

AGENDA
IRVINE RANCH WATER DISTRICT
SUPPLY RELIABILITY PROGRAMS COMMITTEE
THURSDAY, MAY 16, 2019

CALL TO ORDER 3:00 p.m., Committee Room, Second Floor, District Office
15600 Sand Canyon Avenue, Irvine, California

ATTENDANCE Committee Chair: Peer Swan _____
Member: Douglas Reinhart _____

<u>ALSO PRESENT</u>	Paul Cook	_____	Kellie Welch	_____
	Rob Jacobson	_____	Christine Compton	_____
	Ray Bennett	_____	Paul Weghorst	_____
	Jo Ann Corey	_____	Dane Johnson	_____
	Fiona Sanchez	_____	_____	_____
	_____	_____	_____	_____

NOTICE

If you wish to address the Committee on any item, please file your name with the Committee. Forms are provided on the table outside of the Committee Room. Remarks are limited to three minutes per speaker on each subject.

COMMUNICATIONS

1. Notes: Weghorst
2. Public Comments
3. Determine the need to discuss and/or take action on item(s) introduced that came to the attention of the District subsequent to the agenda being posted.
4. Determine which items may be approved without discussion.

INFORMATION

5. WATER BANKING PROJECT FACILITIES, CAPACITIES, OPERATIONS, AND PROGRAMS – JOHNSON / WELCH / SANCHEZ / WEGHORST

Recommendation: Receive and file.

6. UPDATE ON SGMA COMPLIANCE FOR IRWD WATER BANKING PROPERTIES – BENNETT / WELCH / SANCHEZ / WEGHORST

Recommendation: Receive and file.

OTHER BUSINESS

7. Directors' Comments
8. Adjourn

Availability of agenda materials: Agenda exhibits and other writings that are disclosable public records distributed to all or a majority of the members of the above-named Committee in connection with a matter subject to discussion or consideration at an open meeting of the Committee are available for public inspection in the District's office, 15600 Sand Canyon Avenue, Irvine, California ("District Office"). If such writings are distributed to members of the Committee less than 72 hours prior to the meeting, they will be available from the District Secretary of the District Office at the same time as they are distributed to Committee Members, except that if such writings are distributed one hour prior to, or during, the meeting, they will be available at the entrance of the meeting room at the District Office. The Irvine Ranch Water District Committee Room is wheelchair accessible. If you require any special disability-related accommodations (e.g., access to an amplified sound system, etc.), please contact the District Secretary at (949) 453-5300 during business hours at least seventy-two (72) hours prior to the scheduled meeting. This agenda can be obtained in an alternative format upon written request to the District Secretary at least seventy-two (72) hours prior to the scheduled meeting.

May 16, 2019

Prepared by: D. Johnson / K. Welch

Submitted by: F. Sanchez / P. Weghorst

Approved by: Paul A. Cook



SUPPLY RELIABILITY PROGRAMS COMMITTEE

WATER BANKING PROJECT FACILITIES, CAPACITIES, OPERATIONS AND PROGRAMS

SUMMARY:

Staff has prepared information related to IRWD's water banking facilities, capacities, operations and exchange programs. The information is presented in a format that can be updated as necessary to reflect changes in IRWD's projects, programs and operations. At the Committee meeting, staff will review this information. Staff will also provide an update on recharge operations, as well as efforts to secure additional water for recharge at IRWD's water banking projects.

BACKGROUND:

To assist with the facilitation of Committee meeting discussions, staff has prepared reference materials in tabular, map and schematic formats that describe IRWD's water banking facilities, capacities, operations, storage, and exchange programs. The reference materials will be updated, as needed, to reflect changes to the projects, programs and operations. The following is an overview of the reference materials. At the Committee meeting, staff will provide an update related to ongoing recharge as well as efforts to secure additional water for recharge at IRWD's water banking projects.

Capacity and Operations Tables:

A table presenting storage, recharge and recovery capacities of existing and planned IRWD water banking projects, including capacities available to IRWD in the Kern Water Bank, is attached as Exhibit "A". Exhibits "B" and "C" provide an update on water banking recovery and recharge operations, as well as the balance of the water stored in the Kern Water Bank. Exhibit "B" provides before-loss estimates of water recharged at the water banking projects, and Exhibit "C" provides after-loss estimates of water recharged at the projects. Both Exhibits "B" and "C" include a column that provides totals for each water type and storage location. No updates to the capacity and operations tables have been made since the April Committee meeting.

Exhibit "D" depicts graphically how storage of State Water Project (SWP) and non-SWP water has changed in the Strand and Stockdale Integrated Banking Projects through time. The table provided as Exhibit "E" shows how capacities in the water banking projects have been dedicated to IRWD's existing and proposed exchange programs.

Project Maps:

To support the tables provided as Exhibits "A", "B", "C" and "E" as well as the figure provided as Exhibit "D", staff has prepared maps that depict project wells and pipelines, recharge basins and Cross Valley Canal turnout locations, along with the most current recharge rates. These maps are provided as Exhibits "F", "G" and "H", respectively. Exhibit "H" has been updated to reflect the

most current estimated infiltration rate as of May 10, 2019. The facilities shown on the maps are associated with the Strand Ranch, Stockdale West, Stockdale East and Rosedale-Rio Bravo Water Storage District Drought Relief Projects.

Program Agreement Diagrams:

Schematic diagrams have been prepared that depict the IRWD water banking and exchange programs with Rosedale-Rio Bravo Water Storage District, Buena Vista Water Storage District, Dudley Ridge Water District and Metropolitan Water District. These diagrams are provided as Exhibits “I”, “J”, “K”, “L” and “M”, as described in the List of Exhibits.

Delivery of Kern River Water:

Buena Vista began deliveries of Kern River water to the Strand Ranch and Stockdale West projects on April 11. As of May 10, staff estimates 5,970 acre-feet (AF) has been delivered, of which IRWD retains one-half consistent with the terms of the existing long-term exchange program agreement with Buena Vista. All of the basins on Strand and Stockdale West are full and recharge rates are stabilizing. All three turnouts from the Cross Valley Canal are being used and the current combined flow rate is 135 cubic feet per second (cfs). The current maintenance fill rates are approximately 0.36 feet per day on the Strand north basins, 0.13 feet per day on the Strand south basins and 0.52 feet per day on the Stockdale West basins. At the Committee meeting, staff will provide an update on the flow rates into the recharge basins. Buena Vista expects to deliver a total of between 12,000 AF and 17,500 AF of water to the Strand and Stockdale West Projects this spring.

Other Recharge Opportunities:

IRWD has been pursuing additional opportunities to secure water for recharge. At the Committee meeting, staff will provide an update on efforts to secure water from:

- Antelope Valley-East Kern Water Agency;
- Central Coast Water Authority;
- Dudley Ridge Water District; and
- Other sources.

FISCAL IMPACTS:

None.

ENVIRONMENTAL COMPLIANCE:

Not applicable.

RECOMMENDATION:

Receive and file.

LIST OF EXHIBITS:

- Exhibit “A” – Recharge, Storage and Recovery Capacities of Current and Anticipated Water Banking Projects
- Exhibit “B” – Water Banking Storage, Recharge and Recovery Operations before Losses
- Exhibit “C” – Water Banking Storage, Recharge and Recovery Operations after Losses
- Exhibit “D” – Historic Water Storage in Strand and Stockdale Projects
- Exhibit “E” – Dedicated Capacities of Current Water Banking Projects
- Exhibit “F” – Map of Water Banking Project Wells and Pipelines
- Exhibit “G” – Map of Water Banking Recharge Basins and Cross Valley Canal Turnout Facilities
- Exhibit “H” – Map of Water Banking Recharge Rates
- Exhibit “I” – Diagram of IRWD-Rosedale Water Banking and Exchange Program Agreements
- Exhibit “J” – Diagram of Long-Term Water Exchange Program with BVWSD and Diagram of One-Year Program to Augment Recharge Using Stockdale West Recharge Facilities with BVWSD
- Exhibit “K” – Diagram of Unbalanced Exchange Program Diagram with DRWD
- Exhibit “L” – Diagram of Coordinated Operating, Water Storage, Exchange and Delivery Agreement with Metropolitan Water District
- Exhibit “M” – Diagram of Template Wheeling Agreement with Metropolitan Water District

Exhibit "A"

TABLE 1
Current and Anticipated Water Banking Project
Recharge, Storage and Recovery Capacities
 May 16, 2019

WATER BANKING PROJECT	OWNERSHIP AND WELL INFO			ALLOCATED CAPACITY (AF)					1 ST PRIORITY RECOVERY CONDITIONS (CFS)		2 ND PRIORITY RECOVERY CONDITIONS (CFS)	
	IRWD OWNED	WELLS EXISTING	WELLS PROPOSED OR UNDER CONST.	TOTAL STORAGE CAPACITY	ANNUAL RECHARGE 1 ST PRIORITY	ANNUAL RECHARGE 2 ND PRIORITY	ANNUAL RECOVERY 1 ST PRIORITY	ANNUAL RECOVERY 2 ND PRIORITY	RECOVERY CAPACITY AS PLANNED ¹	ESTIMATED RECOVERY CAPACITY (APR. 2019 CONDITIONS) ²	RECOVERY CAPACITY AS PLANNED	RECOVERY CAPACITY CURRENT CONDITIONS
Strand Ranch	Yes	7	-	50,000	17,500	-	17,500	-	40.0	40.0	-	-
Stockdale West	Yes	3	-	26,000	27,100	-	11,250	-	15.0	15.0	-	-
Stockdale East	No	-	2	-	-	19,000	-	7,500	-	-	10.0	-
IRWD Acquired Storage Account ³	No	-	-	50,000	-	-	-	-	-	-	-	-
Drought Relief Project Wells ³	No	3	-	-	-	-	-	-	15.0	15.0	-	-
Kern Water Bank Storage Account ⁵	No	-	-	9,495	3,200	-	6,330	-	-	-	-	-
TOTALS		13	2	126,000	44,600	19,000	28,750	7,500	70.0	70.0	10.0	0.0
Partner Capacities ⁴				38,000	22,300	9,500	10,850	0	35.5	25.0	-	-
IRWD Capacities				88,000	22,300	9,500	17,900	7,500	34.5	25.0	-	-
IRWD's recovery <i>during</i> 6 month partner recovery period (AF)									12,420	9,000	-	-
IRWD's recovery <i>after</i> 6 month partner recovery period (AF)									5,480	6,733	-	-
TOTALS (AF)									17,900	15,733	-	-
Number of months needed to recover IRWD's total AF after partners' recovery (Assumes IRWD has use of total recovery capacity after partners' recovery)									8.6	10.2	-	-
Strand Ranch monthly recharge amount assuming 0.3 ft/day average recharge rate (AF)											4,518	
Stockdale West monthly recharge amount assuming 0.3 ft/day average recharge rate (AF)											2,331	

¹ Based on designed Strand recovery capacity assuming 370' bgs. Assumes 5 cfs for each of the Stockdale West and Drought Relief wells in order to meet IRWD's Water Banking, Transfers, and Wheeling policy position. Assumes partners' water is recovered over 6 months.

² Strand Ranch and Stockdale West wells currently idle.

³ IRWD has use of Acquired Storage and Drought Relief Project wells until January 12, 2039, unless the term of the agreement is extended.

⁴ One half of storage capacity at Stockdale West and Strand Ranch will be allocated for partners.

⁵ Kern Water Bank capacities based on 6.58% of Dudley Ridge Water District's 9.62% share of the Kern Water Bank. Annual recharge amount is based on an average of recharge rates for high and low groundwater level conditions. Not included in storage capacity, recharge, and recovery totals to match IRWD's Water Banking Policy Position Paper.

Exhibit "B"

TABLE 2
IRWD's Water Banking Storage, Recharge and Recovery Operations - BEFORE LOSSES
 May 16, 2019

TRANSACTIONS	WATER BANKING ENTITY					TOTAL BY WATER TYPE AND STORAGE LOCATION
	IRWD		BUENA VISTA (BVWSD)	CENTRAL COAST (CCWA)	DUDLEY RIDGE WATER DISTRICT (DRWD) ³	
	SWP ¹	NON-SWP ²	NON-SWP	SWP	SWP	
BEGINNING WATER IN STORAGE 2018 (AF)						
Total Kern Water Bank	-	4,656	-	-	-	4,656
Total MWD System ⁴	8,349	-	-	-	1,174	10,047
Total Kern County	3,257	17,704	6,869	289	2,388	30,507
TOTAL STORED WATER (1/1/2018)	11,606	22,360	6,869	289	3,562	44,686
MWD Water to Jackson Ranch ⁵	-	-	-	-	(295)	
(RECOVERY) AND RECHARGE IN 2018 (AF)						
Kern Water Bank Deliveries	-	-	-	-	-	-
2018 SWP Allocation (35%) ³	310	-	-	-	310	620
High Flow Kern River	-	-	(1,667)	-	-	(1,667)
TOTAL 2018 TRANSACTIONS	310	-	(1,667)	-	310	(1,047)
Total Kern Water Bank	-	4,656	-	-	-	4,656
Total MWD System	8,349	-	-	-	879	9,228
Total Kern County	3,567	17,704	5,202	289	2,698	29,460
TOTAL STORED WATER (1/1/2019)	11,916	22,360	5,202	289	3,577	43,344
(RECOVERY) AND RECHARGE IN 2019 (AF)						
Kern Water Bank Deliveries	-	-	-	-	-	-
2019 SWP Allocation (70%) ³	612	-	-	-	612	1,224
Kern River water (estimated) ⁶	-	8,750	8,750	-	-	17,500
TOTAL ESTIMATED 2019 TRANSACTIONS	612	8,750	8,750	-	612	18,724
ESTIMATED WATER IN STORAGE 2019 (AF)						
Total Kern Water Bank	-	4,656	-	-	-	4,656
Total MWD System	8,349	-	-	-	879	9,228
Total Kern County	4,179	26,454	13,952	289	3,310	48,184
TOTAL ESTIMATED STORED WATER TO DATE	12,528	31,110	13,952	289	4,189	62,068

NOTES:

-MWD = Metropolitan Water District of Southern California.

¹ IRWD's SWP includes 437 AF from CVWD that stays in Kern County.

² IRWD's Non-SWP total includes 3,158 AF of Kern County Water Agency Article 21 Water.

³ DRWD water supply will be returned by MWD or IRWD's Strand Ranch to IRWD's Jackson Ranch. IRWD's 2013-2016 SWP allocation amounts are stored in the MWD system. IRWD's 2017 and 2018 SWP allocation water is stored in Kern County; assumes 2019 SWP water will be stored in Kern County.

⁴ Beginning balance of water stored in MWD system includes: 4,494 AF from 2014 Exchange, 3,206 AF of 2014 borrowed SWP, 649 AF of IRWD's 2013-2016 SWP allocations through DRWD.

⁵ Water returned to DRWD by MWD for use on IRWD's Jackson Ranch.

⁶ Kern River water deliveries could increase by 12,500 AF in 2019

Exhibit "C"

TABLE 3
IRWD's Water Banking Storage, Recharge and Recovery Operations - AFTER LOSSES
 May 16, 2019

TRANSACTIONS	WATER BANKING ENTITY					TOTAL BY WATER TYPE AND STORAGE LOCATION
	IRWD		BUENA VISTA (BVWSD)	CENTRAL COAST (CCWA)	DUDLEY RIDGE WATER DISTRICT (DRWD) ³	
	SWP ¹	NON-SWP ²	NON-SWP	SWP	SWP	
BEGINNING WATER IN STORAGE 2018 (AF)						
Total Kern Water Bank	-	4,233	-	-	-	4,233
Total MWD System ⁴	7,393	-	-	-	1,174	9,091
Total Kern County	2,782	15,564	6,199	246	2,131	26,921
TOTAL STORED WATER (1/1/2018)	10,175	19,797	6,199	246	3,305	39,721
MWD Water to Jackson Ranch ⁵	-	-	-	-	(295)	(295)
(RECOVERY) AND RECHARGE IN 2018 (AF)						
Kern Water Bank Deliveries	-	-	-	-	-	-
2018 SWP Allocation (35%) ³	264	-	-	-	264	528
High Flow Kern River	-	-	(1,667)	-	-	(1,667)
TOTAL 2018 TRANSACTIONS	264	-	(1,667)	-	264	(1,139)
Total Kern Water Bank	-	4,233	-	-	-	4,233
Total MWD System	7,393	-	-	-	879	8,272
Total Kern County	3,046	15,564	(1,667)	246	2,395	19,584
TOTAL STORED WATER (1/1/2019)	10,439	19,797	4,532	246	3,274	38,288
(RECOVERY) AND RECHARGE IN 2019 (AF)						
Kern Water Bank Deliveries	-	-	-	-	-	-
2019 SWP Allocation (70%) ³	520	-	-	-	520	1,040
Kern River water (estimated) ⁷	-	7,501	7,896	-	-	15,397
TOTAL ESTIMATED 2019 TRANSACTIONS ⁶	520	7,501	7,896	-	520	16,437
ESTIMATED WATER IN STORAGE 2019 (AF)						
Total Kern Water Bank	-	4,233	-	-	-	4,233
Total MWD System	7,393	-	-	-	879	8,272
Total Kern County	3,566	23,065	12,428	246	2,915	42,220
TOTAL ESTIMATED STORED WATER TO DATE	10,959	27,298	12,428	246	3,794	54,725

NOTES:

-Water in storage has been adjusted to account for losses. IRWD's water stored in Kern County is adjusted 15% for losses (5% for out of county loss, 6% surface loss, and 4% reserve loss); Water stored for DRWD and BVWSD in Kern County is adjusted 10% (6% for surface loss and 4% for reserve loss); KWB losses are 10%; no losses for water directly delivered to MWD system.

-MWD = Metropolitan Water District of Southern California.

¹ IRWD's SWP includes 389 AF from CVWD that stays in Kern County.

² IRWD's Non-SWP total includes 2,842 AF of Kern County Water Agency Article 21 Water.

³ DRWD water supply will be returned by MWD or IRWD's Strand Ranch to IRWD's Jackson Ranch. IRWD's 2013-2016 SWP allocation amounts are stored in the MWD system. IRWD's 2017 and 2018 SWP allocation water is stored in Kern County; assumes 2019 SWP water will be stored in Kern County.

⁴ Beginning balance of water stored in MWD system includes (net of CVC losses): 3,920 AF of 2014 Exchange, 2,824 AF of 2014 borrowed SWP, 649 AF of IRWD's 2013-2016 SWP allocations through DRWD.

⁵Water returned to DRWD by MWD for use on IRWD's Jackson Ranch.

⁶2019 transactions may be adjusted for conveyance losses in CVC.

