The exchange of CVP supplies for SWP supplies will require environmental documentation, as will any transfers of contracts.

Sub-Options considered but Rejected

None

Figures

98-1 Vicinity Map
98-2 Project Location Map

Attachments

References

98-1 GEI Consultants, Poso Creek Integrated Regional Water Management Plan, Appendix. D. *No. 01 Connect Friant-Kern Canal Turnout to Cawelo's North System,* July 2007.

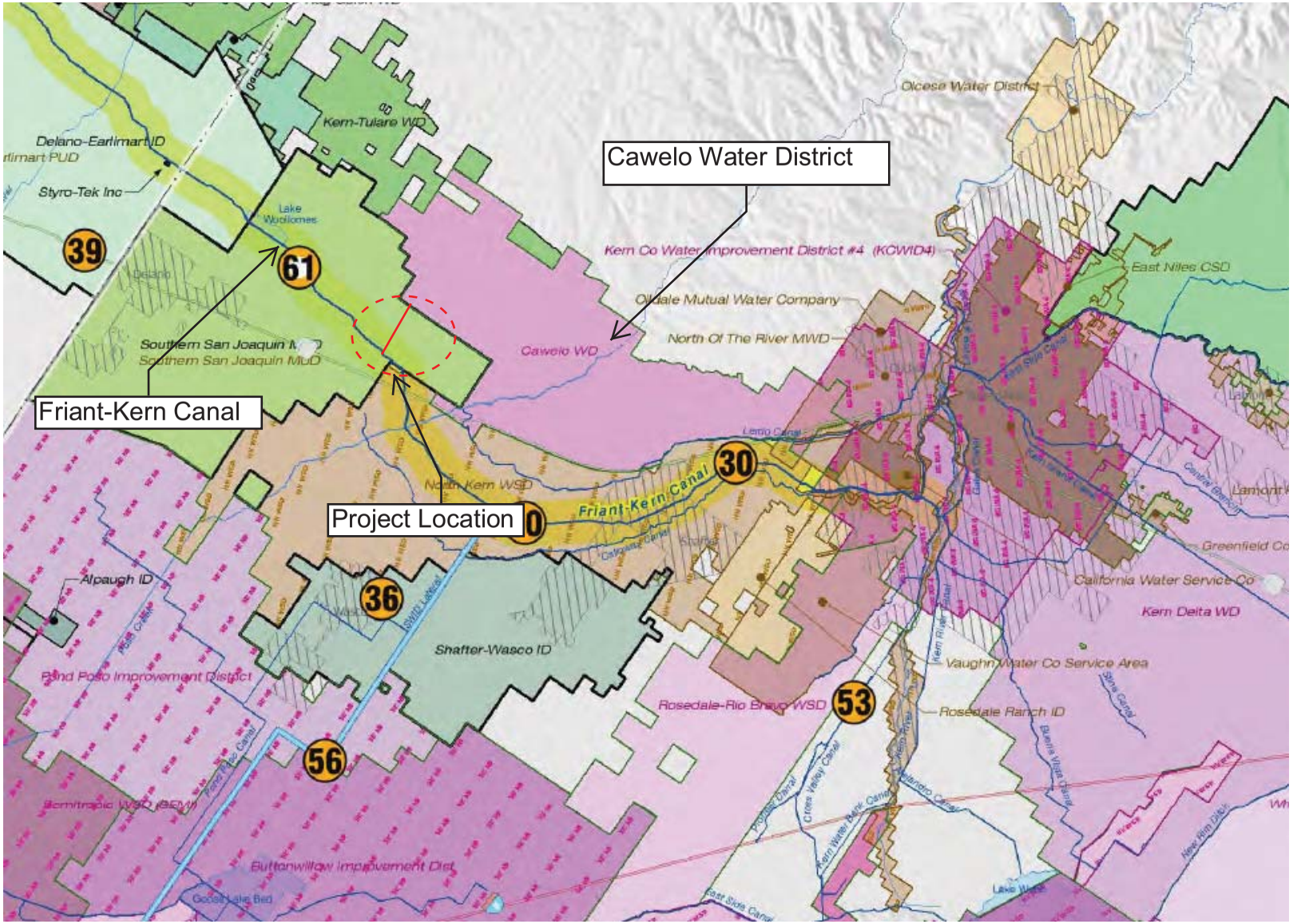


Figure 98-1: Vicinity Map

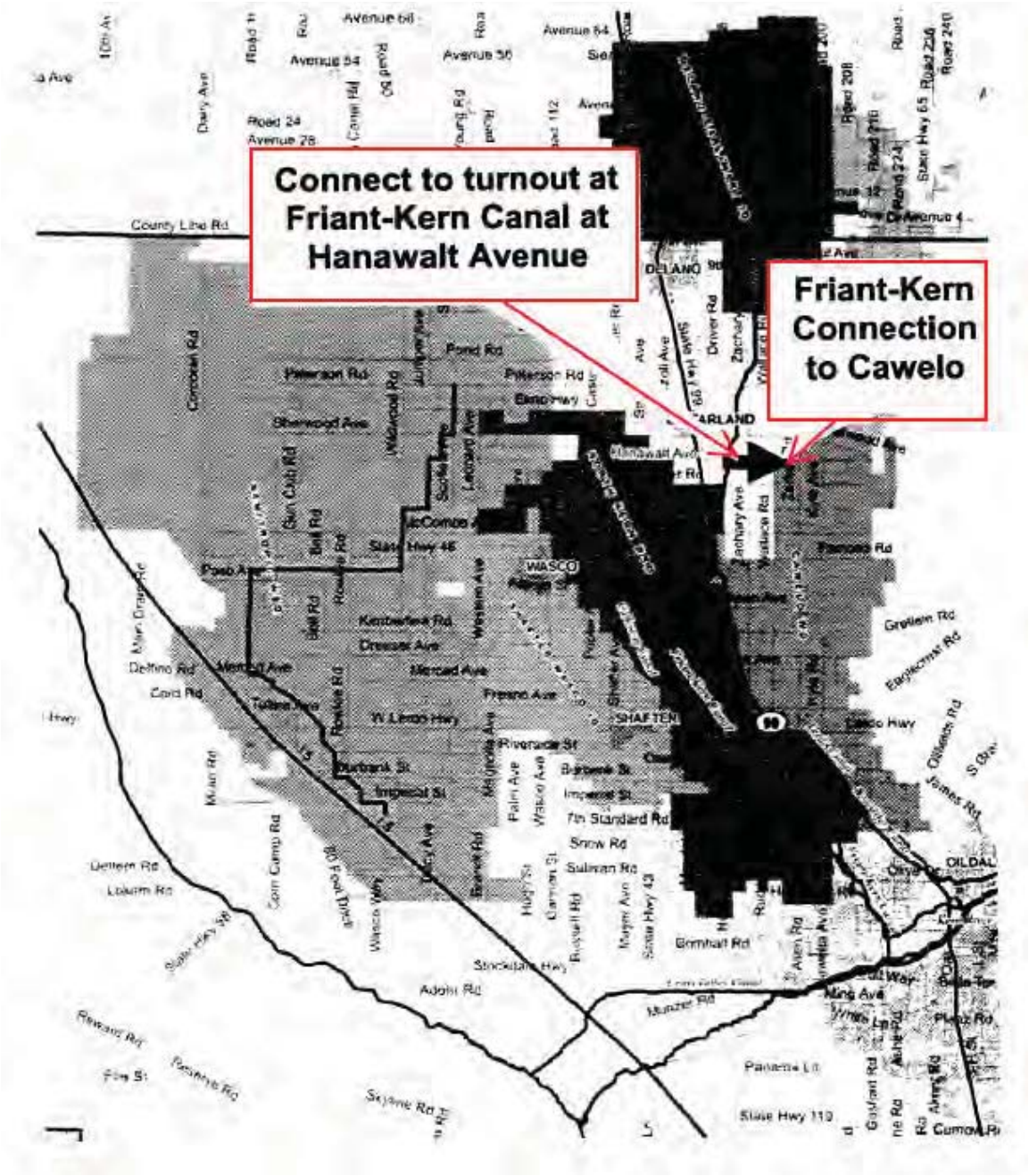


Figure 98-2: Project Location Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
102	Semitropic Pond-Poso Spreading Grounds (Non-Friant)		10 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
Semitropic Water Storage District proposes to improve operation of the Semitropic Groundwater Bank by developing the ability to store surface water near Pond-Poso Canal. The project would involve construction of spreading grounds to absorb excess surface water, when available. The Water Management Goal could be met by storing Recaptured and surplus San Joaquin River water in the proposed spreading basins for later recovery for Friant Division contractors.

Performance Criteria
Construct a groundwater banking area to absorb excess surface water from Poso Creek.

Design Criteria
Reclamation Cost Estimating Guidelines

Description
Starting in 2004, consideration has been given to improving the operation of the Semitropic Groundwater Bank by developing the ability to store surface water delivered by Pond-Poso Canal. The project has been referred to as the Pond-Poso Spreading Grounds Unit of the Semitropic Groundwater Bank. These facilities would allow capture and spreading of surface water when available. In addition, the facilities would be operated to regulate flows on the Pond-Poso Canal. See **Figure 102-1**.

The location of the Pond-Poso Spreading Grounds is in Kern County approximately four miles north and two miles west of the City of Wasco. See **Figure 102-2 and 102-3**. The project will cover up to 4.5 sections within a 15-section area. Water would be delivered to the project from the Pond-Poso Canal, which divides the site. The project would provide the District with the ability to take deliveries of surface water supplies with the water being returned to Pond-Poso Canal after temporary storage.

Construction would include supply facilities (canals, pipelines, and pumps) to deliver water from the Pond-Poso Canal, diked spreading grounds, supply pipelines and pumps, return structures (for return to the canal), and production and monitoring wells. The amount of anticipated groundwater banking for this project is unknown.

During wet years, the Pond-Poso Spreading Grounds would allow capture and spreading of surface water when it is available. It also adds capacity during the time when surface water is available in excess of the in-lieu demand to match the supply. During dry years, the Pond-Poso Spreading Grounds add absorptive capacity for surface water delivered outside of the irrigation season demand for the in-lieu service area. The Pond-Poso Spreading Grounds also provide sites for recovery wells that have less impact to other wells in the area.