⁷Kern River water deliveries could increase by 12,500 AF in 2019

Exhibit “D”

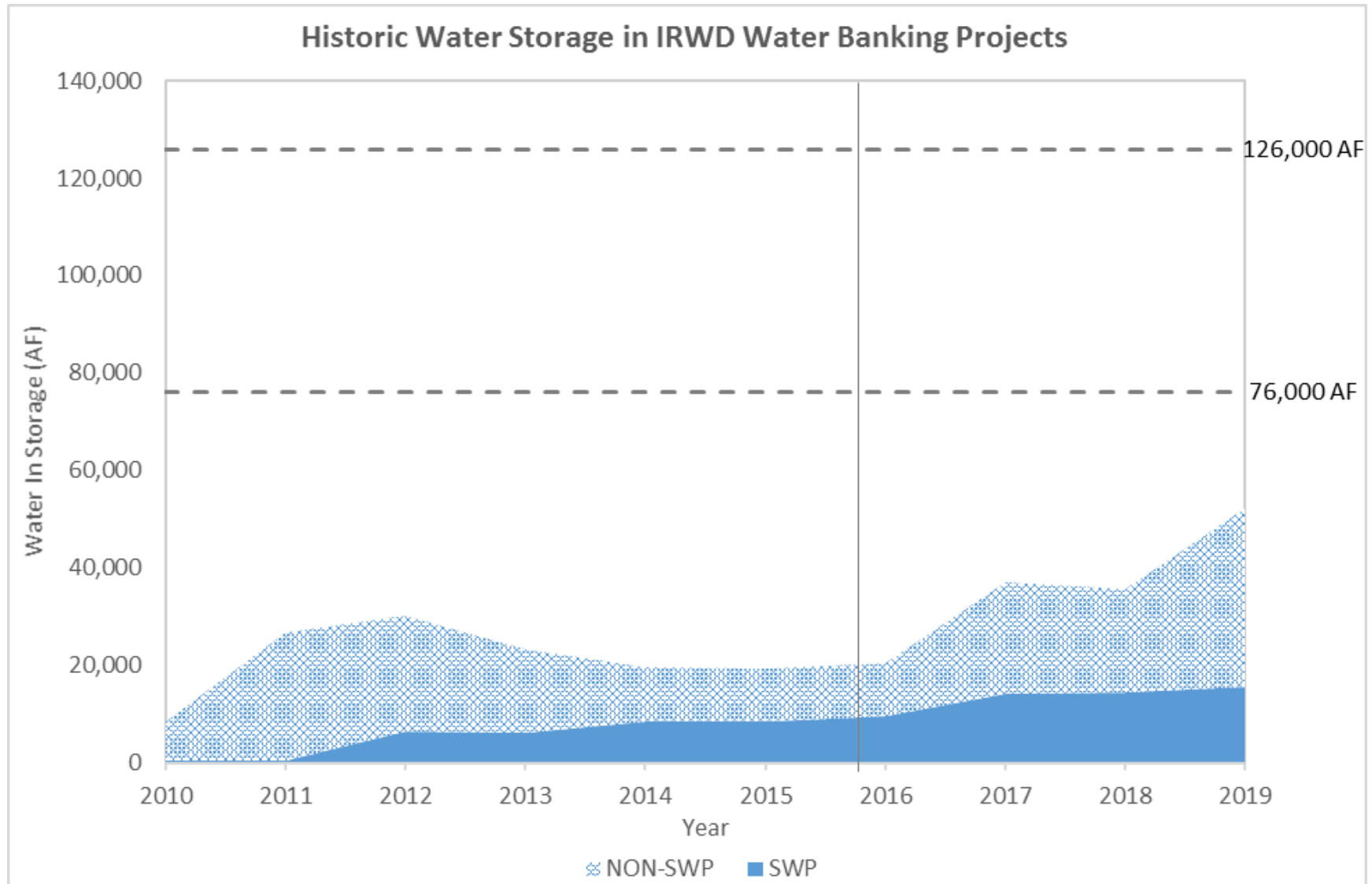


Exhibit "E"

Program	Dedicated Storage Capacity Strand Ranch (AF)	Dedicated Storage Capacity Stockdale West (AF)	Dedicated Storage Capacity Leased Storage Account (AF)	Kern Water Bank Storage Capacity (AF)
Total Capacity	50,000	26,000	50,000	9,495
BVWSD	40,000	-	-	-
DRWD	10,000	-	-	-
AVEK	-	20,000	-	-
CVWD	-	5,000	-	-
Total Dedicated	50,000	25,000	-	-
Total Remaining	-	1,000	50,000	9,495

RECHARGE CAPACITY

Program	Dedicated Recharge Capacity Strand Ranch (AF)	Dedicated Recharge Capacity Stockdale West (AF)	Dedicated Recharge Capacity Leased Storage Account (AF)	Kern Water Bank Recharge Capacity (AF)
Total Capacity	17,500	27,100	-	3,200
BVWSD	17,500	-	-	-
DRWD	-	-	-	-
AVEK	-	20,000	-	-
CVWD	-	5,000	-	-
Total Dedicated	17,500	25,000	-	-
Total Remaining	-	2,100	-	3,200

RECOVERY CAPACITY

Program Partner	Dedicated Recovery Capacity Strand Ranch (AF)	Dedicated Recovery Capacity Stockdale West (AF)	Dedicated Recovery Capacity Leased Storage Account (AF)	Kern Water Bank Recovery Capacity (AF)
Total Capacity	17,500	11,250	-	6,330
BVWSD	6,667	-	-	-
DRWD	-	-	-	-
AVEK	-	3,333	-	-
CVWD	-	833	-	-
IRWD	10,833	7,084	-	6,330
Total Dedicated	17,500	11,250	-	6,330
Total Remaining	-	-	-	-

Exhibit "F"



Irvine Ranch
WATER DISTRICT

Location Map: IRWD Water Banking Projects Wells and Turnin Pipelines

MAP FEATURES

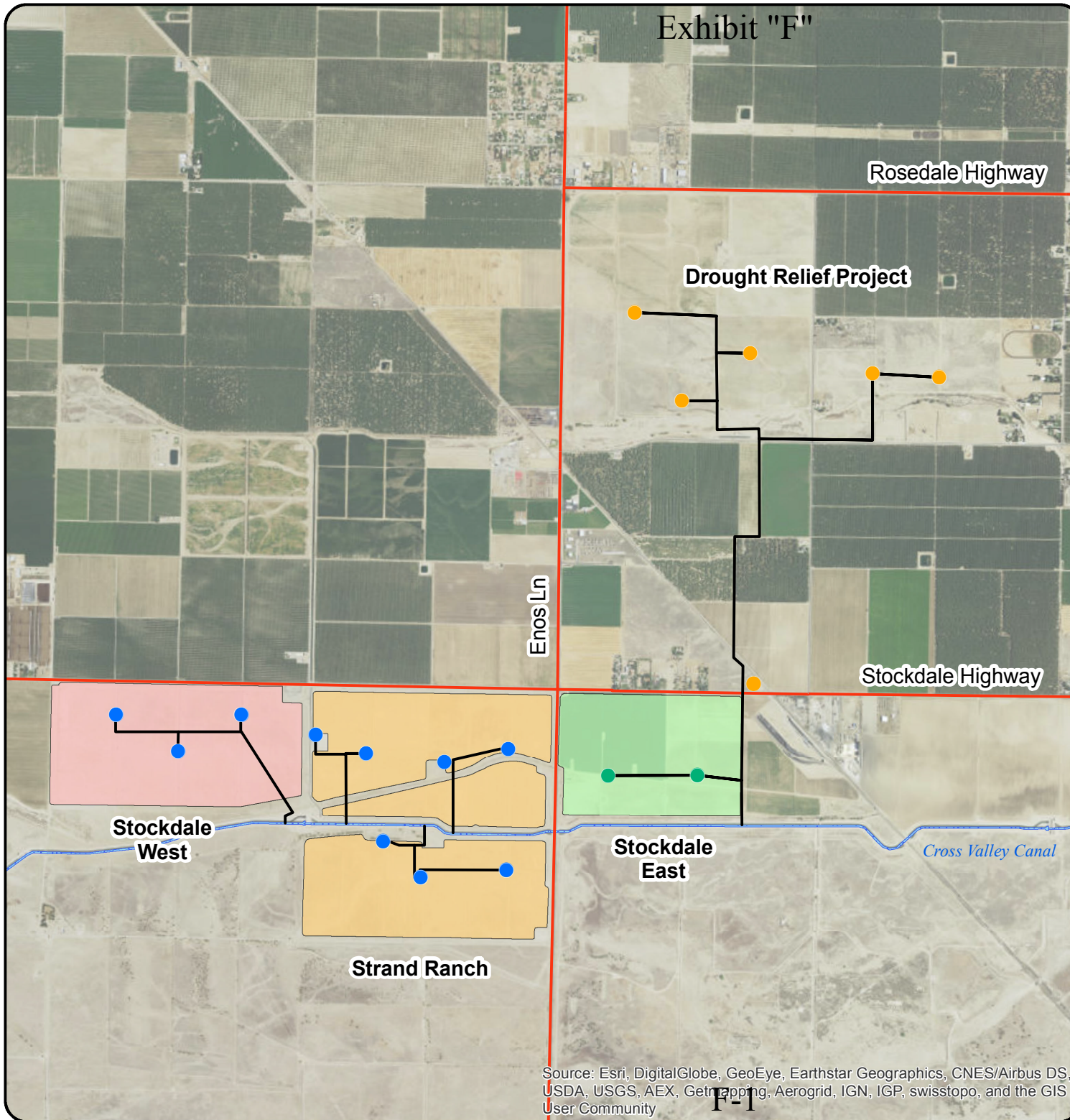
- Existing Extraction Well
- Planned Extraction Well
- Well Under Construction
- Well Discharge Pipelines
- Stockdale East
- Stockdale West
- Strand Ranch

This figure shows the location of IRWD's water banking project sites as well as existing and proposed extraction wells.



0 0.25 0.5 1 Miles

NAD 83 State Plane Zone 5 (feet)
Central Meridian: -118



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Exhibit "G"

Rosedale Highway



Irvine Ranch
WATER DISTRICT

Location Map: IRWD Water Banking Projects Recharge Basins & Turnout Facilities

MAP FEATURES

- ▲ Turnouts
- Stockdale West
- Strand Ranch

This figure shows the location of recharge basins as well as existing and anticipated pipelines and turnout facilities.

Existing Siphon
50 CFS Capacity
From Strand

Stockdale West
Turnout
100 CFS Capacity

Existing North & South
Strand Ranch
Turnout Facilities
100 CFS Capacity Each

Cross Valley Canal

Stockdale Highway

Enos Ln

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

G-1



0 0.25 0.5 1
Miles

NAD 83 State Plane Zone 5 (feet)
Central Meridian: -118

Exhibit "H"

Rosedale Highway



Location Map: IRWD Water Banking Projects Recharge Rates

MAP FEATURES

- ▲ Turnouts
- Stockdale West
- Strand Ranch

This figure shows the location of recharge basins and their associated recharge rates as of May 10, 2019.

Stockdale West
0.52 feet/day
70 CFS

Strand Ranch North
0.36 feet/day
50 CFS

Strand Ranch South
0.13 feet/day
15 CFS

Stockdale Highway

Cross Valley Canal

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



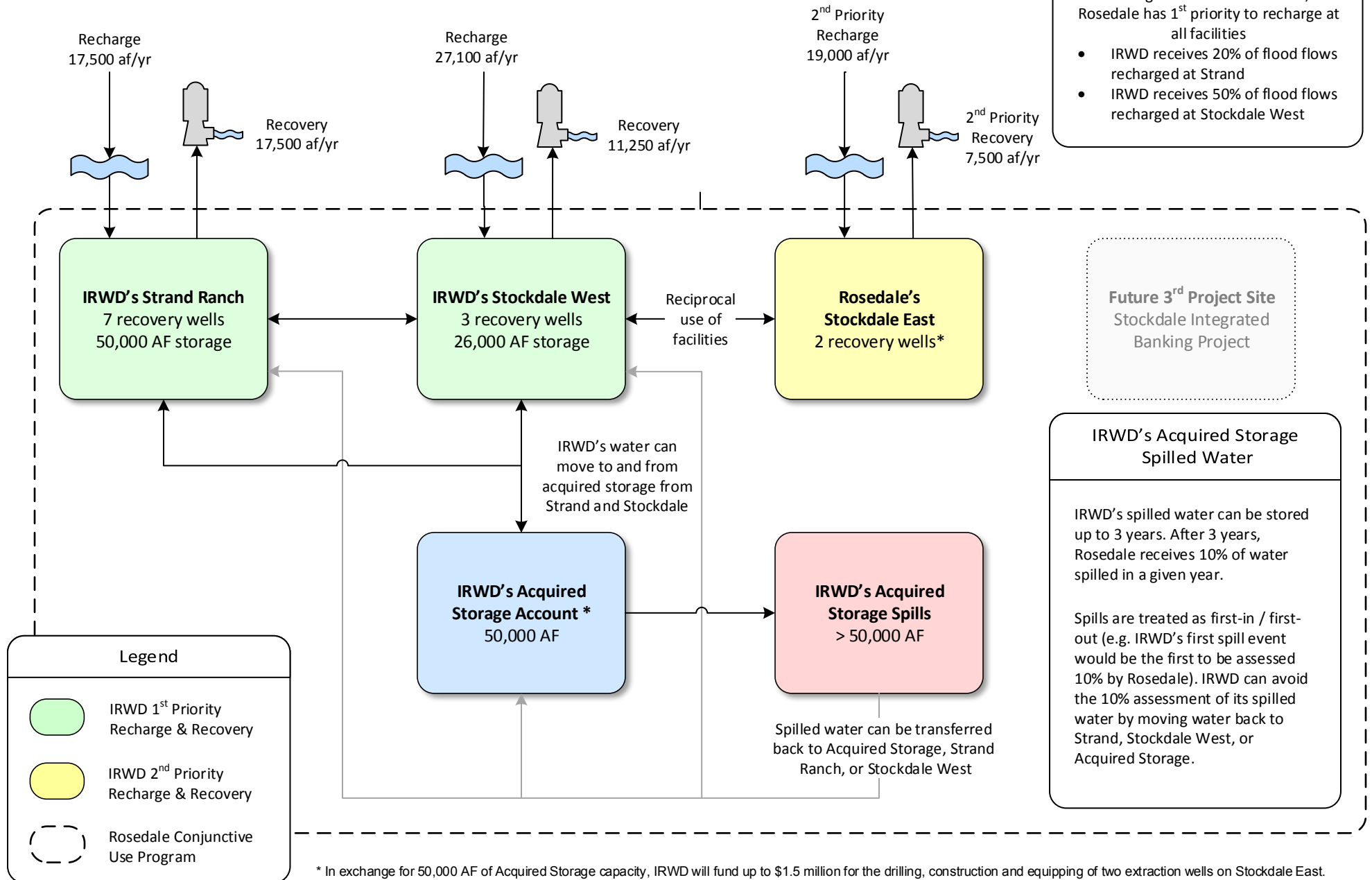
0 0.25 0.5 1
Miles

NAD 83 State Plane Zone 5 (feet)
Central Meridian: -118

Exhibit "I"

IRWD-Rosedale Water Banking and Exchange Program Agreements

Effective 1/12/2009 through 1/12/2039 (Strand Ranch)
2/4/2016 through 1/12/2039 (Stockdale West)

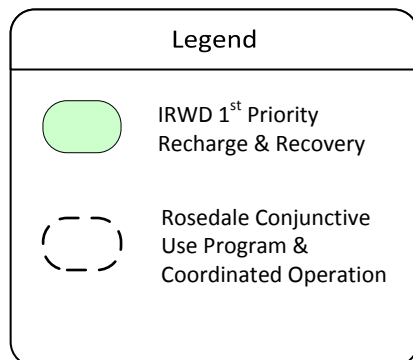
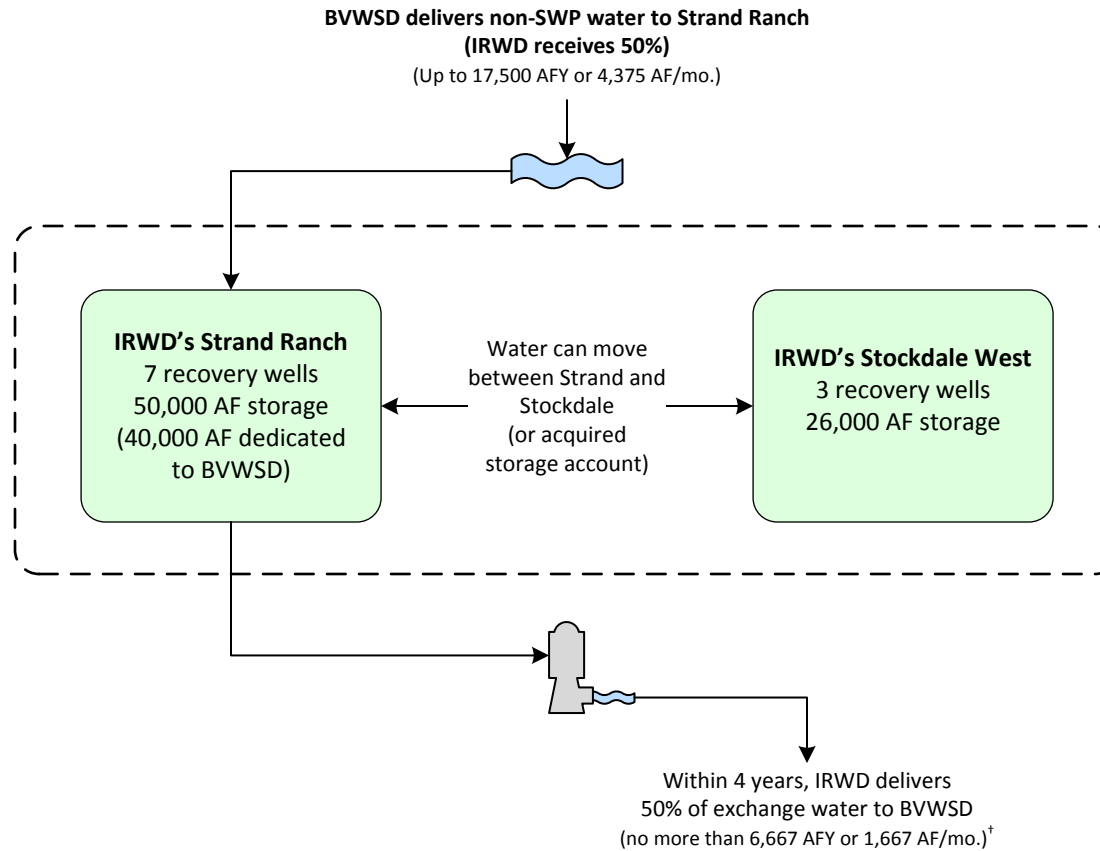


* In exchange for 50,000 AF of Acquired Storage capacity, IRWD will fund up to \$1.5 million for the drilling, construction and equipping of two extraction wells on Stockdale East.

Exhibit "J"

Buena Vista Water Storage District Long Term Water Exchange Program

Effective 1/1/2011 through 1/12/2039

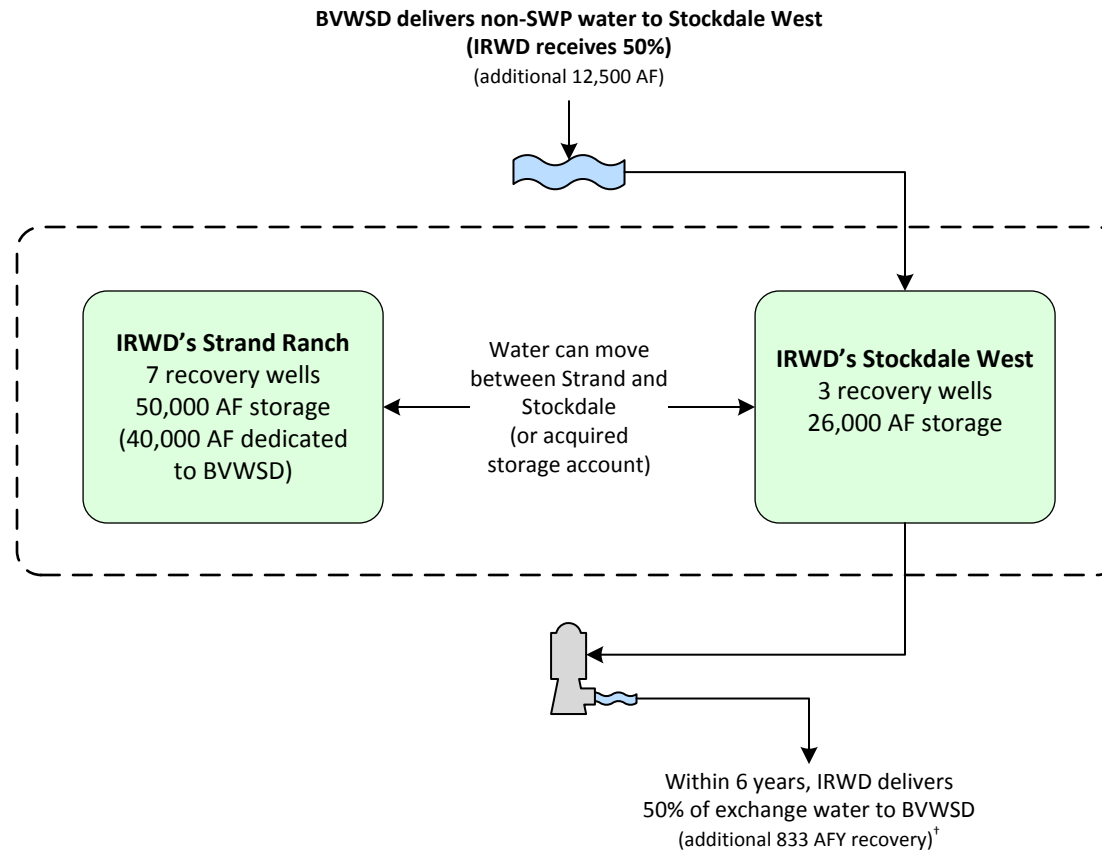


[†]IRWD shall remit one-half of the exchanged supply less one-half of reasonable losses back to BV no later than December 31st of the 4th year following the associated recharge event. IRWD pays for recovery of water returned to BV. Water to be remitted back to BV may remain in storage at Strand Ranch beyond the 4th year, in exchange for a greater percent being transferred to IRWD as compensation per the table shown to the right:

Year Following Recharge Event	Percent Transferred to IRWD	Percent Returned to BV During or Before Indicated Year
1	50%	50%
2	50%	50%
3	50%	50%
4	50%	50%
5	60%	40%
6	70%	30%
7	80%	20%
8	90%	10%
9	100%	0%

Buena Vista Water Storage District One-Year Program to Augment Recharge Using Stockdale West Recharge Facilities

Effective 4/1/2017 through 3/30/2018

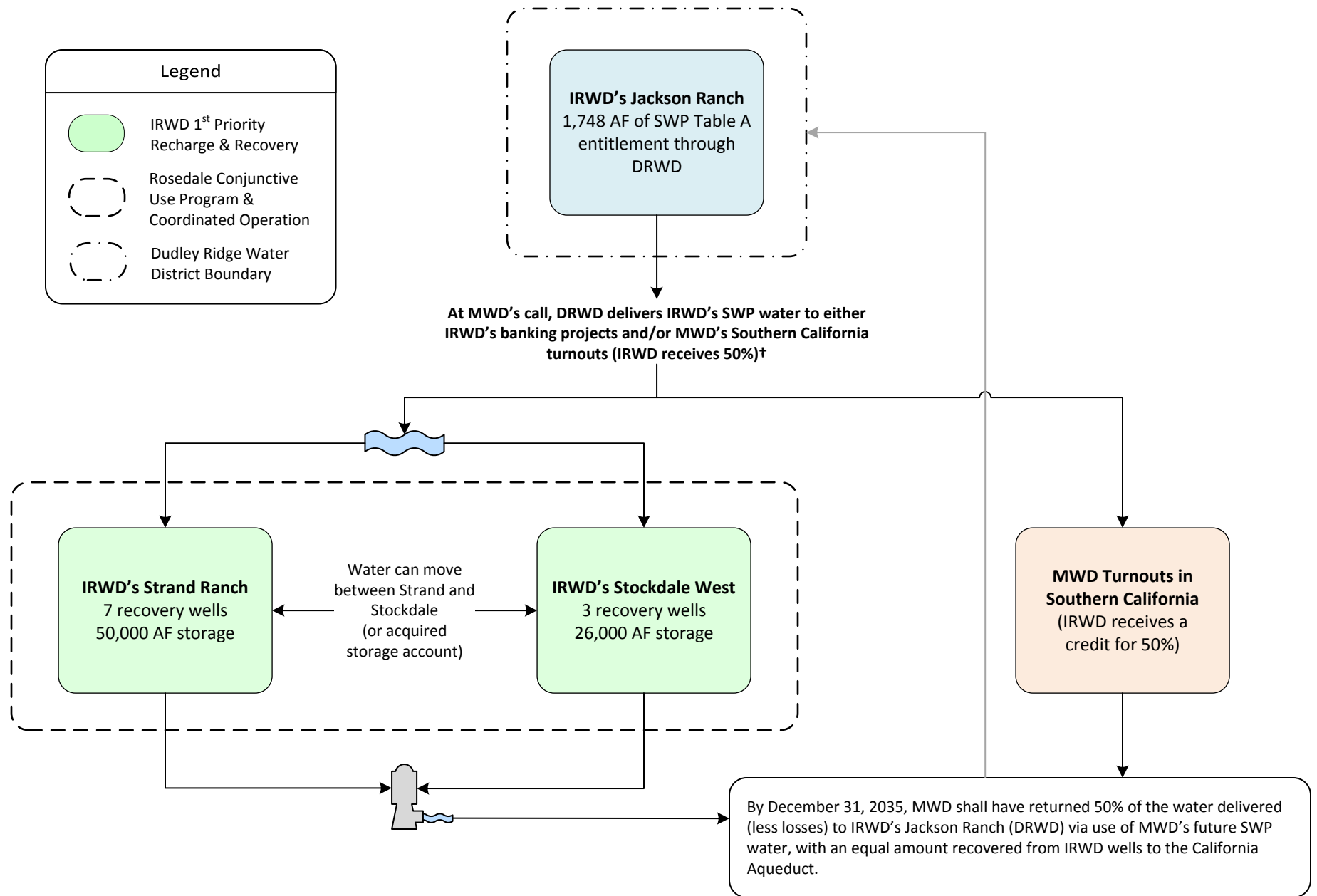


Legend	
	IRWD 1 st Priority Recharge & Recovery
	Rosedale Conjunctive Use Program & Coordinated Operation

[†]IRWD shall remit one-half of the exchanged supply less one-half of reasonable losses back to BV no later than December 31st of the 6th year following the associated recharge event. IRWD pays for recovery of water returned to BV. Water to be remitted back to BV may remain in storage at Strand Ranch beyond the 6th year, in exchange for a greater percent being transferred to IRWD as compensation per the table shown to the right:

Year Following Recharge Event	Percent Transferred to IRWD	Percent Returned to BV During or Before Indicated Year
1	50%	50%
2	50%	50%
3	50%	50%
4	50%	50%
5	50%	50%
6	50%	50%
7	75%	25%
8	100%	0%
9	100%	0%

Exhibit "K"
Dudley Ridge Water District (DRWD) Unbalanced Exchange Program
Up to 12,240 AF delivered from 6/7/2018 through 12/31/2027



†Consistent with IRWD-MWD coordinated operating agreement.

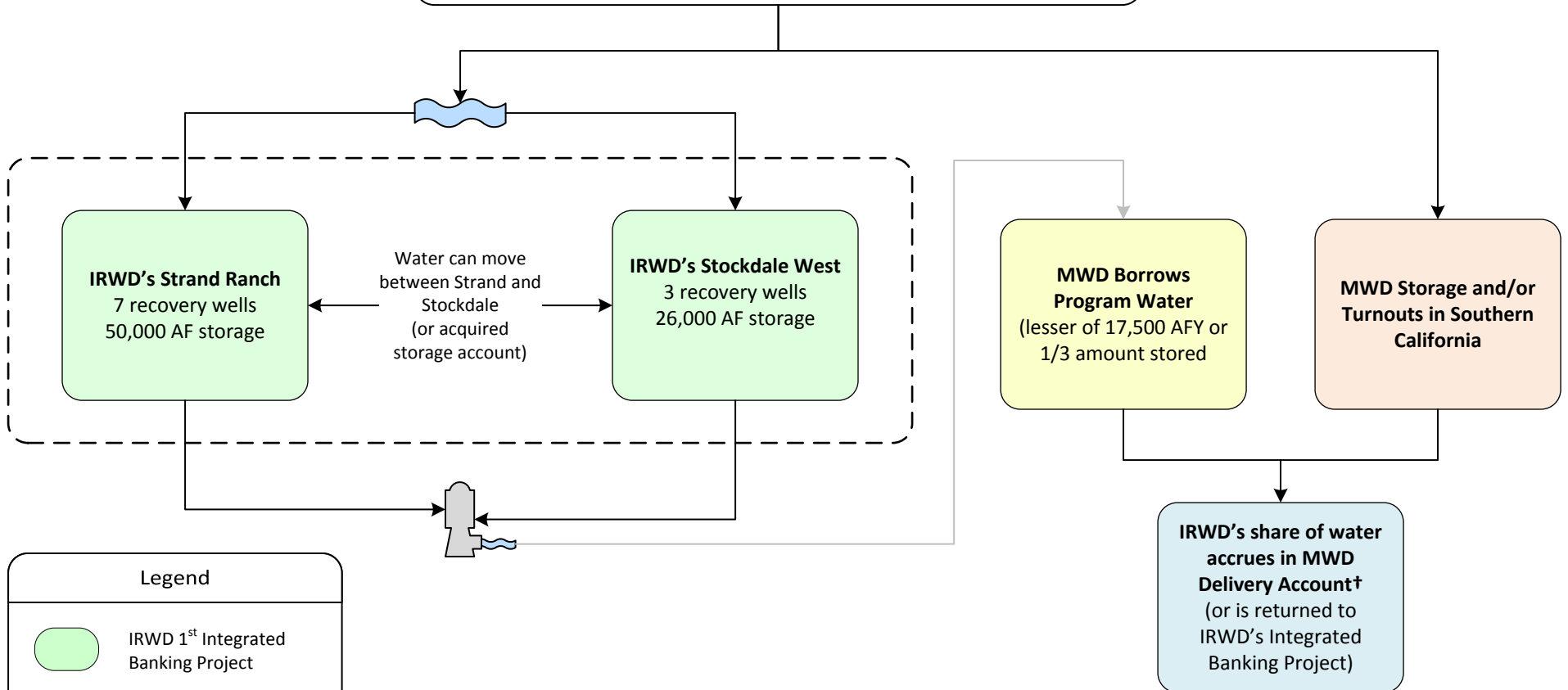
Exhibit "L"

Coordinated Operating, Water Storage, Exchange and Delivery Agreement Between MWD, MWDOC and IRWD Effective 5/1/2011 through 11/4/2035

With MWD's consent, IRWD secures SWP water (Program Water) through exchanges with IRWD Banking Partners for use as extraordinary supply under MWD Water Supply Allocation Plan

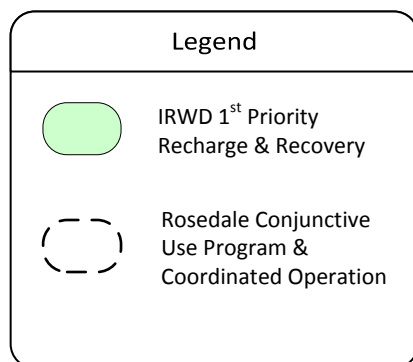
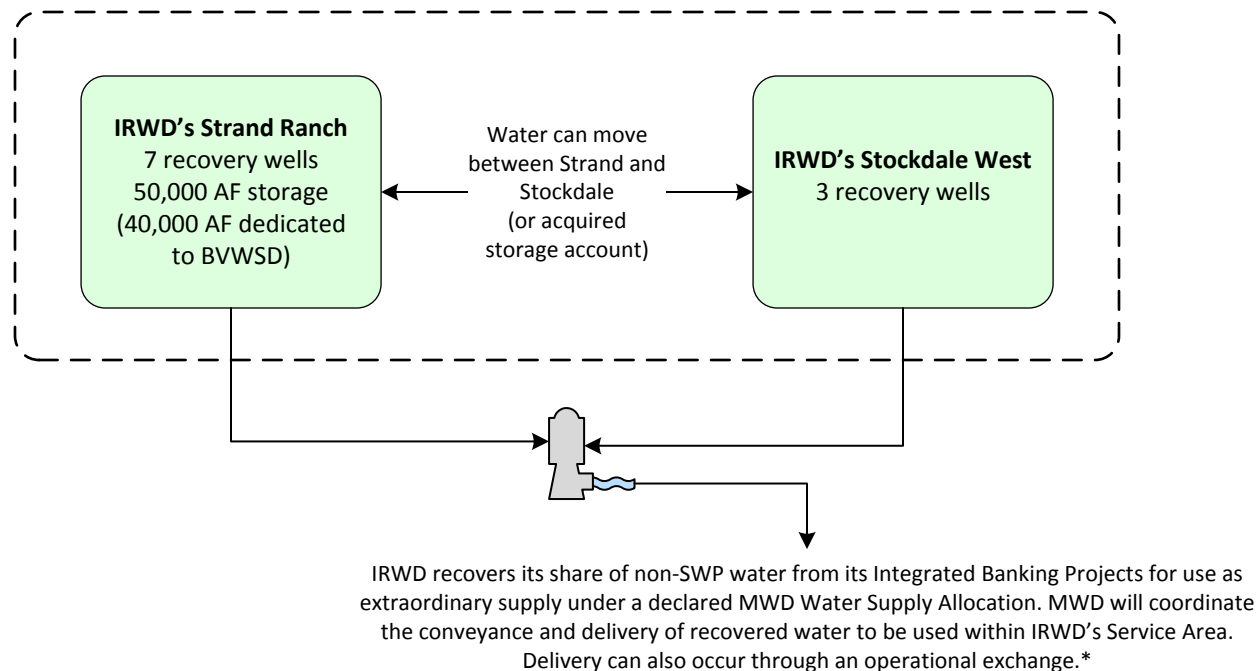
MWD has three options for the use and storage of Program Water:

- Storage of water in IRWD's Integrated Banking Project
- Delivery to Southern California for immediate use and/or storage in MWD system
- Borrow a portion of Program water, with accrual in MWD Delivery Account



- Under an MWD Allocation, when IRWD calls for water, IRWD must first recover Program Water from the Integrated Banking Project before receiving water from the MWD Delivery Account.
- MWDOC shall pass through extraordinary supply credits for IRWD's benefit.
- † IRWD's banking partner share of Program Water to be returned by MWD.

Exhibit "M"
Agreement for Conveyance of Water Between MWD, MWDOC, and IRWD (Wheeling Agreement)
Template for future agreements



*The recovered water must be used within IRWD's service area. IRWD to pay MWD wheeling charges, including system access rate, water stewardship rate, and treatment surcharge (if applicable), for each acre foot of recovered water wheeled by MWD. IRWD will pay the actual costs of power incurred by MWD to convey recovered water in the California Aqueduct to IRWD delivery points.

May 16, 2019

Prepared by: R. Bennett / K. Welch

Submitted by: F. Sanchez / P. Weghorst

Approved by: Paul A. Cook 

SUPPLY RELIABILITY PROGRAMS COMMITTEE

UPDATE ON SGMA COMPLIANCE FOR IRWD WATER BANKING PROPERTIES

SUMMARY:

The Kern Groundwater Authority was formed in 2017 as a local Groundwater Sustainability Agency, which includes Rosedale-Rio Bravo Water Storage District as a member. To comply with the Sustainable Groundwater Management Act (SGMA), each member of the Authority is preparing its own chapter of a Groundwater Sustainability Plan (GSP). The GSP will describe how groundwater will be managed within the local groundwater basin. In March 2019, IRWD executed two agreements with Rosedale to provide SGMA coverage for IRWD's water banking properties that are located outside of Rosedale's boundaries. Consistent with these agreements, IRWD's water banking properties will be included within Rosedale's chapter of the GSP along with other un-districted lands. The Authority's GSP will be submitted to the California Department of Water Resources (DWR), which will then review the document for compliance with SGMA. At the Committee meeting, staff will present an overview of Rosedale's chapter of the GSP and the requirements of SGMA.

BACKGROUND:

On September 16, 2014, Governor Brown authorized SGMA, which requires establishing Groundwater Sustainability Agencies to implement GSPs to sustainably manage the groundwater resources throughout California. IRWD's Strand Ranch and Stockdale West water banking properties are located within the Kern County Sub-basin of the San Joaquin Valley Groundwater Basin that has been designated as a high-priority basin requiring the development and submittal of a GSP to DWR.

The Kern Groundwater Authority is one of several Groundwater Sustainability Agencies in Kern County whose members include a number of water districts and public agencies. The Authority includes Rosedale as a member. Provided as Exhibit "A" is a map that shows the location of the current Groundwater Sustainability Agencies within the Sub-basin. The Authority is preparing an umbrella GSP with chapters that provide specific information for individual members. Rosedale is preparing its own chapter to the Authority's GSP.

GSP Coverage for IRWD Properties:

Rosedale is incorporating IRWD's water banking lands within its chapter of the Authority's GSP consistent with two agreements that IRWD executed with Rosedale. The first agreement is a Landowner Agreement which provides SGMA coverage using a standard contract developed by Rosedale for agricultural lands located outside of its district boundary. The second Supplemental Agreement limits selected parts of the Landowner Agreement regarding any fees, charges or

assessments to correct groundwater overdraft problems to which IRWD's projects do not contribute.

Rosedale's Chapter of the GSP:

Beginning in January 2019, staff has participated in monthly progress meetings as a member of the Landowner Advisory Committee and the Rosedale Stakeholder Advisory Committee that were formed to assist Rosedale with the development of its chapter to the Authority's GSP. In March 2019, Rosedale submitted a draft of its chapter to staff for IRWD's review. This chapter is provided as Exhibit "B". Staff has reviewed the document and provided comments and suggestions to Rosedale for its consideration in revising the document. At the Committee meeting, staff will present an overview of Rosedale's chapter of the GSP, staff comments provided to Rosedale, and the requirements of SGMA.

FISCAL IMPACTS:

To date, IRWD has paid \$26,223 to cover a proportional share of Rosedale's overall costs to prepare its chapter of the GSP. These costs include a \$10 per acre charge associated with participating in the Landowner Agreement and an \$18 per acre charge to cover costs from 2014 through 2019 for modeling and development of the GSP chapter. The Landowner Agreement indicates that additional costs will be allocated using a formula to be determined by Rosedale in consultation with the entities that signed the agreement. Consistent with the Supplemental Agreement with Rosedale, IRWD's water banking properties will be exempt from any Rosedale GSP chapter restrictions, fees, charges or assessments intended by the Authority to correct groundwater overdraft problems to which IRWD's projects do not contribute.

ENVIRONMENTAL COMPLIANCE:

Not applicable.

RECOMMENDATION:

Receive and file.

LIST OF EXHIBITS:

Exhibit "A" – Location of Groundwater Sustainability Agencies in the Kern County Sub-basin
Exhibit "B" – Preliminary Draft of Groundwater Sustainability Plan Chapter for the Rosedale-Rio Bravo Management Area.