Recommendation for Water Management Approach
Semitropic Water District is not a Friant contractor and receives its water from contracts with the State Water Project (SWP). Water is delivered via the California Aqueduct. This project could potentially work toward meeting the Water Management Goal if an alternative were to be developed that would allow Recaptured and surplus San Joaquin River water to be stored and later delivered to Friant contractors.

Background information indicates that phases of construction of this project started in 2007 and are anticipated to be completed in 2008 and 2009. It is unclear the extent of completed construction. No additional cost data was provided besides an estimated total value.

Construction Considerations
Some construction may already be taking place or completed. Construction considerations would be assessed once a more detailed feasibility study has been completed.

Schedule
November 2006: "Notice of Intent to Adopt a Negative Declaration" was published
Winter 2006-2007: Construction
January 2007: CEQA certification
2008-2009: Construction of additional phases

Real Estate Requirements
- **Fee Purchase** Required for spreading basins, but unknown quantity.
- **Access Rights** Unknown
- **Permanent and Temporary Easements** 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 combined to form an alternative in which water could be sent down the San Joaquin River for river restoration, recaptured and pumped back via the California Aqueduct, and stored in Pond-Poso Improvement District or Semitropic Water Storage District for later recovery and conveyance to Friant contractors. East-west conveyance, including the Semitropic to Shafter-Wasco interconnections, would be required to return the banked water to the Friant Division. These facilities could also create an opportunity to convey and store surplus San Joaquin River supplies within Semitropic. In addition, this groundwater banking effort can be coordinated with other Semitropic groundwater banking options, including option 100, 101, and 108.

Operational and Maintenance Requirements
- **Operations**

Unknown
- **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
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 additional water need to be verified and the storage of CVP and Recaptured supplies in Semitropic should be evaluated against the USBR groundwater banking policy. Permitting for water quality, dredge and fill, and environmental impacts may need to be acquired.

Potential Environmental Impacts

- **Temporary (During Construction):**

None

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

It appears that CEQA has already been completed.

Sub-Options considered but Rejected

None

Figures

102-1 Regional Map
102-2 Vicinity Map
102-3 Project Location Map

Attachments

References

102-1 GEI Consultants, Poso Creek Integrated Regional Water Management Plan, Appendix. D. *No. 06 Pond Poso Spreading Grounds Unit of the Semitropic Groundwater Bank*, July 2007

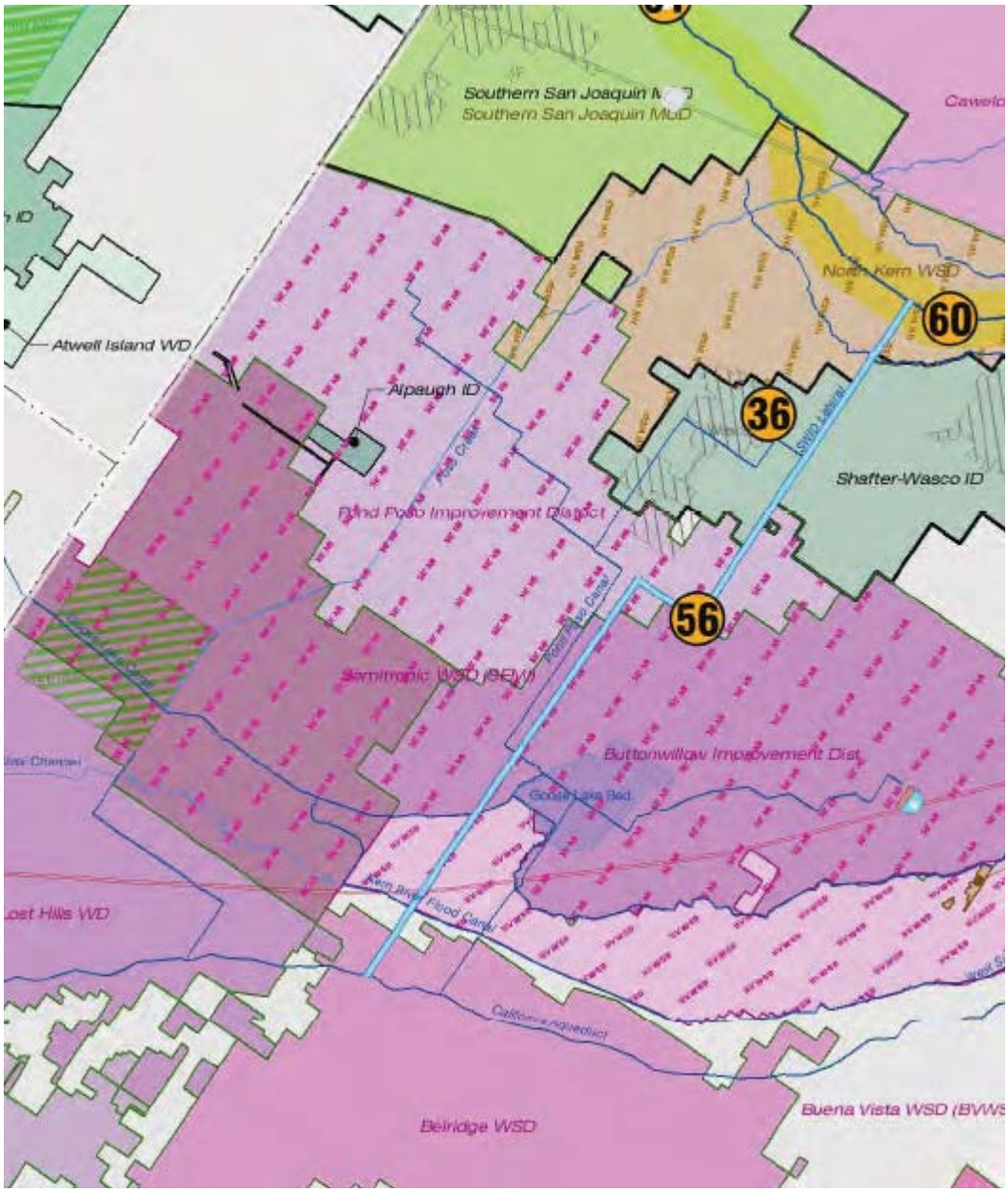


Figure 102-1: Regional Map Showing Water Districts

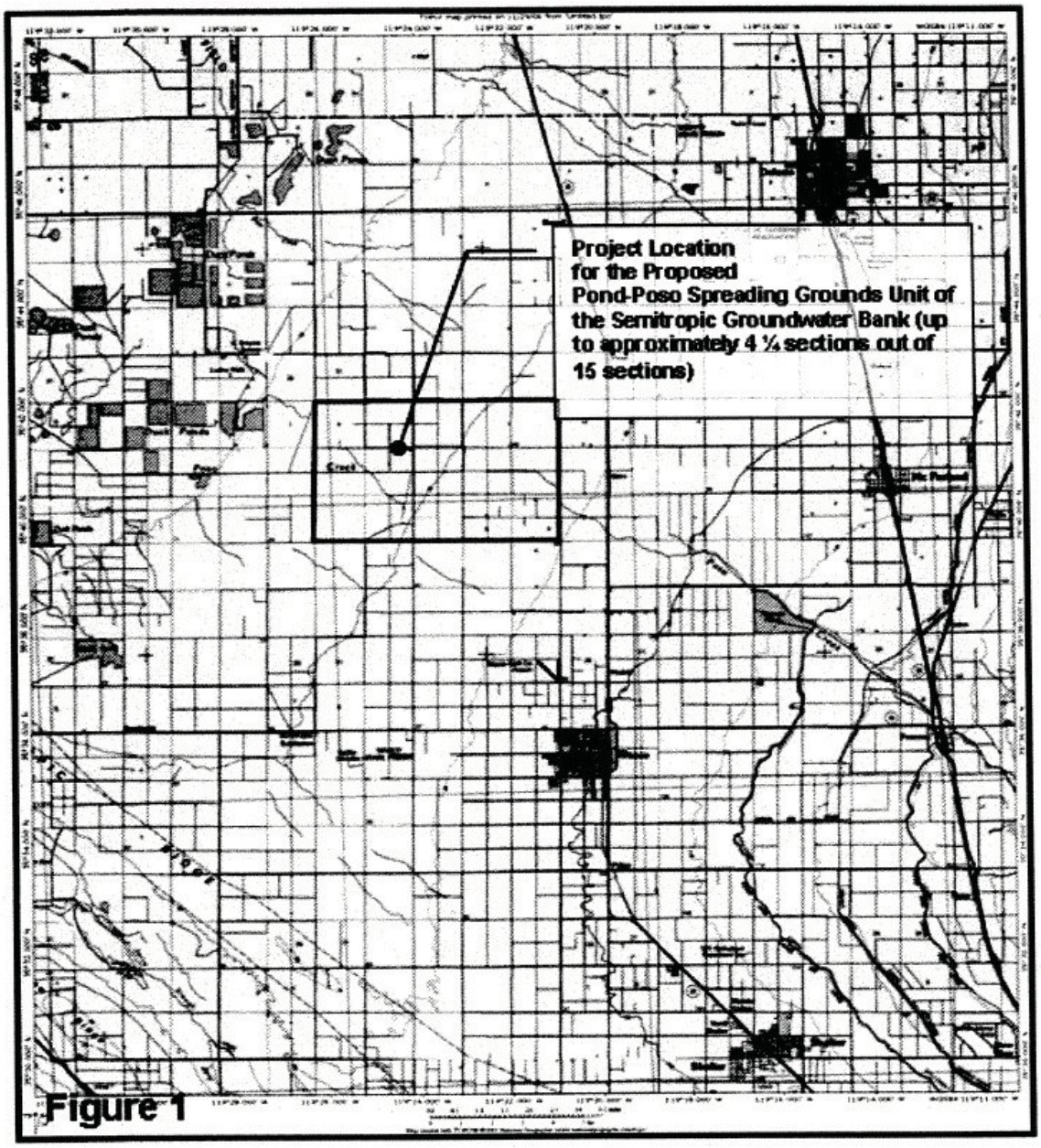


Figure 102-2: Vicinity Map

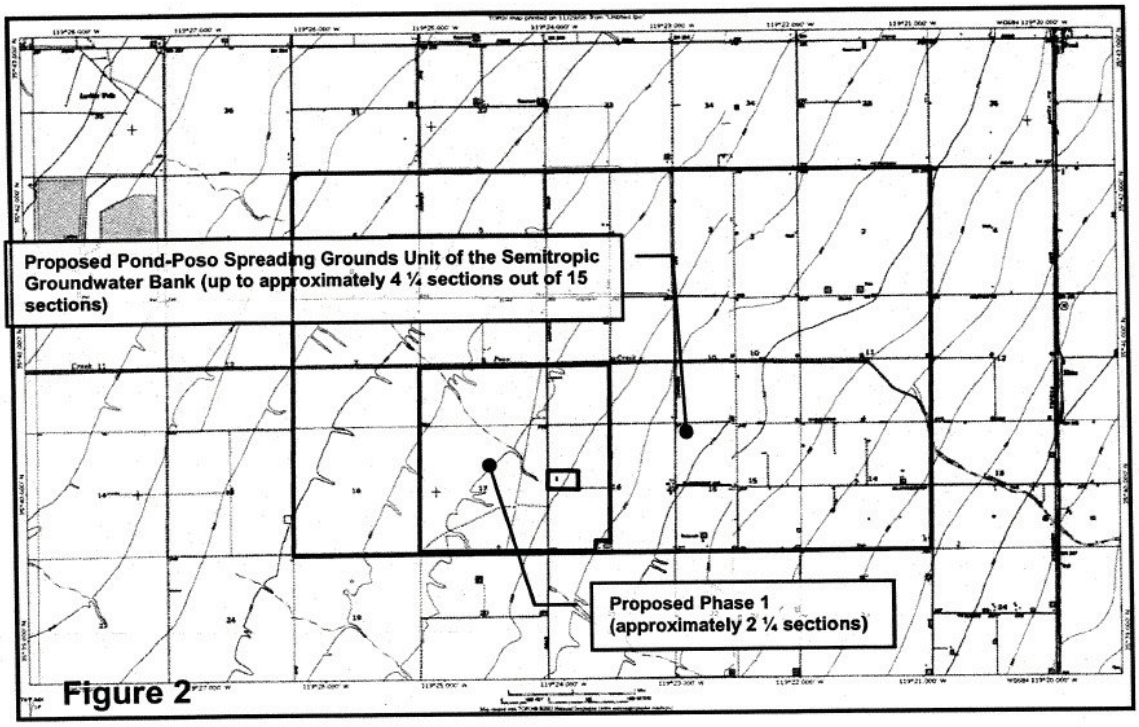


Figure 102-3: Project Location Map

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
103	Rag Gulch Groundwater Banking Project (Non-Friant)		10 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
Rag Gulch Water District, in association with the Integrated Regional Water Management Plan (IRWMP) Management Group, proposes to improve water supply reliability by constructing an 80-acre conjunctive use groundwater bank. Further evaluation will be necessary to determine whether this project meets the objectives of the Water Management Goal.

Performance Criteria
1 Construct an 80-acre spreading pond capable of storing 4,000 acre-feet of water underground.
2 Increase reliability of groundwater supply by reducing dependence on groundwater during wet years when surface water is available

Design Criteria
1 Reclamation Cost Estimating Guidelines

Description
Rag Gulch Water District (RGWD) is located in the southern portion of the San Joaquin valley near the terminus of the Friant-Kern Canal into the Kern River. See **Figure 103-1**. Rag Gulch is not a Friant contracting district, but instead gets water from both the California Central Valley Project (CVP) and has rights to divert water from the Kern River under contract with the City of Bakersfield. The district has significant concerns with regards to future water supplies. The initial term of the district's contract with the City of Bakersfield ends on December 31, 2011, and reliable supply from this source is uncertain beyond this date. In addition, restoration of fish on the San Joaquin River is anticipated to reduce the ability of the district to purchase Friant water supplies.