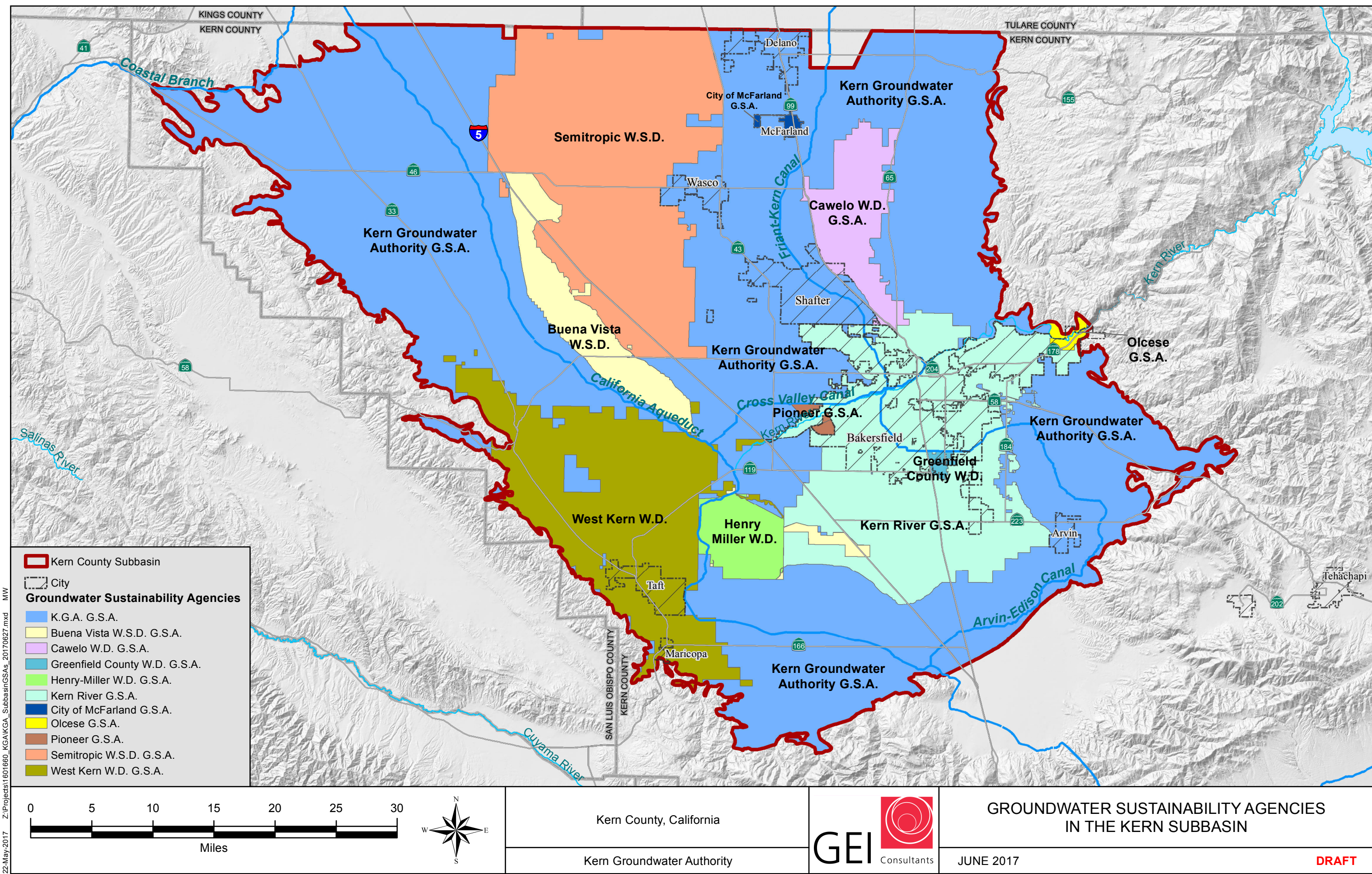


EXHIBIT "B"
PRELIMINARY DRAFT

**Groundwater Sustainability Plan Chapter
for the**

ROSEDALE-RIO BRAVO Management Area

Kern Groundwater Authority Groundwater Sustainability Agency

Kern County Sub-basin 5-22.14, California



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1. Administrative Information

1.1 General Information

1.1.1 Purpose of GSP

The purpose of this chapter is to describe the Rosedale-Rio Bravo Water Storage District Management Area (RRBMA) compliance with the requirements of the California Sustainable Groundwater Management Act (SGMA) developed in coordination of the Kern Groundwater Authority Groundwater Sustainability Agency (KGAGSA).

The Rosedale-Rio Bravo Water Storage District (RRBWSD or District) operates primarily as a groundwater replenishment district similar to a traditional groundwater bank. Direct surface deliveries to beneficial uses are minimal with most in-District deliveries via direct groundwater recharge. District landowners recover water for multiple beneficial uses via private and public groundwater extraction wells. The District since its inception has implemented a number of projects and acquired water supplies sufficient to provide for overlying demands. In spite of these efforts water levels have declined due to the existence of overdraft in other areas of the groundwater basin.

1.2 Agency Information

1.2.1 Chapter Agency

RRBWSD is a public agency organized in accordance with California Water Storage District Law (Division 14, commencing with §39000 of the California Water Code) for the purpose of acquiring, storing, distributing, and replenishing water supplies within its boundaries in Kern County, California. There is a board of five elected members that govern the District. It is operated by a General Manager, Eric Averett who is tasked with implementing the District's activities, including the District's activities under this plan; Mr. Averett is the District's "Plan Manager" for purposes of this chapter.

Physical Address: 849 Allen Road, Bakersfield CA, 93314.

Mailing Address: PO Box 20820, Bakersfield CA, 93390

Email: eaverett@rrbwsd.com

Phone: 661 589-6045

1.3 GSP Implementation Costs

1.3.1 Costs Generated by GSP Implementation and Funding

As described in section 7. RRBWSD has been developing several projects in order to meet its measurable objectives by developing approximately 27,500 AF/yr of new water supplies as summarized below. In addition to these project costs are administrative and SGMA GSP management implementation and reporting costs of about \$200,000/yr.

2020 Projects.

It is estimated that approximately **5,000 AF/yr** of additional supply could be developed by 2020 by the West Basin Improvements and Stockdale East projects. Total capital cost are approximately \$13.2M and annual O&M costs are approximately \$386,000. Total annualized cost is \$1,341,000 or \$268/acre-foot (plus water cost).

2025 Projects.

It is estimated that approximately **11,500 AF/yr** could be on-line by 2025 through the implementation of Pilot Projects, James Groundwater Storage Project, and the Onyx Project. Total capital cost are approximately \$38.8M and annual O&M costs are approximately \$753,000. Total annualized cost is \$3,223,000 or \$280/AF (plus water cost for direct recharge projects).

2030 Projects.

It is estimated that another potential **10,000 AF/yr** is in development and could be on-line by 2030 through the implementation of the Kern Fan Project. Total capital cost are approximately \$45M and annual O&M costs are approximately \$1,350,000. Total annualized cost is \$4,700,000 or \$468/AF (plus water cost).

2035 Projects.

It is estimated that another potential **1,000 AF/yr** is in project development and could be on-line by 2035 (Western Rosedale In-Lieu Service Area). Total capital cost was approximately \$5,100,000 and annual O&M costs are approximately \$152,000. Total annualized cost is \$526,000 or \$467/AF (plus water cost).

RRBWSD estimates that full implementation and management of the groundwater management plan (GSP) could cost up to \$10M per year. Costs may be recovered from several sources, including district assessments; charges to white lands via contract; a “Water Charge” for certain volumetric uses of water; and District water management program revenues. The proposed new water charge would be driven by the need to manage the underlying groundwater reservoir in a sustainable manner, which is something that has been hindered in the short term by hydrology, with the most recent period of drought, chronic overdraft within the basin, and in the long term by regulatory constraints which have been imposed on pumping from the Sacramento-San Joaquin River Delta, which have resulted in a declining yield of the District’s contract for imported water from the State Water Project. Management of the area’s water resources in a sustainable manner is not just a District initiative; it has been mandated by the State of California’s passage of the Sustainable Groundwater Management Act.

Since the cost of a new water supply, assuming it could be found, is highly variable and speculative, it is proposed to initially base a Water Charge on a demand-management strategy. Under this approach, and assuming that long-term average water supply is less than long-term average water use, it would be intended that the Water Charge generate revenue to buy land(s) within the District for the purpose of retiring it from water-using purposes (and potentially for use as recharge facilities - a dual benefit that would both reduce demand and generate additional water supplies). Over time, it is intended that enough land be purchased and retired in this manner such that long-term water supply and water use are in relative balance. The unit Water Charge would be a function of the consumption which will be avoided for each acre retired; land cost; and the demand-management planning horizon. In particular, the land cost per acre is divided by the avoided consumption per acre, which yields a cost per acre-foot of avoided water use. The initial unit Water Charge would be equal to this amount divided by the planning horizon in years. While this strategy is the basis for a proposed Water Charge, the District will place a high priority on and endeavor to develop additional water supply programs to minimize the amount of land retirement which may be required under SGMA.

The District has also entered into contractual arrangements with landowners whose lands are outside of the District to assist those landowners with SGMA compliance. Pursuant to these contract, the District will recoup costs associated with assisting those landowners. These arrangements are included in Appendix I.

1.4 Description of Plan Area

1.4.1 Geographic Areas Covered

The RRBMA encompasses approximately 49,084 acres of lands (77 square miles) and is generally located at the western limit of Bakersfield between Stockdale Highway to the south and 7th Standard Road to the north, Interstate Highway 5 (I-5) near the west and the Santa Fe Railroad on the east as shown on Figure 1.

Within the RRBMA there are approximately 7,291 acres of lands that are not within any district boundaries but have agreed, via agreement, to be included in the RRBMA along with District lands as illustrated in Figure 1. The lands which are not in the RRBWSD but in the RRBMA are referred to as the Rosedale-Rio Bravo White Lands (RRBWLs) which is a sub-management area of the RRBMA with its own water balance, projects, and management actions.

Within the RRBMA there are approximately 41,793 acres of land that is within the RRBWSD which are referred to as the Rosedale-Rio Bravo Water Storage District Lands (RRBDL) within the RRBMA which is a sub-management area of the RRBMA with its own water balance, projects, and management actions.

There are 1512 acres of lands within RRBWSD but within the Kern River GSA and will be covered there and not in the RRBMA but could be included in RRBDL projects and management actions.

1.4.2 Plan Area Setting

The RRBMA is primarily rural in nature with the exception of urban development in the eastern portions of the management area as shown in Figure 2. There are approximately 41,500 acres of irrigated agriculture, 4,100 acres of undeveloped lands, 3,000 acres developed in residential, commercial and industrial. The areas not developed for typical land uses or undeveloped are mostly developed for water banking facilities, which include storage basin berms, water control structures, canals, groundwater wells, and power lines. The water banking areas total approximately 2,500 acres. There are also Scattered oil-field facilities are also present in some areas. There are 1512 acres of lands developed to residential, commercial and industrial within RRBWSD but within the Kern River GSA and will be covered there.

The whole of the RRBMA is dependant on groundwater as the primary source of supply. There are approximately 375 wells in the RRBMA (4.9 wells/square mile). Approximately 183 of these wells are agricultural, 24 banking, 25 municipal, and 143 domestic. The M&I wells are predominately on the eastern portion of the RRBMA and the agricultural and banking wells on the west.

The northern monitoring zone is a total of 8,072 acres and has 20 domestic and 32 agricultural wells (1.6 domestic well per square mile and 2.5 agricultural wells per square mile).

The central monitoring zone is a total of 13,377 acres and has 26 domestic and 36 agricultural wells (1.2 domestic well per square mile and 1.7 agricultural wells per square mile).

The southern monitoring zone is a total of 13,935 acres and has 13 domestic and 44 agricultural or banking wells (0.6 domestic well per square mile and 2 agricultural or banking wells per square mile).

The eastern monitoring zone is a total of 11,115 acres and has 75 domestic, 28 agricultural or banking wells, and 21 municipal wells (4.3 domestic well per square mile, 1.6 agricultural or banking wells per square mile, and 1.2 municipal wells per square mile).

The south of river monitoring zone is a total of 2,596 acres and has 1 domestic, 6 agricultural or banking wells, and 1 municipal well (0.25 domestic well per square mile, 1.5 agricultural wells per square mile, and 0.25 municipal wells per square mile).

To support groundwater extraction and use, the RRBWSD imports surface water from various sources, including federal, state, and local supplies, through unbalanced exchange agreements, purchase or temporary transfers, or other means as available. Sources include the Central Valley Project (CVP), the State Water Project (SWP), Kern River, and appropriative (pre-1914 and post-1914) water rights. From 1962 through 2017, the District has taken delivery of approximately 3.8 million acre-feet of imported surface water supplies.

Groundwater Banking Activity

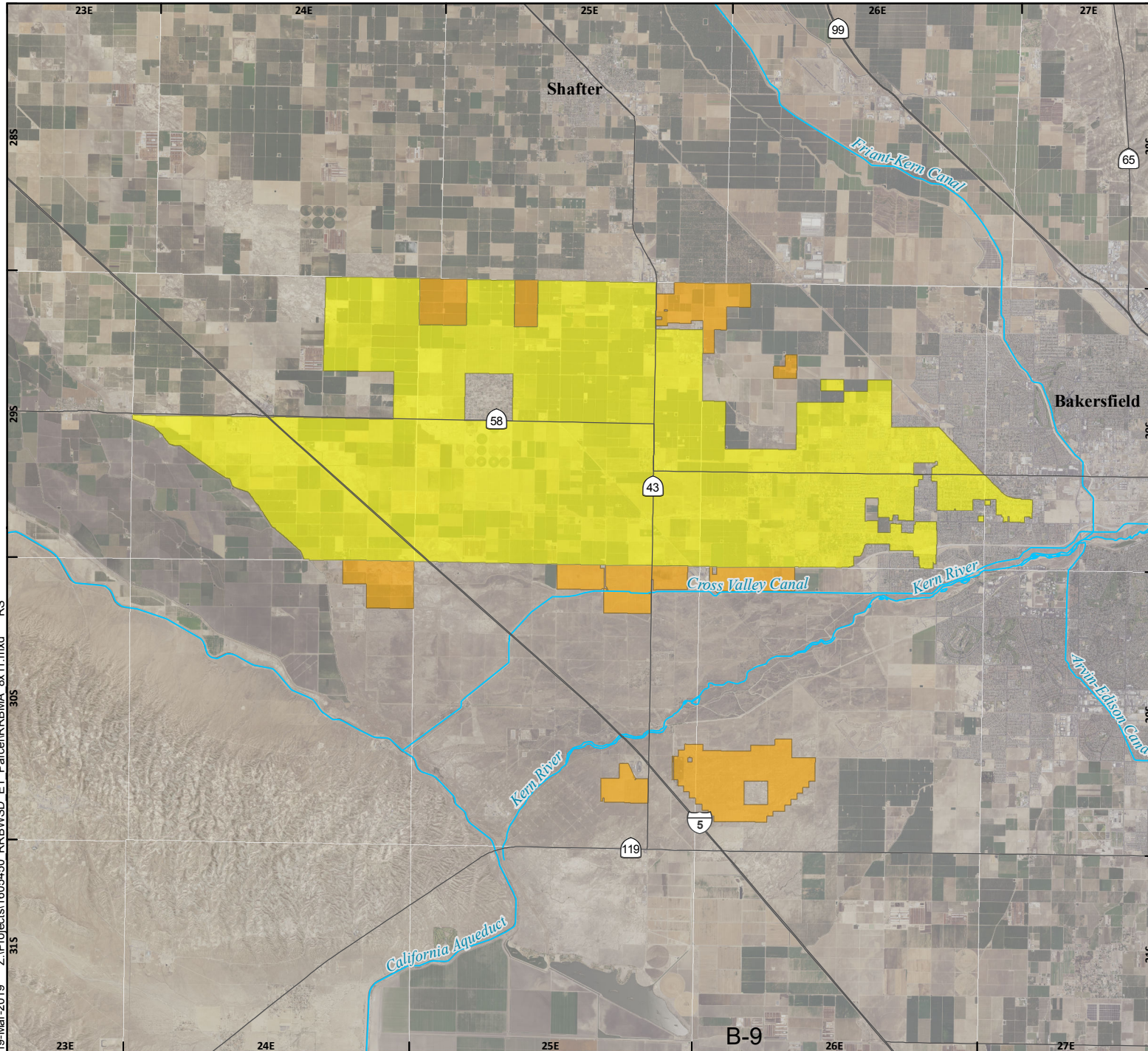
The RRBWSD current boundary and recharge project facilities are shown on Figure 3. The District's groundwater recharge project was initially developed to take advantage of the Goose Lake channel, which traversed the District from east to west. The channel of the Goose Lake slough has been modified for use as a water conveyance and groundwater recharge canal. The District also participated in the initial construction and expansion of the Cross Valley Canal (CVC), and has constructed a network of groundwater recharge basins and channels as a part of its project that as of the end of 2017 covers approximately 1,770 gross acres and 1,180 net wetted acres.

In addition to groundwater recharge basins and channels, the District's facilities include recovery wells and pipelines for return of water as a part of its groundwater banking programs. Seven recovery wells, associated pipelines, and an outlet to the CVC were constructed at the east end of the District in 2006 as part of the RRB-ID4 Joint Use Recovery Project (JURP). The District constructed three recovery wells adjacent to the Enns Ponds and west intake canal in 2009 as a back stop to its groundwater banking programs. Three additional recovery wells were constructed adjacent to the West Basins during 2016 as a part of the District's Drought Relief Project.

The District also has the right to use groundwater recharge and recovery facilities in groundwater banking projects located to the south of the District as a part of agreements with the City of Bakersfield, Kern Water Bank, and the Kern County Water Agency (KCWA). The District has partnered with the Irvine Ranch Water District (IRWD) in the development of the Stockdale Integrated Banking Project located along the south boundary of the District, which includes the District owned Stockdale East recharge and recovery area and the IRWD owned Strand Ranch and Stockdale West banking areas. All totaled, the District's average groundwater recharge rate is over 600 cfs.

Central Valley Project

The Central Valley Project (CVP) is a network of dams, power plants, and canals that provides water supply reliability to the Central Valley in periods of drought. The Bureau of Reclamation makes excess non-storable CVP Section 215 flood water available during wet years. If conveyance is available, this surplus CVP water could be delivered to the RRBWMA from the Friant-Kern Canal through the CVC. RRBWSD is a fourth priority non-CVP SOD Contractor that can take CVP water under certain conditions.