Rag Gulch has a contract with the Bureau of Reclamation for an annual supply of 13,300 acre-feet from the CVP. Under this contract, water is delivered through the California Aqueduct to Tupman, CA. Water is then conveyed through the Cross Valley Canal and delivered into the Friant-Kern Canal (FKC). Rag Gulch diverts water from the FKC despite the fact that they are not Friant long-term contractors. In many years, water diverted through the Cross-Valley Canal never actually reaches the FKC, but is exchanged with Arvin-Edison Water Storage District for FKC supplies. Rag Gulch also has a contract with the City of Bakersfield to divert 3,000 acre-feet from the Kern River.

The goal of this option is to improve water supply reliability through increased conjunctive use of surface water and groundwater. The district has identified approximately 80 acres of land located within the district's service area as a potential candidate for a groundwater bank. Water for this project will be conveyed in existing facilities from the Friant-Kern Canal to the district's Cecil Reservoir. In addition, Option 99 proposes to increase the capacity from the FKC to Cecil Reservoir by 35 cfs. A new turnout and

36-inch pipeline would be constructed under this option to carry water from Cecil Reservoir to the proposed spreading grounds.

Project operation is anticipated to run as follows. During wet years, the districts will deliver an additional 4,000 acre-feet to the proposed spreading facilities. The estimated conveyance capacity to the spreading facilities is 30 cfs. The water will likely be Section 215 water, flood waters available in the Friant-Kern Canal, or water purchased from Friant Contractors. During dry years, the districts will recover approximately 3,000 acre-feet of previously banked water from project wells. These wells will discharge into Cecil Reservoir and help reduce reliance upon water supplies from the Friant-Kern Canal.