ROSEDALE-RIO BRAVO MANAGEMENT AREA (RRBMA)

- Rosedale-Rio Bravo W.S.D. in RRBMA (41,793 ac)
- White Lands in RRBMA (7,291 ac)

All Other Features

- Highway
- Waterway



Rosedale-Rio Bravo Management Area
Kern County, California

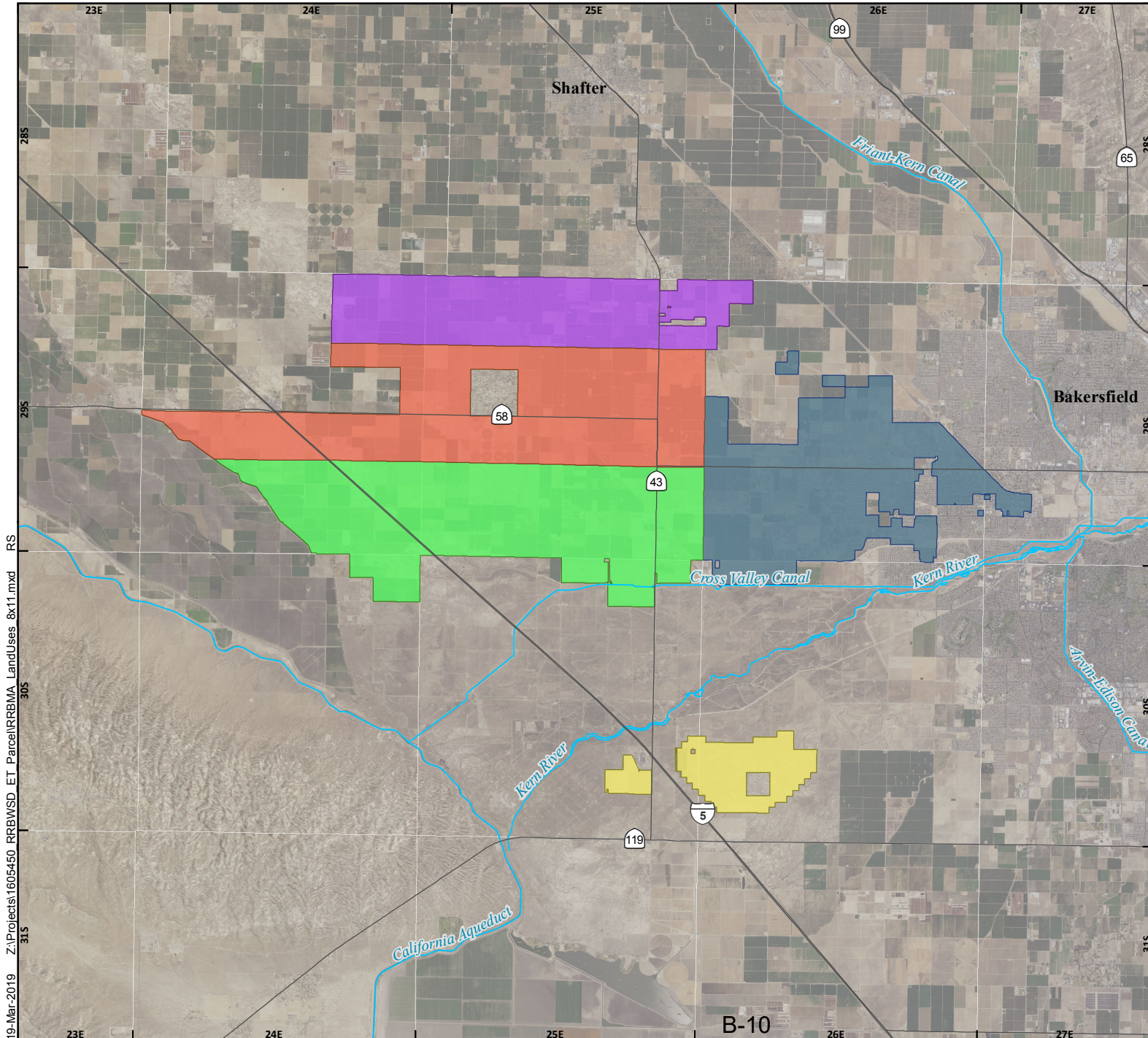
Rosedale-Rio Bravo WSD



MARCH 2019

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FIGURE 1



RRBMA LAND USES

Proposed Monitoring Zones

- East Zone - Agriculture, Urban and Groundwater Banking
- South Zone - Agriculture and Groundwater Banking
- Central Zone - Agriculture
- North Zone - Agriculture
- South of River Zone - Agriculture and Groundwater Banking

All Other Features

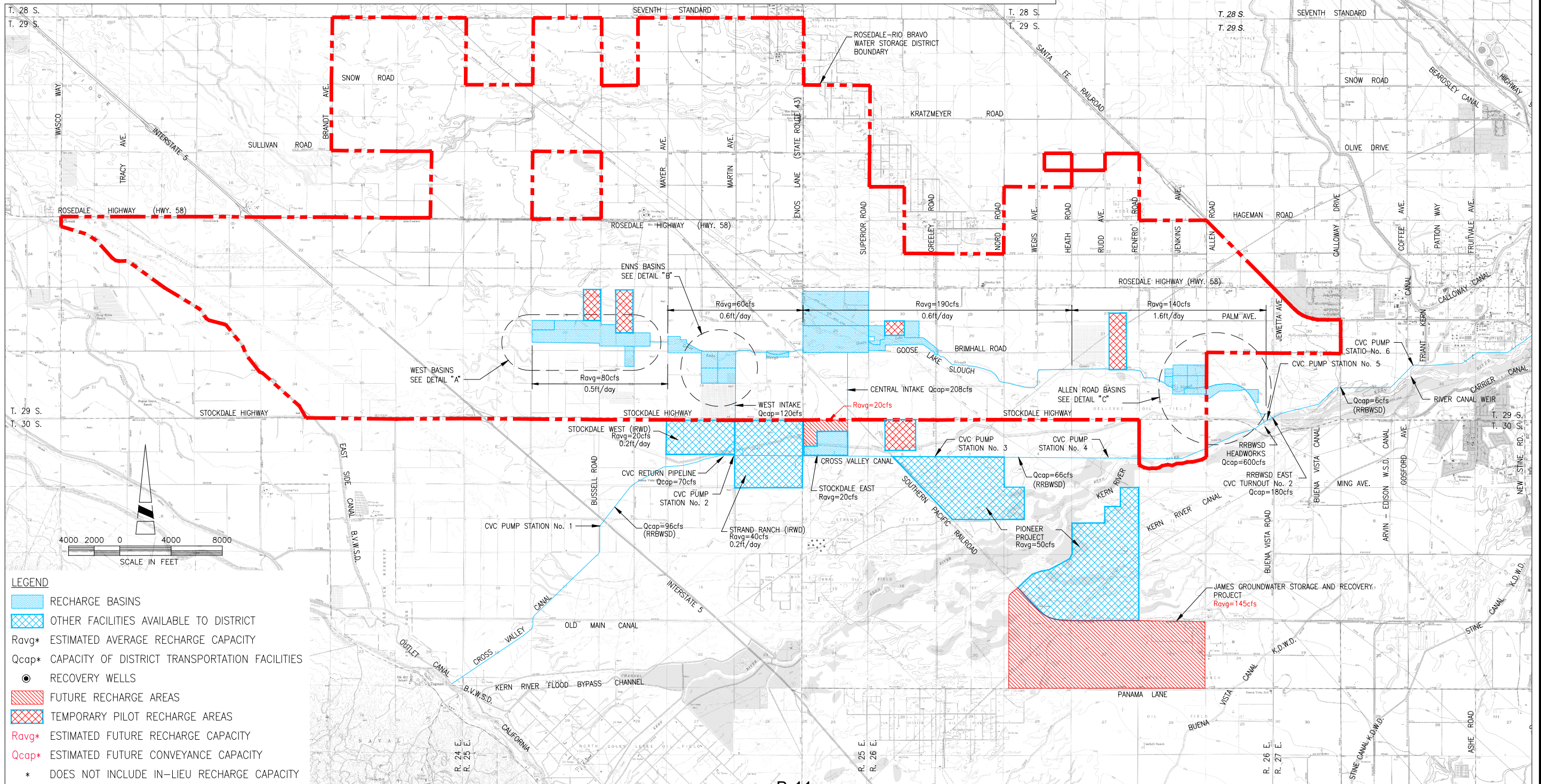
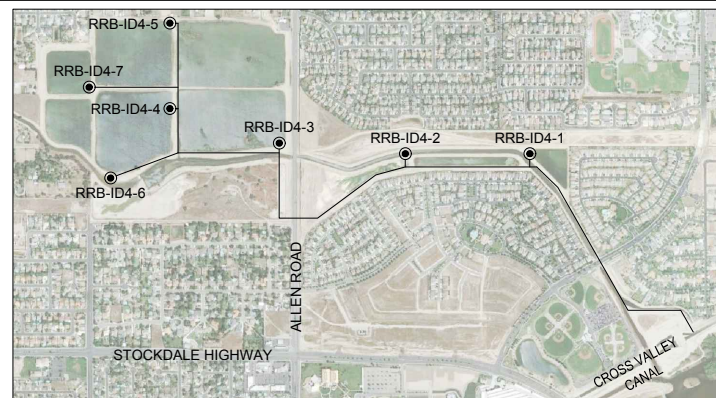
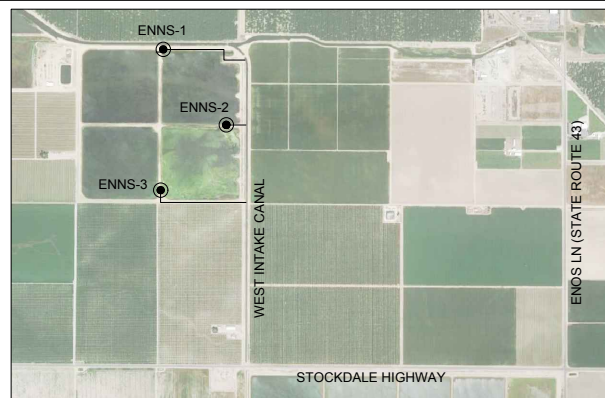
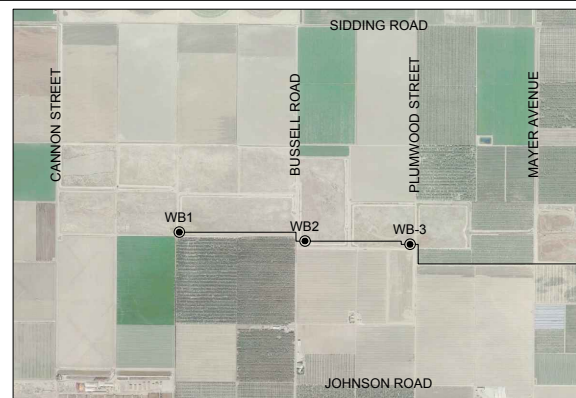
- Highway
- Waterway

Rosedale-Rio Bravo Management Area
Kern County, California

Rosedale-Rio Bravo WSD

GEI Consultants

MARCH 2019 **DRAFT** FIGURE 2



State Water Project

DWR delivers water to 29 State Water Contractors, including 21 south of the Sacramento River Delta, that are served from the California Aqueduct. State Water Contractors can order water up to their Table A allocation under a given allocation set by DWR, even if the water is not needed in that year, and this excess water can be stored outside the contractor's place of service for future use. RRBWSD currently receives SWP water through a water supply contract with Kern County Water Agency (KCWA), one of the State Water Contractors.

During wet hydrologic years, DWR may declare Article 21 water available, which is uncontrolled water that cannot be stored in State reservoirs. Article 21 supplies are available in short duration, and, if conveyance capacity exists, can be purchased and stored for future use. RRBWSD purchases excess Article 21 water through its State Water Contractor for delivery to existing project recharge facilities using the CVC when such water is available.

Appropriative Water Rights

Surface water rights, including pre-1914 and post-1914 water rights, are held by water districts and parties throughout California, including Kern River water rights. These water rights can be transferred to other parties as long as legal users of water are not injured (per Water Code Section 1706 and 1702). The SWRCB supervises changes to post-1914 water rights, but not pre-1914 water rights.

Unregulated Kern River flows are available during wet years when the U.S. Army Corps of Engineers (USACE) conducts mandatory releases of water from Isabella Reservoir for flood control purposes. The Kern River Watermaster records the amount of water released daily from the Isabella Reservoir into the Kern River. During these periods of flooding, releases from the Isabella Reservoir may be available for diversion.

RRBWSD currently receives Kern River water when it is available for groundwater recharge through water service agreements with the City of Bakersfield. Kern River water is also available to RRBWSD when water (1) is offered to all takers willing to sign a "Notice/Order"; or (2) is offered to the Kern River/California Aqueduct Intertie for disposal; or (3) is expected to flood farm acreage; or (4) is expected to be delivered into the Kern River Flood Channel for disposal out-of-county.

1.4.3 General Plans in Plan Area

Most lands within the RRBMA also fall within the Kern County General Plan (Kern County Planning Department, 2009), which designates the majority of the lands as Intensive Agriculture, as well as the Western Rosedale Specific Plan (WRSP) updated in 2007. The Kern County General Plan is in the midst of a 2040 update which expected to be adopted in 2019. The Western Rosedale Specific Plan (WRSP) was prepared in response to the concerns of the Rosedale community, landowners, and the Kern County Board of Supervisors. The General Goals of the WRSP is to:

1. Establish the role of Western Rosedale in the Bakersfield Metropolitan area
2. Improve the quality of air, land, water, and plant and animal life
3. Provide a range of housing alternatives
4. Diversify land uses and improve the economic opportunities
5. Provide public facilities and services existing and future development

6. Manage growth to conserve natural resources
7. Provide a mechanism for development of community identity
8. Protect public health and safety
9. Protect existing development from incompatible land uses

The WRSP area is largely served by a series of water districts and companies formed to serve specific housing tracts or areas. The western portion of the WRSP area is served by individual or small group wells, which are not always operated by a named district or company. Vaughn Water Company is the only water purveyor with an established service area within the area. The WRSP area obtains its water solely from underlying aquifers. Currently no treated surface water is delivered into the area aside from groundwater recharge. The existing infrastructure consists of well installations with storage facilities and deliver systems to the serve the developments. No backbone transmission or delivery systems exist within the WRSP area.

According to the WRSP, future reliance on groundwater will not adequately provide a safe, reliable water source for the future. As the water table is repeatedly drawn down, the opportunity is increased for contaminants from various levels of the aquifer to commingle. To alleviate the pressure on the groundwater basin, it will be necessary to increase utilization of surface water either through increased basin recharge or through treatment and direct use of surface water. Groundwater recharge systems will need financial support.

[Add language from WRSP that encourages recharge]

1.4.4 Other Plan Elements from CWC § 10727.4

A groundwater sustainability plan shall include, where appropriate and in collaboration with the appropriate local agencies, all of the following:

- Control of saline water intrusion.
- Wellhead protection areas and recharge areas.
- Migration of contaminated groundwater.
- A well abandonment and well destruction program.
- Replenishment of groundwater extractions.
- Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage.
- Well construction policies.
- Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.
- Efficient water management practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use.
- Efforts to develop relationships with state and federal regulatory agencies.
- Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.

- Impacts on groundwater dependent ecosystems.

RRBWSD currently cooperates in several existing District, multi-agency and other governmental programs and policies that address many of the above mentioned issues as follows and found in Appendix A:

1. Memorandum of Understanding Regarding Operation and Monitoring of the Rosedale-Rio Bravo Water Storage District Groundwater Banking Program 2009 Amended (RRBWSD Banking MOU) Appendix A-1);
2. Memorandum of Understanding Regarding Operation and Monitoring of the Rosedale-Rio Bravo Water Storage District Groundwater Banking and Sale Program 2004 (RRBWSD Banking and Sale MOU) (Appendix A-2);
3. Kern Fan Purge Pump Water Quality Sampling Procedures (Sampling Procedures Appendix A-3);
4. Department of Water Resources Water Quality Policy and Implementation Process for Acceptance of Non-Project Water into the State Water Project (Pump-in Policy)(Appendix A-4);
5. Project Recovery Operations Plan Regarding Pioneer Project, Rosedale-Rio Bravo Water Storage District, and Kern Water Bank Authority Projects (Joint Operations Plan) (Appendix A-5);
6. RRBWSD Long Term Operations Plan from Stockdale EIR (Appendix A-6);
7. Kern Groundwater Authority Joint Powers Agreement (KGA JPA)(Appendix A-7);
8. Rosedale-Rio Bravo Water Storage District Groundwater Management Plan 2011 and 2013 (Appendix A-8);
9. Rosedale-Rio Bravo Water Storage District Operations Report, 2017 (Appendix D);
10. Kern County Environmental Health Department Water Well Ordinance; and .
11. Kern Fan Monitoring Committee Operations Report (Appendix A - 9)

Kern County Well Ordinance

The Kern County Environmental Health Department issues permits for the construction and destruction of wells within the basin. The ordinance has a number of components related to seals, water quality testing, destruction standards, proximity, and inspections that serve to protect groundwater quality.

RRBWSD MOU's

Within the RRBMA are lands used for groundwater banking operations that are subject to the conditions specified in the MOU's (Appendix A-1 and A-2). The MOU's recitals include, "Adjoining Entities and Project Participants desire that the design, operation and monitoring of the Project be conducted and coordinated in a manner to insure that the beneficial effects of the Project to the Project Participants are maximized but that the Project does not result in significant adverse impacts to water levels, water quality or land subsidence within the boundaries of Adjoining Entities, or otherwise interfere with the existing and ongoing programs of Adjoining Entities." A Monitoring Committee, comprised of one representative of each of the Adjoining Entities and one representative of the RRBWSD, has numerous functions specified in the MOU's including, to "Develop procedures, review data, and recommend Project operational criteria for the purpose of identifying, verifying, avoiding, eliminating or mitigating, to the extent practicable, the creation of significant imbalances or significant adverse impacts."

A primary purpose of the monitoring committee is to evaluate groundwater information and determine if impacts are likely to occur as a result of project operations. If the monitoring committee determines that impacts are likely, then mitigation strategies are developed. Measures to prevent significant adverse impacts from occurring may include: (1) spreading out recovery areas; (2) providing buffer areas

between recovery wells and neighboring overlying users; (3) limiting the monthly, seasonal, and/or annual recovery rate; (4) providing sufficient recovery wells to allow rotation of recovery wells or the use of alternate wells; (5) providing adequate well spacing; (6) adjusting pumping rates or terminate pumping to reduce impacts; and (7) imposing time restrictions between storage and extraction to allow for downward percolation of water to the aquifer. The MOU's also stipulates water quality is to be at least maintained and, where possible, enhanced. Some of the measures prescribed in the MOU's to protect water quality include: 1) giving storage priority to the best quality water available, 2) removing more salts than are stored, 3) controlling the migration of poor quality water, and 4) extracting poorer quality groundwater where practicable (and where blending with excellent quality water from elsewhere in the area results in the water quality objectives of downstream users being met).

Pump-in Policy

The delivery of recovered water into the California Aqueduct is subject to the DWR's Pump-in Policy (Appendix A-4). The policy establishes a Facilitation Group of affected stakeholders and describes the requirements to implement a program including necessary monitoring and reporting. In practice, a proposal is submitted to DWR which describes the project proponents, maps showing all water sources and delivery points, rates and volumes of inflow, detailed water quality data for all recovery wells, and the expected blend of water delivered to the aqueduct. Well-water quality data and recovery rates are modeled to determine resultant blends and anticipated water quality changes in the aqueduct, and this information is reported to the Facilitation Group daily during recovery programs.

MMRP and Joint Operations Plan

Recovery operations are subject to a Long-Term Operations Plan established in the MMRP and the Joint Operations Plan (Appendix A-5 and A-6). Consistent with the MOU's, both plans designate specific measures to be employed to "... prevent, eliminate or mitigate significant adverse impacts" resulting from project operations. The Joint Operations Plan designates mitigation measures similar to those contained in the Long-Term KWB Plan described in the MMRP. The Joint Operations Plan was developed to supersede the Long-Term Plan as it considers cumulative recovery operations of KWBA, Rosedale, and KCWA projects. Both plans designate a committee that regularly monitors potential groundwater level impacts of banking project recovery operations on neighboring agricultural and domestic wells based on groundwater modeling. Specific triggers are set for potential mitigation actions, with significant impacts being avoided, eliminated, or mitigated by implementing one or more corrective actions, including investigation of any claims and pump lowering, well replacement, and/or reduction or adjustment of banking project recovery operations, as appropriate.

KGA Joint Powers Agreement

The KGA GSP includes an "umbrella" document with chapters that provide specific information for districts/banks/etc. With respect to water-banking projects, the JPA (Appendix A-7) provides that: "Such chapter or provisions may include operating conditions for groundwater banking projects that have previously been negotiated with other Members or agencies within the Basin and/or are contained within approved environmental documents. The Authority will recognize such operating conditions and/or environmental documents as meeting the requirements of consistency with the Authority's GSP and the requirements of SGMA."