Recommendation for Water Management Approach
Although not a Friant contractor, Rag Gulch has an existing turnout on the Friant-Kern Canal, and this groundwater banking option represents a potential storage opportunity to capture short-duration surplus San Joaquin River flows available in the Friant-Kern Canal and store them for use in dryer years. This project and Option 99 will likely need to provide storage or exchange benefits to a Friant Division long-term contractor to be a part of the San Joaquin River Restoration Program. The size of the proposed facilities may limit the extent to which Rag Gulch can offer conveyance and storage capacity to other districts; however, this will need to be further evaluated. Groundwater benefits to neighboring Friant districts and exchange potential with Friant Districts will need further evaluation as well. The potential rate at which water could be banked is unknown, but it appears that approximately 4,000 acre-feet of storage is available.

It is also worth noting that engineering studies were completed in December 2006 by the IRWMP Management Group and spreading sites were determined to be not feasible at this time. The reasons for this recommendation are not known.

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

Schedule
Engineering and Design: Oct-2006 to Dec-2006 (completed)
Agreements and Funding: Jan-2009 to Jan-2010
Land Acquisition: Feb-2010 to Sept-2010
Construction: Oct-2010 to Mar-2011
Operational: Mar-2011

Real Estate Requirements
- **Fee Purchase** 80 acres
- **Access Rights** None
- **Permanent and Temporary Easements** Permanent easements will be required for access to pipeline. Temporary easements may be required for construction.
- **Flowage Easements** Flowage easements may be required for spreading grounds.
-

Coordination with Other Options
This option may be coordinated with other options that involve capture and storage of short-duration flood waters in the FKC for use in dryer years. Option 99 involves increasing the existing capacity from the FKC to Cecil Reservoir which could enhance banking opportunities in this option. Rag Gulch has also made another proposal for groundwater storage within the district boundaries (Option 104).

Operational and Maintenance Requirements

- **Operations**

Water will be diverted from the FKC into Cecil Reservoir at times when excess flood water is available. The new turnout and pipeline to the spreading ground is anticipated to be run by PLC.

- **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

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 and compliance with the USBR groundwater banking policy 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 and facilities will generate dust and potentially impact surrounding farmers.

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

The long-term groundwater banking program will likely require appropriate CEQA/NEPA environmental documentation.