Groundwater Management Plan

The District adopted a Groundwater Management Plan in 1997 under the provisions of California Water Code (CWC), Division 6, Part 2.75, Sections 10750 et seq., otherwise known as AB 3030. The provisions

of CWC Sections 10750 et seq. were amended through California Senate Bill 1938 (SB 1938). At its meeting on November 13, 2012, the District board adopted a Resolution of Intention to update its current Groundwater Management Plan in order to be consistent with the provisions of CWC Sections 10750 et seq. as amended by SB 1938.

The goal of the District, as identified in its 1997 Groundwater Management Plan, is to balance recharge with consumptive use while respecting adjacent landowners and other basin users. Objectives listed in that plan included:

- Formalizing the District’s groundwater management practices to provide for the continuance of local management and to enhance existing monitoring activities, and
- Identifying and implementing modifications to ongoing practices in order to preserve and enhance groundwater resources.

The updated 2013 Groundwater Management Plan (Appendix A-8) described current conditions in the plan area and the status of the District’s groundwater monitoring and management programs. Annually the District produces an updated operations plan in accordance with plan. In addition, Basin Management Objectives have been developed as a part of this Groundwater Management Plan, as required by CWC Section 10750 as follows:

- Maintaining a positive water supply balance for its landowners,
- Working cooperatively with landowners and other water agencies overlying the Subbasin on groundwater issues,
- Protecting groundwater quality, and
- Maintaining groundwater levels.

Each year since the RRBWSD updates the report and posts the report on the District website.

1.5 Notice and Communication

Prior to enactment of the SGMA, the Kern Groundwater Authority (“Groundwater Authority”) was established to provide a framework for the active, comprehensive management of the groundwater basin underlying the valley portion of Kern County, to preserve and maintain local control (“self-determination”) of groundwater resources and provide long term surety for all basin users.

With passage of the SGMA, the Groundwater Authority has sought to coordinate local groundwater management efforts and is working with its members to determine the most cost effective and efficient way of meeting the new requirements of the SGMA.

In May 2018 the KGA (of which the District is a member) adopted a Communication and Engagement Plan. Implementation of SGMA and outreach requirements are broken down into four phases:

Phase 1: GSA Formation and Coordination – Phase 1 ranged from 2015 to 2017, and during this phase, local agencies created groundwater sustainability agencies (GSA). The responsibility of a GSA is to develop and implement a groundwater sustainability plan (GSP) that will consider all beneficial uses and groundwater users within the basin. GSAs were required to be formed by June 30, 2017.

Phase 2: GSP Preparation and Submission – The second phase of SGMA implementation ranges from 2017 to 2020. During this phase, GSAs must develop GSPs with measurable objectives and

milestones that ensure basin sustainability. A basin may be managed by a single GSP or multiple coordinated GSPs. The California Department of Water Resources (DWR) developed regulations for evaluating GSPs and alternatives to GSPs by June 1, 2016.

Phase 3: GSP Review and Evaluation – For the Kern Groundwater Authority (KGA), Phase 3 will be held in 2019, and consists of a public review period. The public review period will be held 90 days prior to the adoption of the GSP. Once the GSP has been submitted to the DWR by January 31, 2020, DWR will hold another 60-day review and comment period for stakeholders.

Phase 4: Implementation and Reporting – Following the submission of the GSP, the KGA will immediately begin the implementation of efforts described in the GSP to reach sustainability within the basin. This will be an ongoing phase, as the goal of SGMA is to reach sustainability by 2040.

1.5.1 Participating Agencies

The Kern Groundwater Authority (KGA) provides local policy makers, stakeholders, and the public a forum to monitor, report and/or discuss groundwater activities and identify and address any local groundwater issues.

On April 26, 2017 The KGA (JPA) elected to become a GSA and was formed for the purpose of:

1. Coordinating groundwater management programs and activities;
2. Identifying and addressing issues pertaining to sustainable groundwater management; and
3. Establishing a framework for local groundwater management.

The 16 participants in the KGA are:

Arvin Community Services District
Arvin-Edison Water Storage District
Cawelo Water District
City of Shafter
Kern County Water Agency
Kern-Tulare Water District
Kern Water Bank Authority
North Kern Water District
Rosedale-Rio Bravo Water Storage District
Semitropic Water Storage District
Shafter-Wasco Irrigation District
Southern San Joaquin Municipal Utility District
Tejon-Castaic Water District
West Kern Water District
Westside District Water Authority
Wheeler Ridge-Maricopa Water Storage District

SGMA requires all high- and medium-priority groundwater basins, as designated by the DWR Bulletin 118, to be managed by a GSA or multiple GSAs. Part of the Tulare Lake Basin, the Kern County Groundwater Subbasin is a high-priority basin that is in critical groundwater overdraft. The Kern County Groundwater Subbasin currently has 10 GSAs:

Kern Groundwater Authority GSA (KGA)

Buena Vista Water Storage District
Cawelo GSA
Greenfield County Water District
Henry Miller Water District Kern Groundwater Authority
Kern River GSA McFarland GSA
Olcese GSA – Olcese Water District
Pioneer GSA
Semitropic Water Storage District
West Kern Water District

1.5.2 Beneficial Uses

Known RRBMA groundwater beneficial uses include:

Municipal and Domestic Supply (MUN) - Includes uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Agricultural Supply (AGR) - Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Service Supply (IND) - Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

1.5.3 Public Meetings

KGA's Stakeholder meetings are held the first Monday of each month at 3:30 p.m., at the RRBWSD office.

KGA's Board meetings are held at 8 a.m. on the fourth Wednesday of every month, at either the KERN County Supervisor's office or the Greater Bakersfield Chamber of Commerce.

The KGA has hosted numerous informational workshops and solicited comments in a variety of forums including on-line stakeholder surveys in both english and spanish.

Informational Meeting on Sustainable Groundwater Plan, Compliance & State Intervention – September 20, 2018

Groundwater Workshops – April 26 & May 21, 2018

Stakeholder Workshop #1 – October 24, 2016

Stakeholder Workshop #2 – November 1, 2016

Stakeholder Workshop #3 – November 15, 2016

Stakeholder Workshop #4 – November 28, 2016

Stakeholder Workshop #5 – December 5, 2016

Stakeholder Workshop #6 – December 20, 2016

Please see Appendix C of Umbrella GSP for KGA comprehensive outreach effort.

The RRBMA has sought to solicit input from its local stakeholder groups. While the RRBMA is governed by the RRBWSD, an unofficial RRBMA Stakeholder Advisory Group has been established to provide an

organized solicitation of input forum. This forum is made up of representatives from four key stakeholder groups: Agricultural, Urban, White Lands, and Groundwater Banking. Meetings are held monthly or as needed and geared towards discussions surrounding the development and implementation of the RRBMA SGMA GSP. The RRBWSD has designated representatives from each group. Meetings are posted and open to all stakeholders within the RRBMA and key documents posted in the District website. <https://www.rrbwsd.com/rrbma>

White Land Stakeholder Workshop - November 11, 2018

RRBMA Stakeholder Workshop #1 – January 29, 2019

RRBMA Stakeholder Workshop #2 – February 26, 2019

RRBMA Stakeholder Workshop #3 – March 26, 2019

RRBMA Stakeholder Workshop #4 – April 23, 2019

Please see RRBMA outreach documentation in Appendix B.

The District maintains a website (www.rrbwsd.com); the District regularly posts materials regarding SGMA and conducts outreach to all stakeholders using the website.

1.5.4 Comments Received

KGA comments are found in Appendix C of Umbrella GSP and RRBMA comments received found in Appendix B.

1.6 GSP Organization

See section 1. of Umbrella GSP

2. Basin Setting

2.1 Hydrogeologic Conceptual Model

See section 2.1 of Umbrella GSP for Kern County Subbasin conceptual model and basin setting.

2.1.1 Local Refinements

As part of the RRBWSD's efforts to manage groundwater and evaluate impacts of neighboring groundwater banking projects a numerical groundwater flow model was developed in 2011 and has been updated and refined each year since. Current model boundary and calibration wells is shown on Figure 4. A more detailed description is found in Appendix C. The tool has been essential in mitigating groundwater impacts from banking recovery as well as evaluating future groundwater levels relative to future projects and management actions. For the RRBMA this tool was used to evaluate the adequacy of projects and management actions to effect compliance with minimum thresholds and measurable objectives.

Regional Geologic Setting

The hydrogeology of the southern San Joaquin Valley, and in particular the Kern Fan area, has been the focus of several previous studies by the Department of Water Resources and/or the United States Geological Survey. Croft (1966) studied in detail the hydrogeology of the Kern Fan area and Dale (et.al., 1972), in a broader work, studied the subsurface geology of the water bearing deposits beneath the southern San Joaquin Valley. The Department of Water Resources investigated the geology of the Kern Water Bank in great detail during the completion of studies for the development of the Kern Fan Element and the Rosedale Local Element of the Kern Water Bank (DWR, 1990). These earlier studies were subsequently refined by the RRBWSD as more information regarding the aquifer became available (R.Crewdson, 2003 and T.Harder 2011, 2013).

The RRBMA lies within the region of California referred to as the Great Valley geomorphic province. The Great Valley geomorphic province is a long alluvial plain that runs approximately 400 miles through central California (CGS, 2002). The Great Valley can be further divided into the northern Sacramento Valley and the southern San Joaquin Valley. The RRBMA is located within the San Joaquin Valley which is flanked by the Sierra Nevada Range to the east, and the Coast Range to the west. Sediments located within the project area range in age from the Jurassic to Holocene period. Granitic and metamorphic rocks outcrop along most of the eastern and southern flanks of the Great Valley and marine rocks of pre-Tertiary age outcrop along most of the western flank. Post-Eocene-aged continental rocks and deposits found in this area contain most of the fresh groundwater and are underlain by or contain saline water at depth.

The Coast Range is dominated by the northwest trending San Andreas fault. Large coalescing alluvial fans have developed along each side of the valley (CGS, 2002). The larger and more gently sloping fans on the east side consist of deposits derived from the massive intrusive igneous rock sources of the Sierra Nevada; whereas, the smaller and more steeply sloping fans on the west side are built up by sediments originating from predominantly sedimentary rocks of the Coast Range. As a result, the valley floor consists mainly of two kinds of alluvial materials that differ widely in provenance and their respective engineering properties (CGS, 2002).

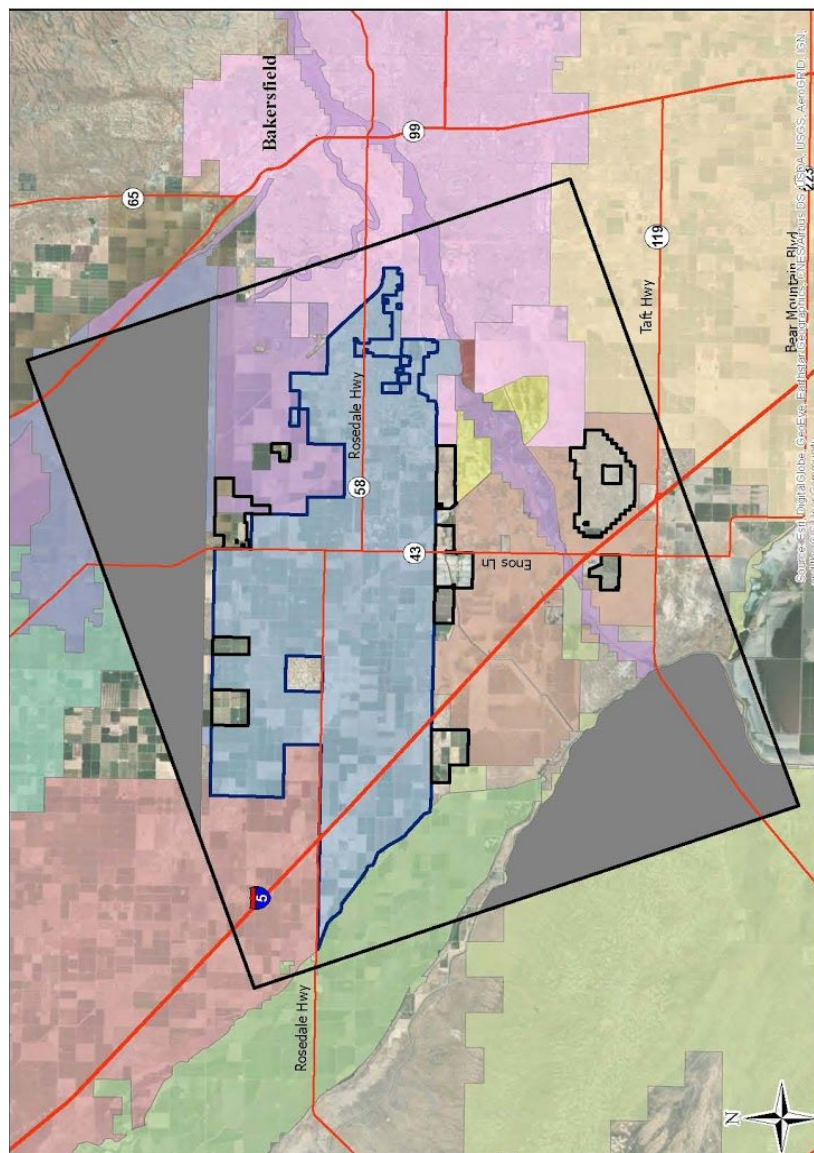


Figure 4. RRBWSD Numerical Model Boundary

The Sierra Nevada block has been tilted westward, caused by faulting and uplifting of the eastern edge. The western side is depressed and overlain by the sedimentary deposits of the valley. The southern boundary of the Sierra Nevada block is the east-west running Garlock fault. The site is located on alluvial deposits derived from the Sierra Nevada Range near the southern boundary of the San Joaquin Valley.

Geology of the Aquifer

The RRBMA is located within the Kern County Subbasin of the San Joaquin Valley Groundwater Basin (DWR, 2006). The subbasin covers the western third of Kern County and includes Kern River and Poso Creek. Geologically, San Joaquin Valley is a structural trough created by tectonic forces and filled with older marine and younger continental sediments that were eroded from the surrounding mountains. These continental sediments derived from the alluvial processes form a wedge of deposits that thicken toward the center of the valley.

The sedimentary deposits of the valley have been estimated to range in thickness from 175 to 2,900 feet with an average of approximately 600 feet (DWR, 2006). Specific yield, the amount of water in storage in the ground that will drain under the influence of gravity and a measurement of water available for man's use, ranges from about 3 – 12% in silts, 15 – 27% in sands and as high as 31% for gravels in the interval from surface down to 300 to 600 feet deep (DWR, 2006). The highest specific yield measurements are associated with sediments of the Kern Fan west of Bakersfield, including those in RRBMA. The well-sorted, sandy sediments have higher specific yields than finer grained silts and clays. For most of the basin, excluding the area of the Kern Fan, there are two water bearing units that are separated by an aquitard known as the Corcoran Clay, which restricts vertical groundwater flow between the overlying unconfined aquifer and the underlying confined aquifer. The hydrogeology of the Kern Fan region is characterized by thick alluvial deposits with an upper unconfined aquifer and areas where there are semi-confined conditions. A semi-confined aquifer is also referred to as a leaky aquifer where the confining layer is not continuous and vertical flow occurs between the upper unconfined aquifer and the lower aquifer. Some estimates indicate a total water storage capacity of 40 million acre-feet (af) (DWR, 2006).

The upper aquifer is considered to be unconfined and extends down to a depth of approximately 200 to 400 feet. The upper unconfined aquifer consists of interbedded silts, sands, with some minor deposits of clay (Meillier, 2001). In the Kern Fan area west of Bakersfield, the Corcoran Clay is not generally present although there are numerous discontinuous clay layers that can locally restrict vertical flow creating a separation between a shallow unconfined aquifer and a deeper semi-confined aquifer. The lower semi-confined aquifer, on average, extends to a depth of approximately 600 feet though in some areas can be quite deeper.

Kern River Characteristics

The Kern River is a losing stream where it runs immediately south of the RRBMA, having only received flows in 6 of the last 22 years. The Kern River Reports prepared by the City of Bakersfield have recorded losses since at least 1987 throughout the lower reaches of the river from the 1st point of measurement several miles east of the RRBMA to the 2nd point of measurement just south of the RRBMA.

The RRBMA is in the central portion of the Kern County Subbasin. Immediately south of the RRBMA is located the Kern River and is at the distal end of the Kern River Alluvial Fan.

2.2 Water Budget Allocation

2.2.1 Kern Subbasin Water Budget

See section 2.3 of Umbrella GSP

2.2.2 RRBWL - RRBWSD Sub-Management Area Water Budget

In 2017, the RRBWSD stored 323,000 AF of water net of losses, which is the highest on record for the District. Annual banking recovery volumes have reached 50,000 AF overlying annual demand of about 105,000 AF in the RRBWSD which includes a in-district consumptive use of about 87,000 AF of agricultural demand and 9,000 AF of urban demand as shown in Appendix E.

The Umbrella GSP groundwater model produced a “basin-wide” balance as described in section 2.3 of the Umbrella GSP. In its Operations Plan Update, the RRBWSD updates its numerical “checkbook” groundwater balance each year as shown in Appendix D and components described below. This is a valuable tool for the District to evaluate whether the District is balancing supplies and demands over time and whether management actions must be taken or projects implemented to meet the sustainability objectives.

Native Yield

There are many definitions of native yield, legal and otherwise; however, for the purposes of this chapter, it refers to groundwater benefits available to landowners that does not relate to Rosedale’s efforts to import surface water supplies that are recharged into the groundwater aquifer and recovered in the RRBMA. Functionally, it is the proportionate share of local unadjudicated waters that enter the Kern County Subbasin that are not a result of imported water supplies. The value of 0.3 acre-feet per acre is the historic number used by the RRBWSD and the value used by AECOM in the District’s 2017 Operations Report. By definition, this unit value is intended to reflect a long-term average; the actual safe yield (a.k.a. native yield) in any given year is dependent upon hydrology, which is highly variable from year to year in the region. A non-precedent-setting native yield unit value of 0.3 AF/acre for each developed acre in the RRBMA will be used in the balance calculations herein. It is understood that this number may be greater than the actual amount; native yield will be periodically reviewed by the District (and others) and will be refined as necessary as more definitive information is available. There are 39,468 acres in the RRBWSD of which 37,991 acres are developed, thus giving a safe yield of 11,397 AF/yr.

Precipitation

Precipitation amounts on the Kern Subbasin surface are very limited and do not completely percolate to groundwater. The Meadows Field station reported an annual range of 3.25” up to 13.32” for the 2008-2017 period with an average of 5.84”. Because the water use calculation method described below accounts for all soil evaporation and crop ET, a gross precipitation number must be used across all lands whether developed or not. Therefore there was an average of 21,598 AF/yr (44,380 acres x 5.84”/12”/ft) of precipitation during the 1998-2017 period.

Project Water

Project Water in RRBWSD is considered to be that which is recharged within or by the District for the benefit of its landowners, all of whom have access to the underlying groundwater reservoir for overlying use. The nature of the District’s Project is such that recharge is highly variable from

year to year, ranging from zero to about 275,000 acre-feet within the District. The District also has access to recharge projects on the Kern River Fan, just south of the District, where it recharges water for the benefit of the District. During periods of drought there can be several consecutive years with little to no recharge. Accordingly, it is appropriate to consider an average annual recharge amount. Therefore, in determining “Project Water” for the purpose of comparing water supplies to water uses, it is proposed to utilize the average annual net recharge attributable to the District’s Project over the last 20-year period (1998-2017), where “net” refers to the gross volume of water diverted into the District less estimated losses to evaporation. For this purpose, the allowance for evaporation will be 3 percent, which is consistent with the Kern Fan MOU.

While the 20-year period extending from 1998 through 2017 will be used initially, a rolling 20-year average will be used going forward. It is intended that the annual average for the period be representative of the long-term average that can reasonably be anticipated going forward. If and when the prior 20-year period is not considered representative owing to changed conditions, adjustments may be required in the methodology. Water balance tables from the District’s 2017 Operations Report are found in Appendix D and provide the basis for determining the average annual amount for 1998-2017, which is approximately 70,315 AF/yr. Based on Assessed Acres totaling 39,468, this results in “Project Water” amounting to 1.78 AF/acre/yr. The project water estimate of 70,315 AF/yr is made up of 36,175 AF/yr of contractual supplies, 18,071 AF/yr purchased supplies, 12,865 AF/yr of “2:1” banking benefits, and 3,204 AF/yr of captured flood flows.

It is recognized that the sustainable yield calculation above is based on a 20 year historical period and may not represent future water supplies with respect to climate change and regulatory restrictions. According to DWR SWP Calsim, Friant-Kern and Kern River water supply forecasts it is expected that historical Project Water could be reduced by about 15,000 AF/yr (analysis in Appendix F) and the resultant water supply deficiency is shown on Table 2.

Demand

As used herein, water use is defined as the total annual consumptive use of water (also referred to as total evapotranspiration or “ET”) and transfers under the District’s water management programs. The total ET is intended to reflect the ET of applied water, as well as the ET of rainfall. In recent years, ET has been estimated by applying remote sensing techniques, and it is proposed that these techniques, or other functionally equivalent means, be used to estimate ET for the purposes described in this report, as opposed to using a metering device at each well. Though not the only provider, one such provider of these data is the Irrigation Training and Research Center (“ITRC”) located at Cal Poly San Luis Obispo. ITRC has been retained by the Kern Groundwater Authority to develop estimates of historical ET for several years. Data is found in Appendix E. By applying GIS techniques to the ET images generated by ITRC, the estimated ET corresponding to a specific area can be extracted on an annual (or more frequent) basis. In this manner, Assessor’s parcel boundaries will be applied to the ET images for the purpose of developing an estimate of the total annual ET for each parcel for a given year, in addition to the total annual ET for the District as a whole. Average Water Use for the District under existing conditions has been estimated by the ITRC to be 91,721 AF/yr (2006-2015). This includes ET of all vegetation as well as soil evaporation. In

addition to the ET demand the District transferred 11,536 AF/yr outside the RRBWSD (2013-17). Going forward, these estimates will be updated annually as the average of the last five years.

Sustainable Yield (Water Balance)

The components of Sustainable Yield is the sum of Native Yield, Precipitation and Project Water all as described above. Table 1 shows historic average annual water supply surplus or deficiency by comparing water demand under existing conditions (2006-2015) with the average annual total water supplies, Sustainable Yield (sum of Safe Yield, Precipitation, and Project Water) for the last 20 years (1998-2017). As shown, this amount is indicated to be on the order of 53 AF/yr of positive budget over the period. Table 2 depicts a forecasted balance considering regulatory and climate change stressors without the implementation of new projects and management actions (see section 7.3 and 7.4), to account for changing conditions. It results in a deficiency of 14,429 AF/yr.

Native Yield	11,397 AF/yr
Precipitation	21,598 AF/yr
<u>Project Water</u>	<u>70,315 AF/yr</u>
Sustainable Yield	103,310 AF/yr
Demand	103,257 AF/yr
Surplus	53 AF/yr

Table 1. Summary of Historical RRBWSD Water Supply, Water Use, and Implied Water Supply Balance

Native Yield	11,397 AF/yr
Precipitation	21,598 AF/yr
<u>Project Water</u>	<u>55,833 AF/yr</u>
Sustainable Yield	88,828 AF/yr
Demand	103,257 AF/yr
Deficiency	14,429 AF/yr

Table 2. Summary of Projected (2015-2070) RRBWSD Water Supply, Water Use, and Implied Water Supply Balance without Projects and Management Actions

2.2.3 RRBWL - White Land Sub-Management Area Water Budget

RRBWL lands are not included in the above RRBWSD balance and the RRBWSD has no records of surface water deliveries for any of the RRBWL. Without delivery infrastructure it is assumed to be zero.

Demands for the 2017-2018 period averaged **14,000 AF/yr (based on RRB avg ag demand of 2.6 AF/acre**

- awaiting Metric analysis) as shown in Appendix E. Assuming the allocation of 0.3 AF/acre of native yield (4954 acres x 0.3 AF/acre = 1,486 AF/yr) and an average of 0.48 AF/acre of precipitation (7,291 acres x 0.48 AF/acre = 3,500 AF/yr) the current deficit is 5,400 AF/yr as shown on Table 3.

Native Yield	1,486 AF/yr
Precipitation	3,500 AF/yr
<u>Project Water</u>	<u>0 AF/yr</u>
Sustainable Yield	6,166 AF/yr
Demand	14,000 AF/yr
Deficiency	7,834 AF/yr

Table 3. Summary of RRBWL Water Supply, Water Use, and Implied Water Supply Deficiency

2.3 Existing/Ongoing Water Resources Programs/Policies

See 1.4.4 Other Plan Elements from CWC § 10727.4

2.4 Existing Monitoring

For Basin-wide monitoring see section 2.2 of Umbrella GSP.

2.4.1 Groundwater Level Monitoring

Historic water levels in the RRBMA have varied through time in response to wet and dry cycles and water banking operations. The RRBMA measures 55 wells and the long term “Average” water level hydrograph is shown in Figure 5. The hydrograph shows a steady decline in the average depth to groundwater from about 110 ft in the early 1960’s down to 175 ft in the late 1970’s. From that period until the beginning of the most recent drought groundwater depths maintained from 150-200 ft (150 ft in recharge years and 200 ft in drought years). But during the last drought cycle (2012-2016) groundwater depths fell to below 250 ft for the first time. Since that time the Average water level has recovered to about 200 ft. A chronic lowering of water levels was not indicated until the most recent drought and numerous pumps were lowered and many wells went dry, in spite of the historical positive water balance as demonstrated in the water budget on Table 1 due to the chronic basin-wide overdraft issue.

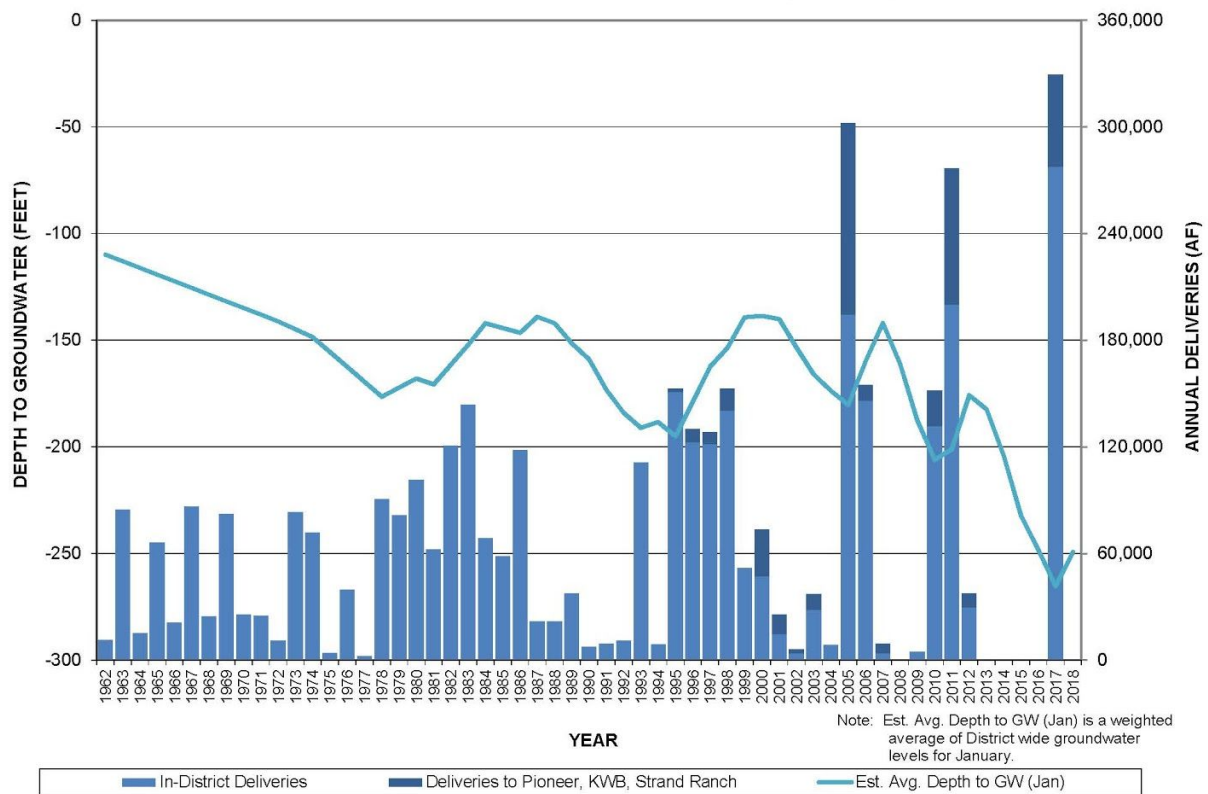
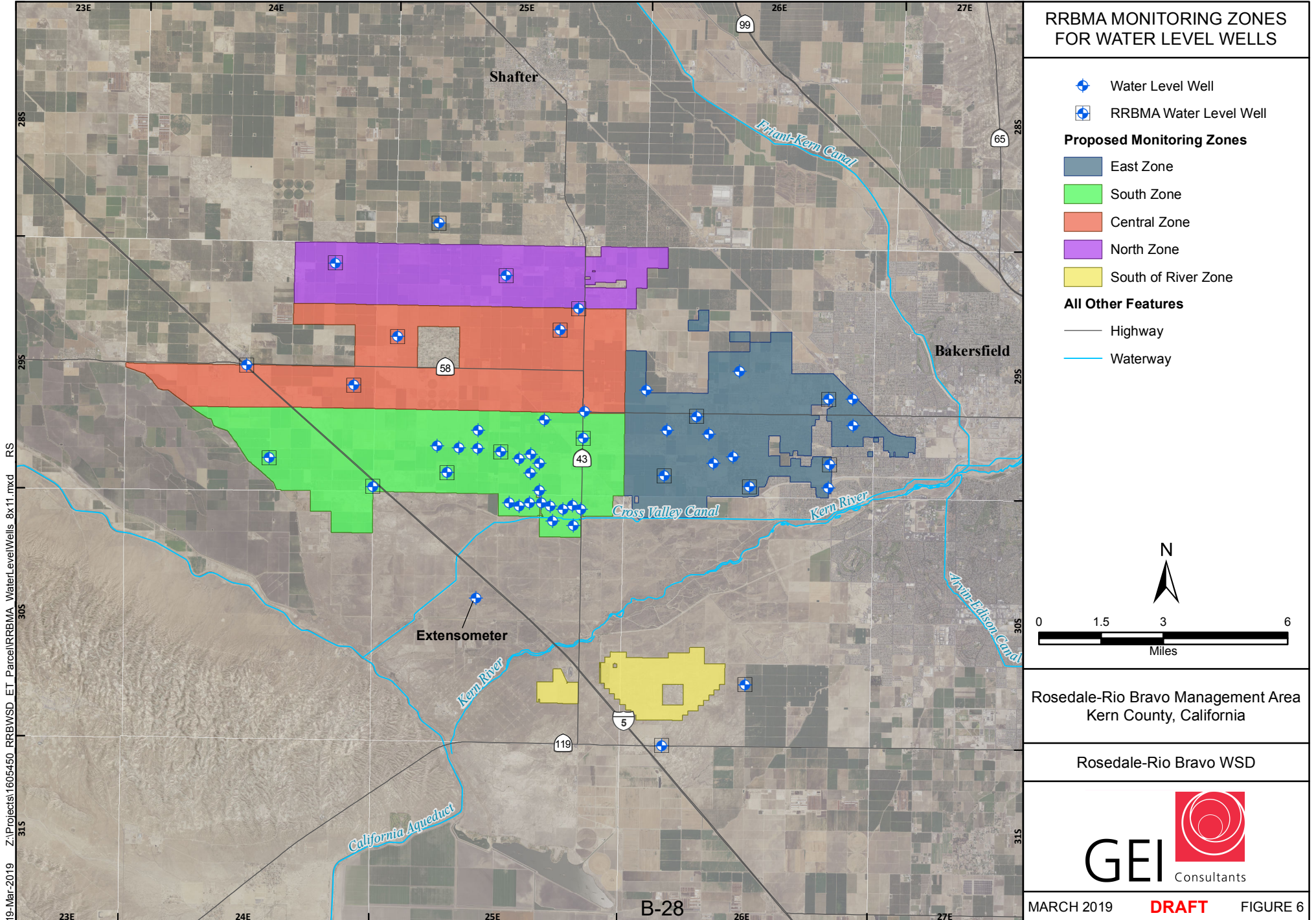


Figure 5. Average Depth to Groundwater

The average water level within the RRBMA is helpful as to long-term regional trends but is unable to identify more site specific water level changes within the management area. The RRBMA is divided into four general zones of similar groundwater conditions with a hydrographs from a number of long-term monitoring wells within the zone. These Zones as shown in Figure 6 are the North, Central, South, East and South of River.

Long-term groundwater hydrograph plots of potentiometric surfaces are shown in Figures 7-11 for each of the zones (North, Central, South, East and South of River). It is noteworthy that the Northern and Central Zones show a muted impact of recharge and recovery operations from the banking projects to the south and indicate a steady decline from about 2001 to date of about 5-6 feet per year. The South and East Zones however depict large fluctuations consistent with large recharge and recovery cycles on the Kern River Fan and reflect similar groundwater level declines of about 3-4 feet per year over the 2001 to current period. The South of River Zone also depicts large fluctuations consistent with large recharge and recovery cycles on the Kern River Fan and reflect similar groundwater level declines of about 3-4 feet per year over the 2001 to current period.

Groundwater depths in the RRBMA generally get deeper the farther from the Kern River. Depths range from 100 ft to 240 ft immediately after the most recent recharge cycles and 240 ft to 300 ft during the most recent drought cycle, Figures 12 and 13.



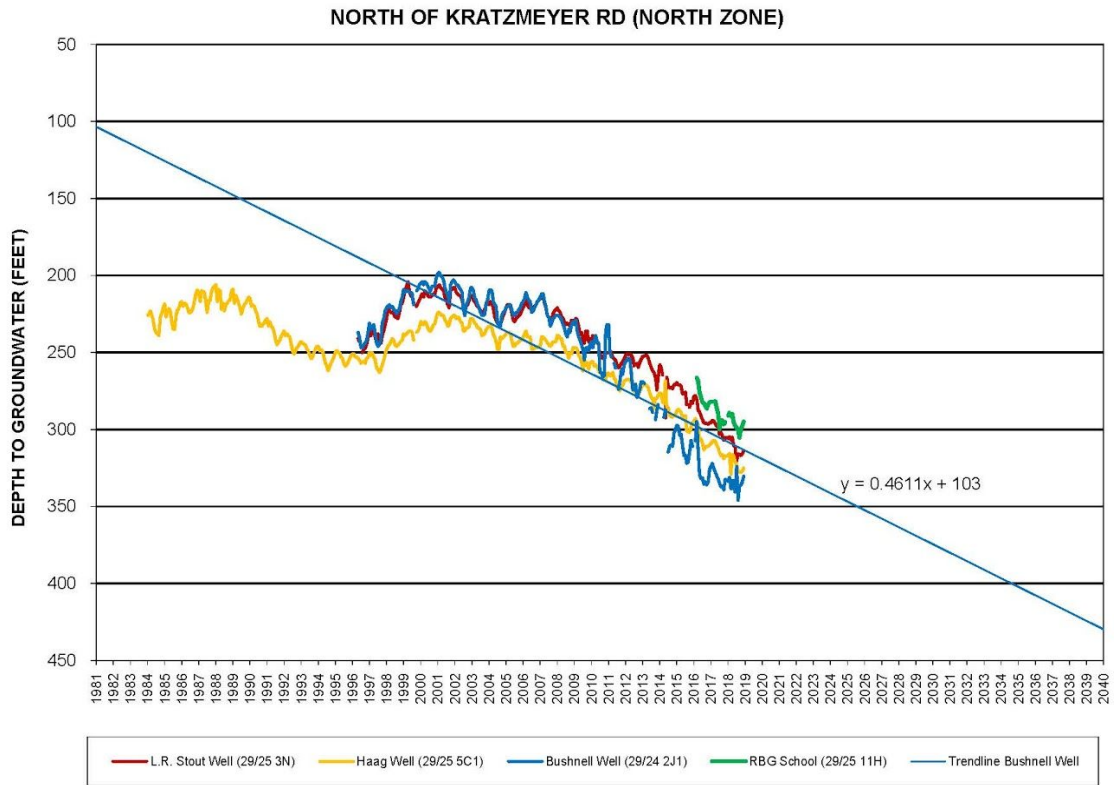


Figure 7. North Monitoring Zone Hydrograph
BETWEEN SIDDING RD AND KRATZMEYER RD (CENTRAL ZONE)