Sub-Options considered but Rejected

None

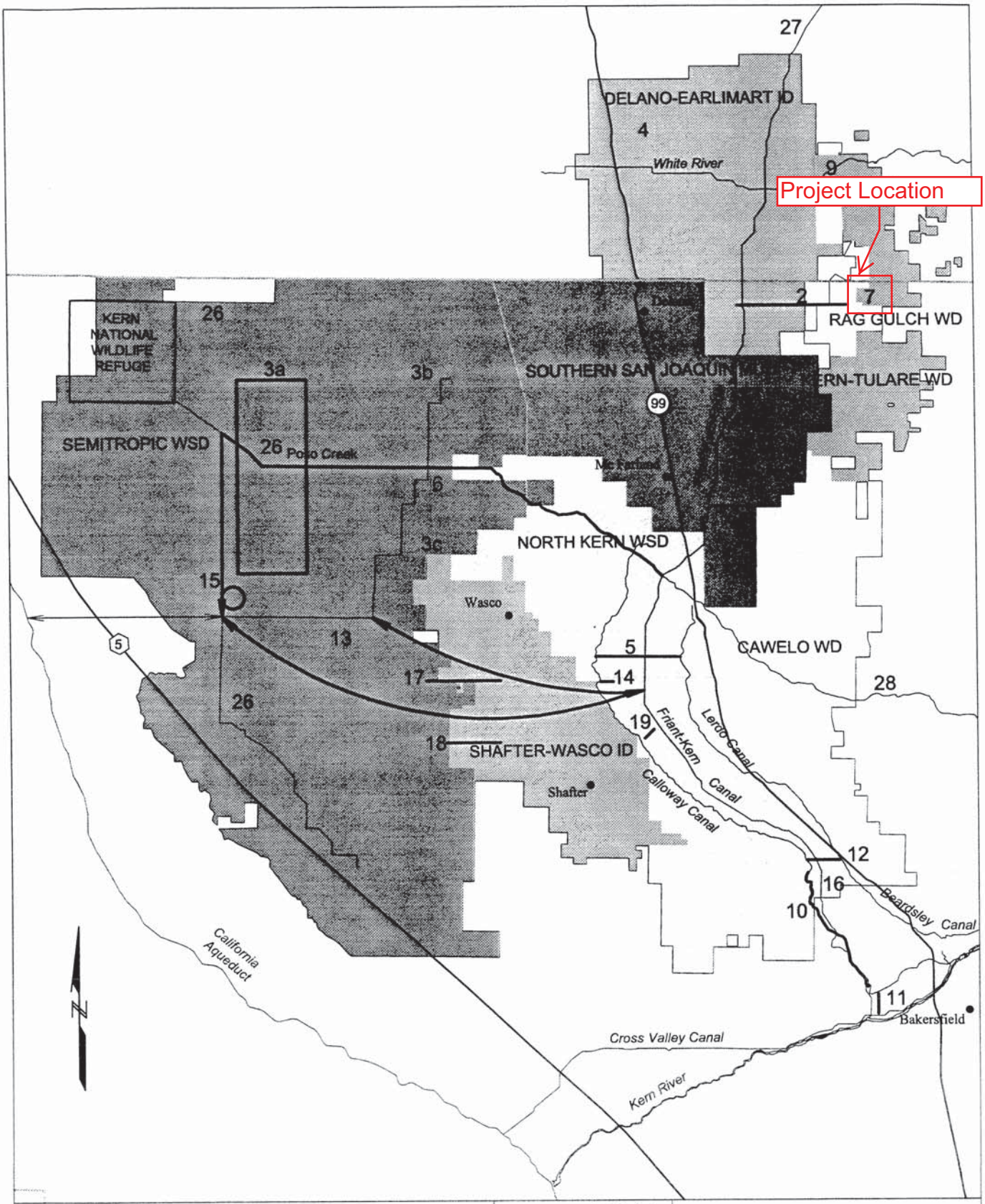
Figures

103-1 Region Map
103-2 Local Area Map

Attachments

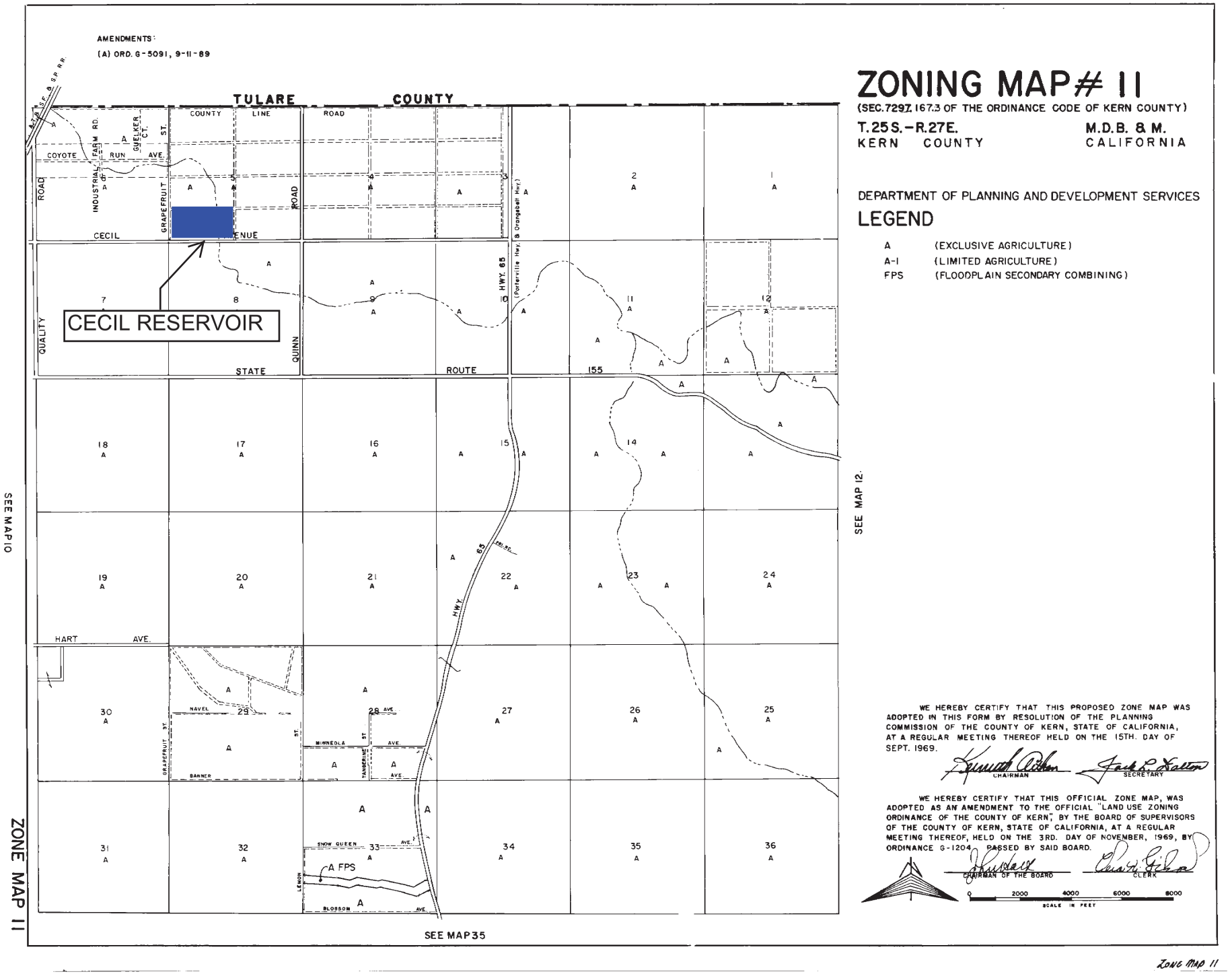
References

103-1 GEI Consultants, Poso Creek Integrated Regional Water Management Plan, Appendix. D. *No. 07 Rag Gulch G-W Banking Project*, July 2007



Poso Creek Integrated Regional Water Management Plan	GEI Consultants Bookman-Edmonston Division	Proposed Project Components
Poso Creek Regional Management Group		June 2007 Appendix D

Figure 103-1: Region Map



ZONING MAP# 11

(SEC. 7297.167.3 OF THE ORDINANCE CODE OF KERN COUNTY)

T. 25 S. – R. 27 E. M.D.B. & M.
KERN COUNTY CALIFORNIA

DEPARTMENT OF PLANNING AND DEVELOPMENT SERVICES

LEGEND

A	(EXCLUSIVE AGRICULTURE)
A-1	(LIMITED AGRICULTURE)
FPS	(FLOODPLAIN SECONDARY COMBINING)

WE HEREBY CERTIFY THAT THIS PROPOSED ZONE MAP WAS ADOPTED IN THIS FORM BY RESOLUTION OF THE PLANNING COMMISSION OF THE COUNTY OF KERN, STATE OF CALIFORNIA, AT A REGULAR MEETING THEREOF HELD ON THE 15TH. DAY OF SEPT. 1969.

CHAIRMAN SECRETARY

WE HEREBY CERTIFY THAT THIS OFFICIAL ZONE MAP, WAS ADOPTED AS AN AMENDMENT TO THE OFFICIAL "LAND USE ZONING ORDINANCE OF THE COUNTY OF KERN", BY THE BOARD OF SUPERVISORS OF THE COUNTY OF KERN, STATE OF CALIFORNIA, AT A REGULAR MEETING THEREOF, HELD ON THE 3RD. DAY OF NOVEMBER, 1969, BY ORDINANCE G-1204 PASSED BY SAID BOARD.

CHAIRMAN OF THE BOARD CLERK

0 2000 4000 6000 8000
SCALE IN FEET

ZONE MAP 11

FIGURE 103-2: LOCAL AREA MAP

San Joaquin River Restoration
Structural Option Description
Pre-Appraisal Level

Option No.	Structural Option Name		Revision Date
104	White River Groundwater Banking in Rag Gulch (Non-Friant)		10 Mar 2008
Reach Number	**River Mile**	**Program Goal**	**Phase**
N/A	N/A	Water Management	II

Task	Responsible Author	Peer Reviewer
Option Description	D. Whitbeck	J. Roldan
Engineering		

Costs (October 2007):
Cost Level: Pre-appraisal
Total Construction Cost: Not available at this time.

Objective of Option
Rag Gulch Water District, in association with the Integrated Regional Water Management Plan (IRWMP) Management Group, proposes to increase distribution system capacity and improve water supply reliability by constructing a groundwater bank beneath 120-acres of land. Further evaluation will be necessary to determine whether this project meets the objectives of the Water Management Goal.

Performance Criteria
1. Construct a 120-acre groundwater bank capable of storing 6,000 acre-feet of water in wet years and recovering 3,000 acre-feet in dry years.
2. Preliminary results of percolation tests indicate an infiltration rate of 0.4 feet per day can be sustained, or 24 cfs based on 120 acres of recharge basins.
3. Increase water supply reliability by reducing dependence on groundwater during wet years when surface water is available,

Design Criteria
1. Reclamation Cost Estimating Guidelines

Description
Rag Gulch Water District (RGWD) is located in the southern portion of the San Joaquin valley near the terminus of the Friant-Kern Canal into the Kern River. See **Figure 104-1**. Rag Gulch is not a Friant contracting district, but instead gets water from both the California Central Valley Project (CVP) and has rights to divert water from the Kern River under contract with the City of Bakersfield. The district has significant concerns with regards to future water supplies. The initial term of the district's contract with the City of Bakersfield ends on December 31, 2011, and reliable supply from this source is uncertain beyond this date. In addition, restoration of fish on the San Joaquin River is anticipated to reduce the ability of the district to purchase Friant water supplies.

Rag Gulch has a contract with the Bureau of Reclamation for an annual supply of 13,300 acre-feet from CVP. Under this contract, water is delivered through the California Aqueduct to Tupman, CA. Water is then conveyed through the Cross Valley Canal and delivered into the Friant-Kern Canal (FKC). Rag Gulch diverts water from the FKC despite the fact that they are not officially Friant contracting districts. In many years, water diverted through the Cross-Valley Canal never actually reaches the FKC, but is exchanged with Arvin-Edison Water Storage District for FKC supplies. Rag Gulch also has a contract with the City of Bakersfield to divert 3,000 acre-feet from the Kern River.

The district has identified 120 acres of land located within the district's service area as a potential candidate for a groundwater bank. Percolation tests have been conducted and the preliminary results indicated that a recharge rate of over 0.4 feet per day (24 cfs) can be sustained. Water for this project will be conveyed in

existing facilities from the Friant-Kern Canal to the spreading site along Road 208. See **Figure 104-2**. The capacity of the existing facilities at Road 208 in the vicinity of the spreading site is about 45 cfs. From Road 208, a new turnout and 48-inch pipeline would be constructed to the proposed spreading facility.

Project operation is anticipated to run as follows. During wet years, the districts will deliver an additional 6,000 acre-feet to the proposed spreading facilities. The water will likely be Section 215 water, flood waters available in the Friant-Kern Canal, or water purchased from Friant Contractors. During dry years, the districts will recover approximately 3,000 acre-feet of previously banked water from project wells. These wells will discharge into the existing distribution system along Road 208 and help reduce reliance upon water supplies from the Friant-Kern Canal.

Recommendation for Water Management Approach
Although not a Friant contractor, Rag Gulch has an existing turnout on the Friant-Kern Canal, and this groundwater banking option represents a potential storage opportunity to capture short-duration surplus San Joaquin River flows available in the Friant-Kern Canal and store them for use in dryer years. This project will likely need to provide storage or exchange benefits to a Friant Division long-term contractor to be a part of the San Joaquin River Restoration Program. The size of the proposed facilities may limit the extent to which Rag Gulch can offer conveyance and storage capacity to other districts; however, this will need to be further evaluated. Groundwater benefits to neighboring Friant districts and exchange potential with Friant Districts will need further evaluation as well. The potential rate at which water could be banked is approximately 24 cfs, and it appears that approximately 6,000 acre-feet of storage is available.

As noted in the reference report (see Reference 104-1), engineering studies were completed in December 2006 by the IRWMP Management Group and spreading sites were determined to be not feasible at this time. The reasons for this recommendation are not known.

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

Schedule
Engineering and Design: Oct-2006 to Dec-2006 (completed)
Agreements and Funding: Jan-2009 to Jan-2010
Land Acquisition: Feb-2010 to Sept-2010
Construction: Oct-2010 to Mar-2011
Operational: Mar-2011

Real Estate Requirements
- **Fee Purchase** 120 acres
- **Access Rights** None
- **Permanent and Temporary Easements** Permanent easements will be required for access to pipeline. Temporary easements may be required for construction.
- **Flowage Easements** Flowage easements may be required for spreading grounds.
-

Coordination with Other Options
This option should be coordinated with other options that involve capture and storage of short-duration surplus San Joaquin River water in the FKC for use in dryer years, especially those in and around the White River channel (e.g. Option 39). Rag Gulch has also made other proposals for water management projects, including options 99 and 103.

Operational and Maintenance Requirements
- **Operations**

Water will be diverted from the FKC into the existing distribution system along Road 208 at times when

excess flood water is available. The new turnout and pipeline to the spreading ground is anticipated to be run by PLC.

- **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

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 and compliance with the USBR groundwater banking policy 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 and facilities will generate dust and potentially impact surrounding farmers.

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

The long-term groundwater banking program will likely require appropriate CEQA/NEPA environmental documentation.

Sub-Options considered but Rejected

None

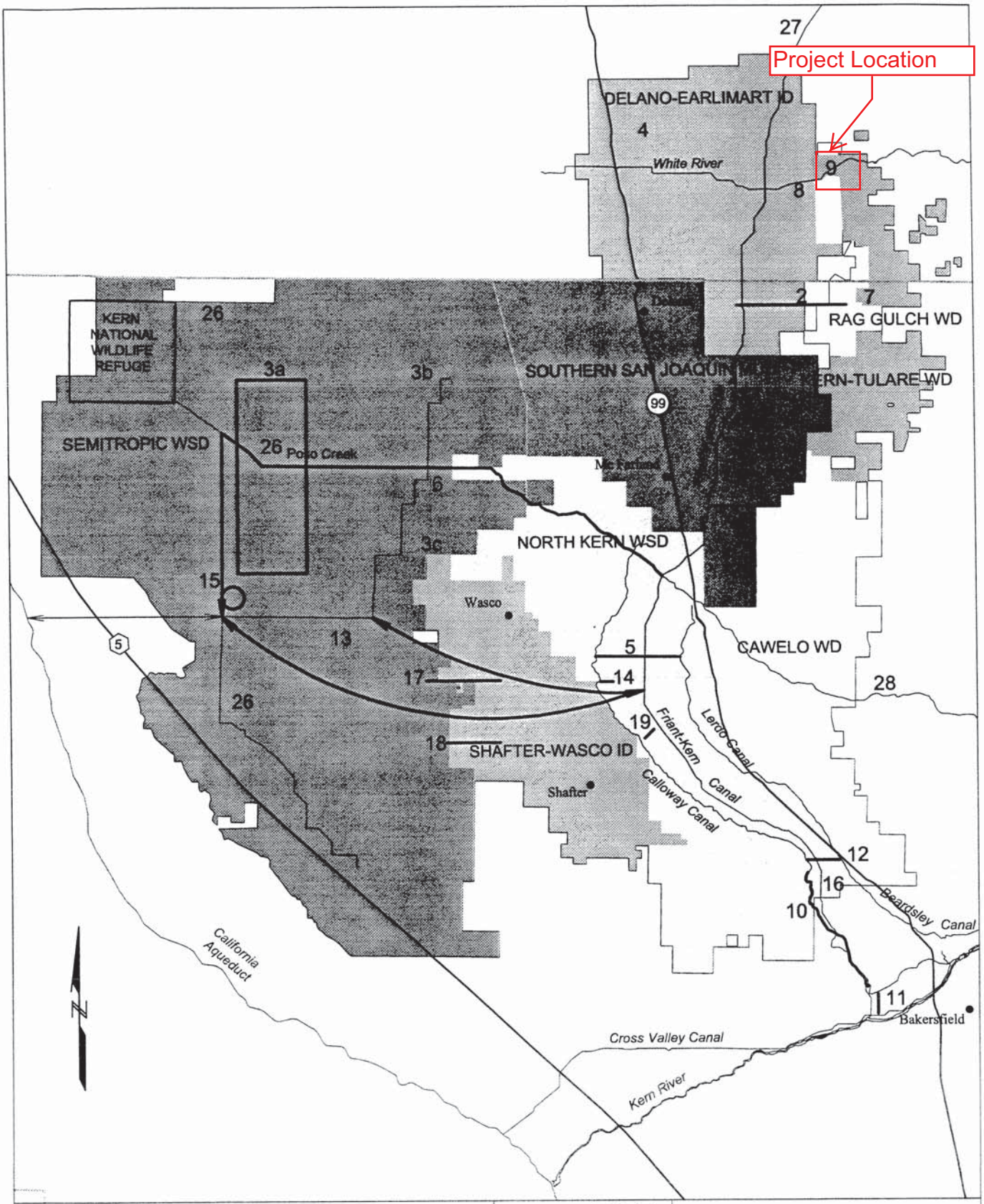
Figures

104-1 Region Map
104-2 Project Location Map

Attachments

References

104-1 GEI Consultants, Poso Creek Integrated Regional Water Management Plan, Appendix. D. *No. 09 White River G-W Banking in Rag Gulch,* July 2007



Poso Creek Integrated Regional Water Management Plan	GEI Consultants Bookman-Edmonston Division	Proposed Project Components
Poso Creek Regional Management Group		June 2007 Appendix D

Figure 104-1: Region Map

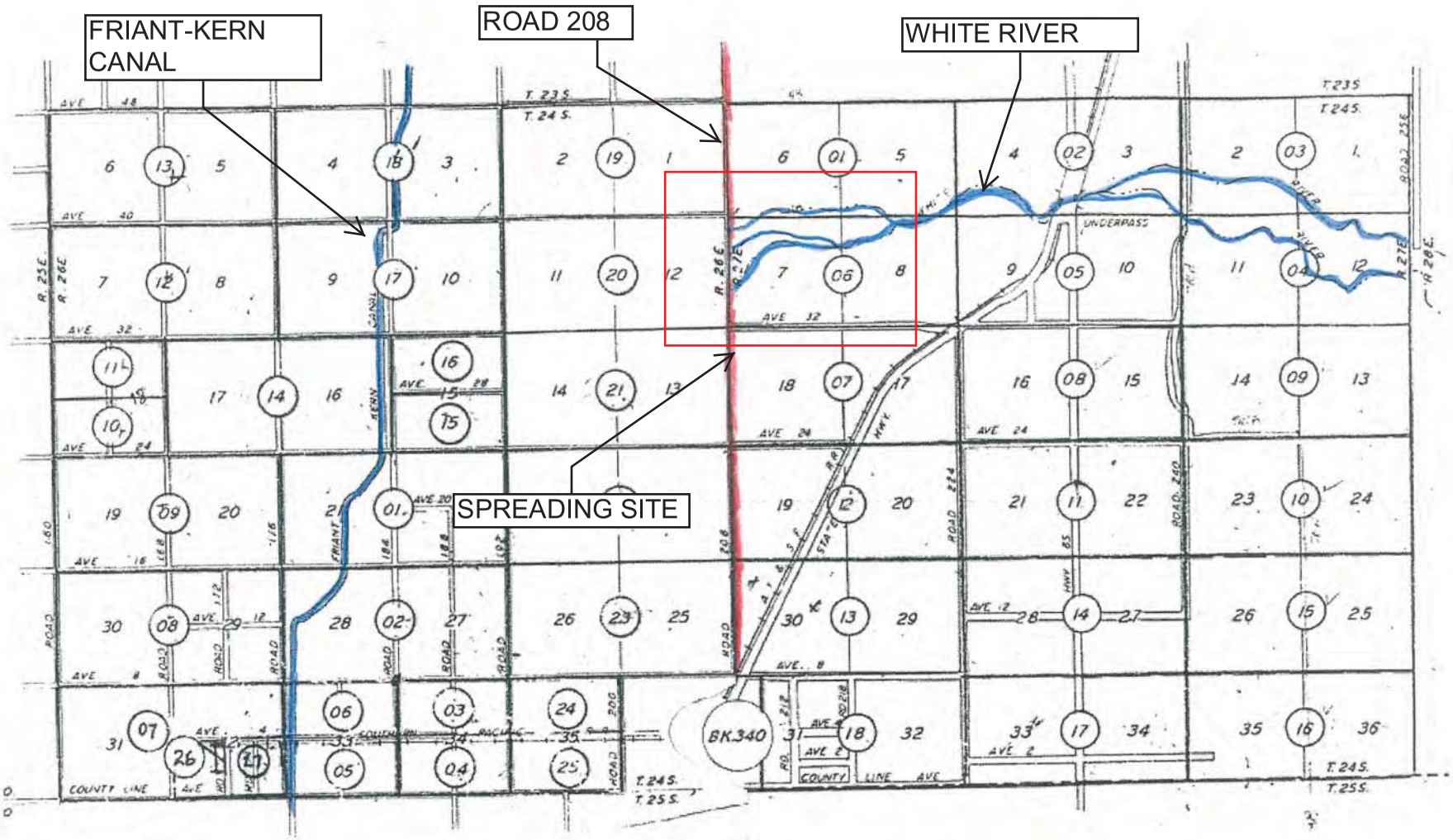


Figure 104-2: PROJECT LOCATION MAP