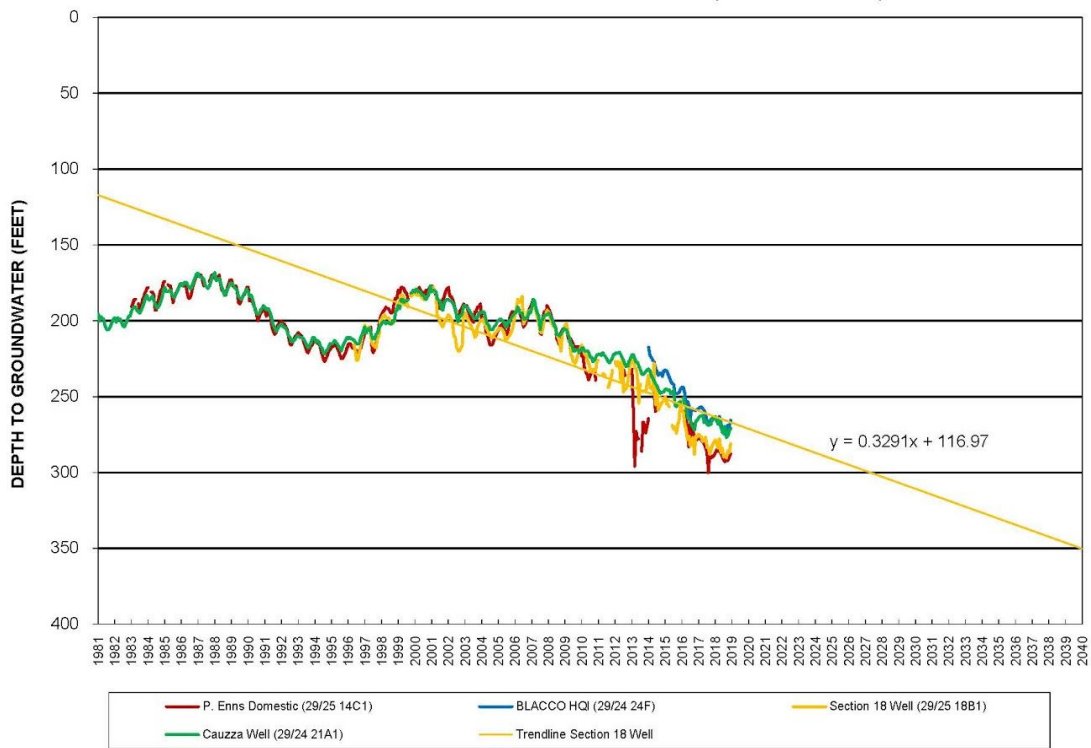


Figure 8. Central Monitoring Zone Hydrograph

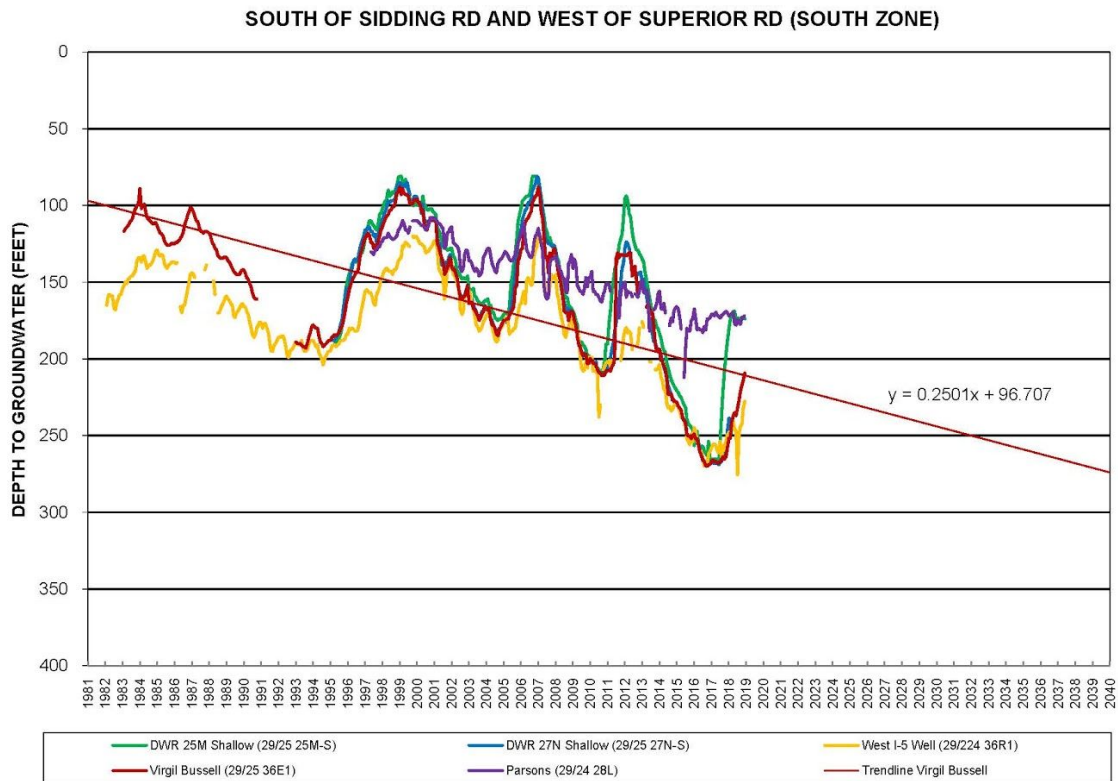


Figure 9. South Monitoring Zone Hydrograph

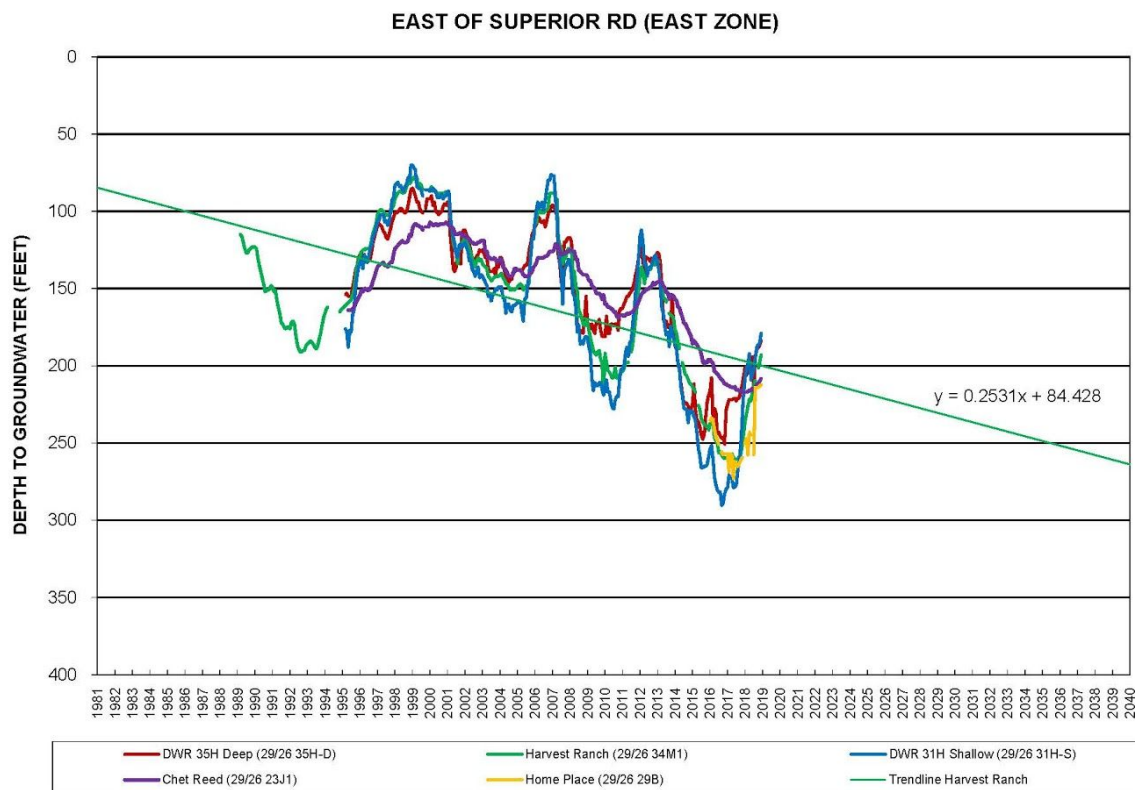
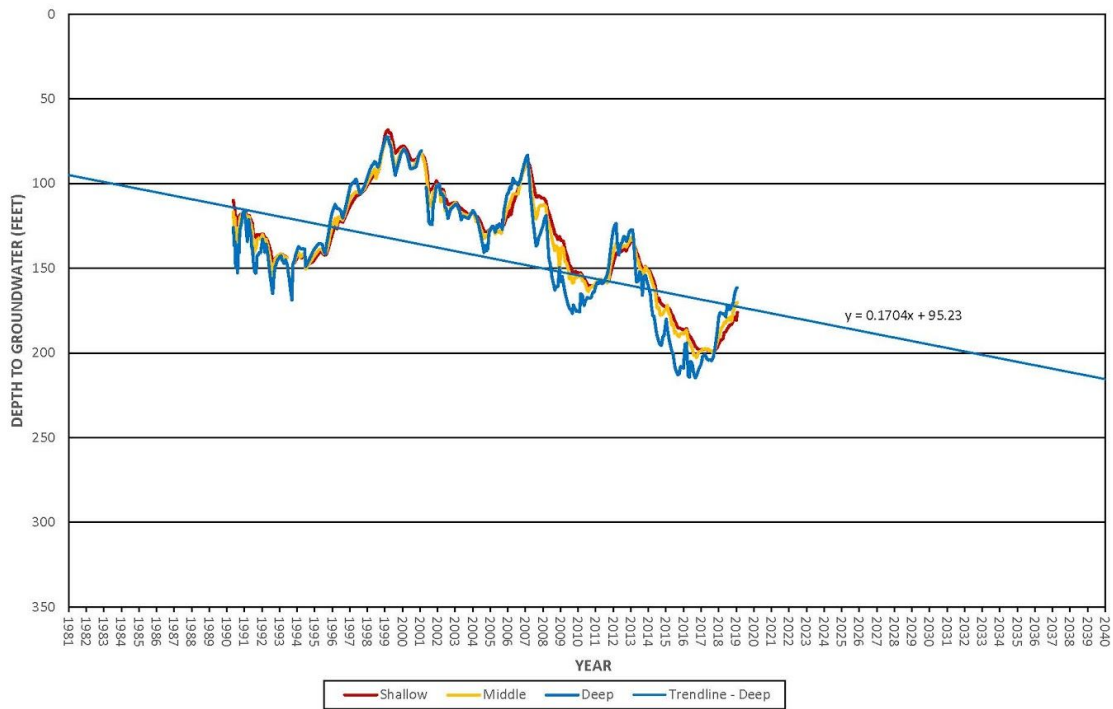


Figure 10. East Monitoring Zone Hydrograph

30S/R26E 28J (South of River Zone)



30S/R26E 32N (South of River Zone)



Figure 11. South of River Monitoring Zone Hydrographs

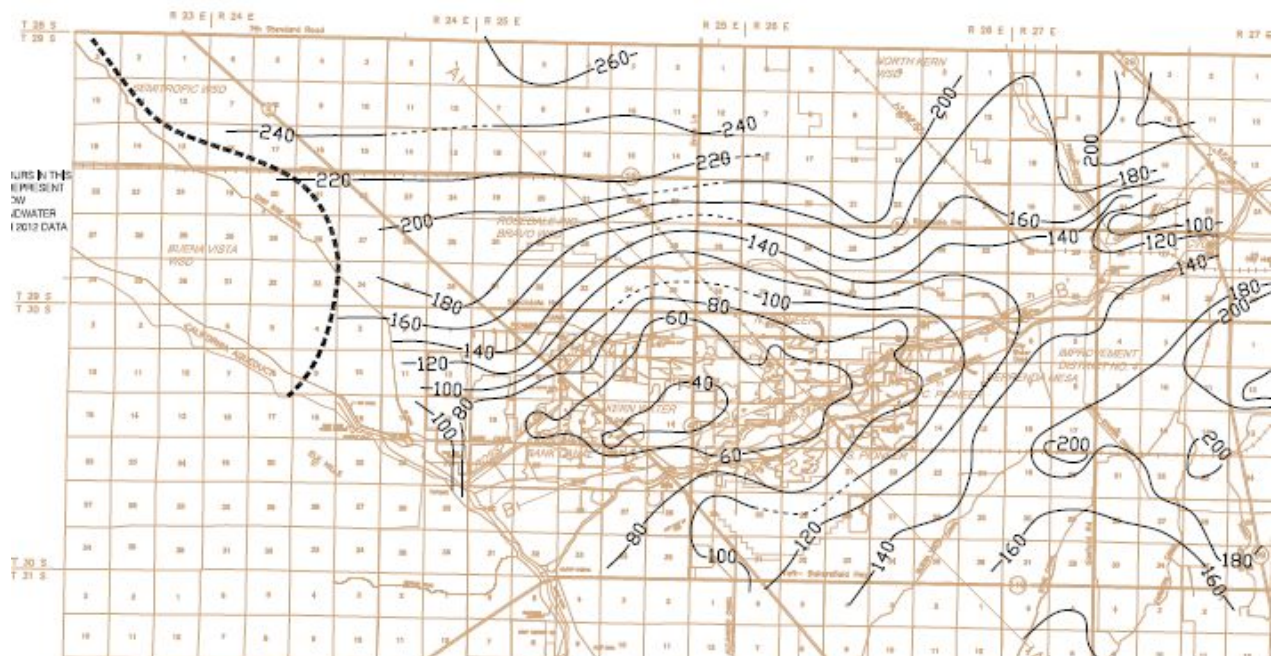


Figure 12. Groundwater Depths Spring 2012 - Immediately Post Recharge Cycle

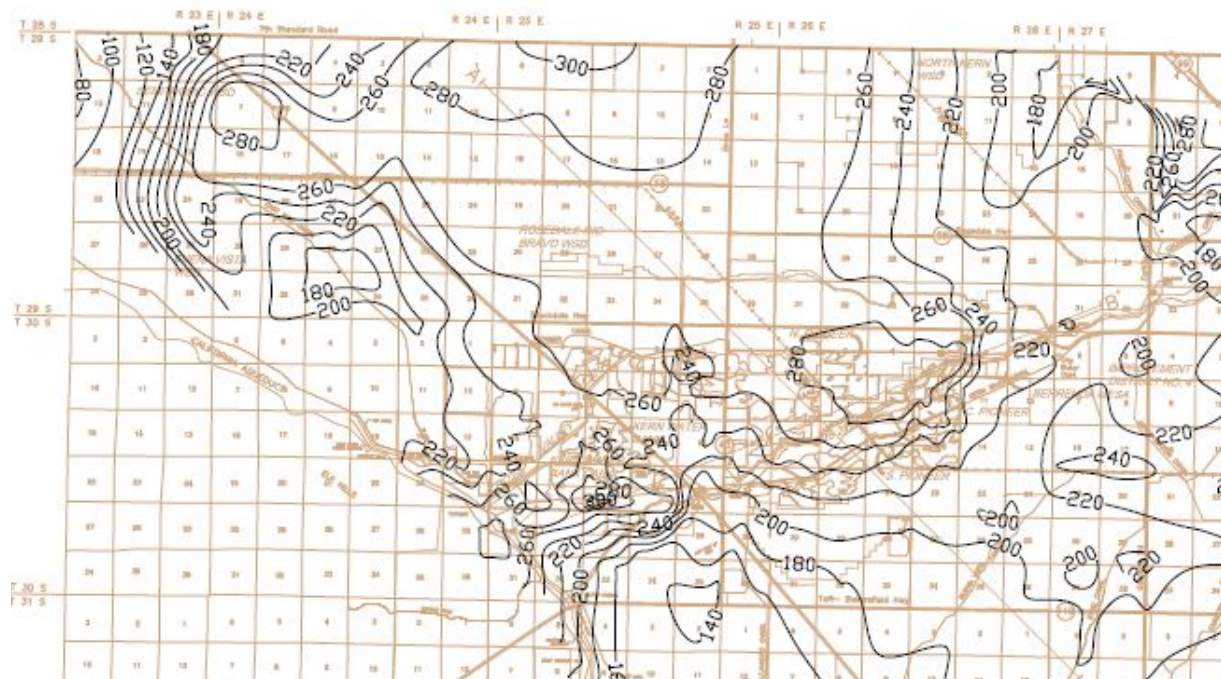


Figure 13. Groundwater Elevations Spring 2016 - Midst of Drought Cycle

Groundwater flow in the RRBMA is generally perpendicular to the Kern River. North of the River it flows northwest to the pumping depression north of RRBMA and south of the River it flows southeast as shown on elevation contour maps, Figures 14 and 15.

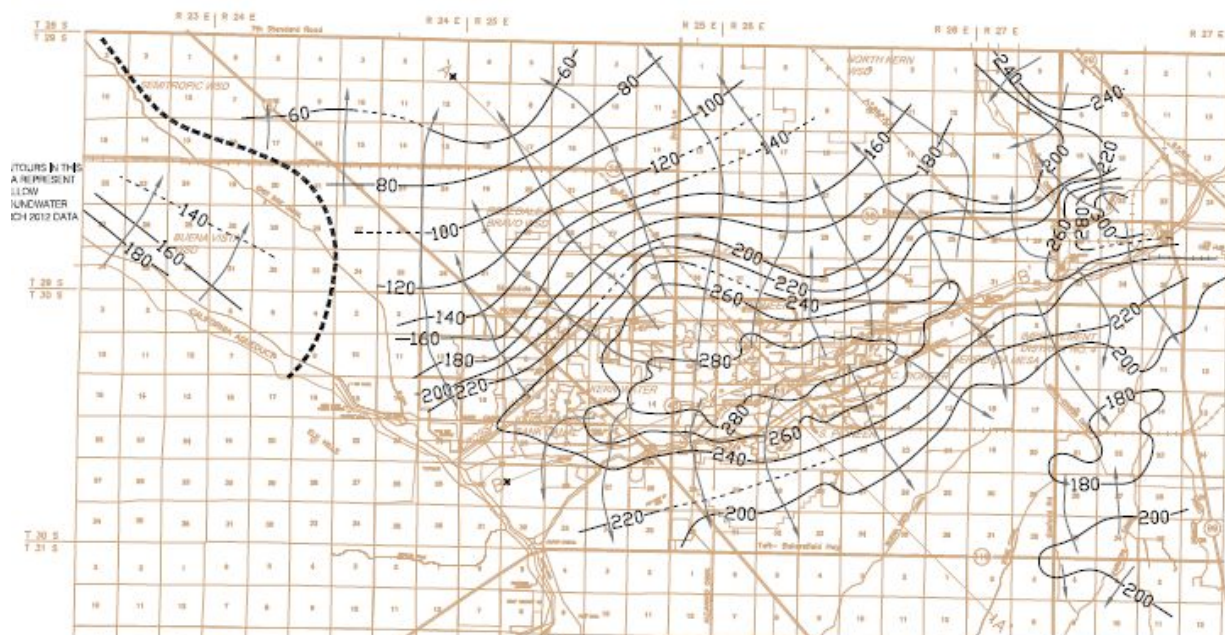


Figure 14. Groundwater Elevations Spring 2012 - Immediately Post Recharge Cycle

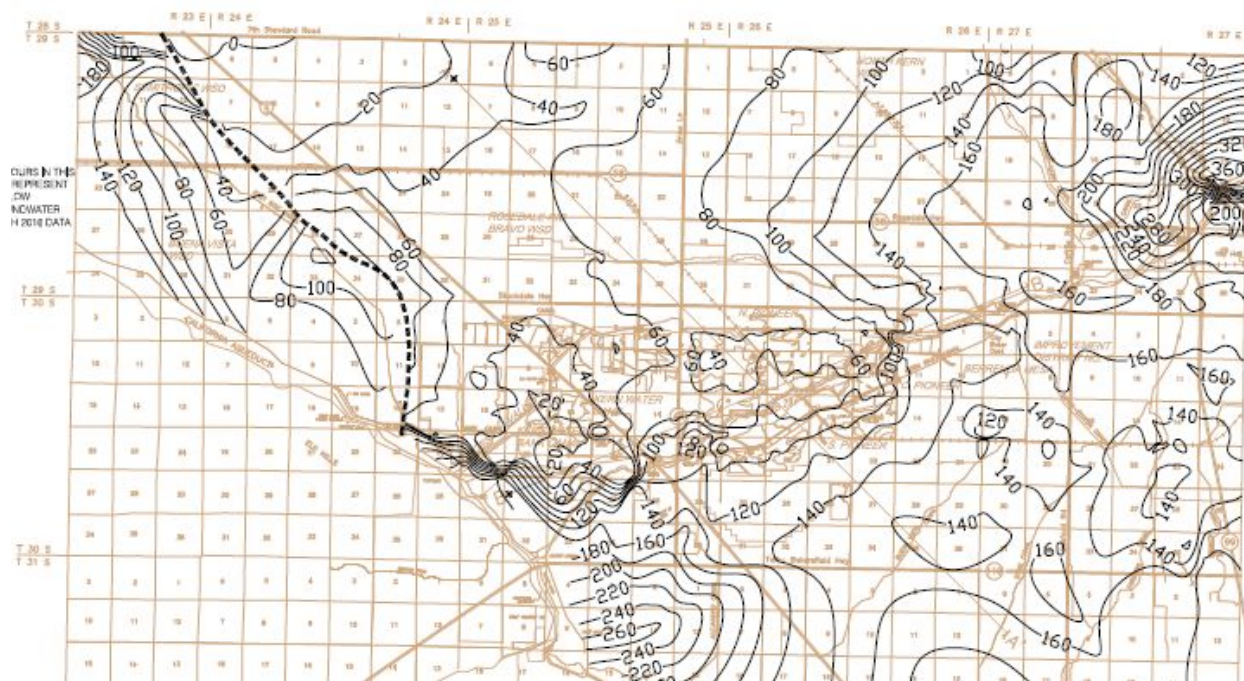


Figure 15. Groundwater Elevations Spring 2016 - Midst of Drought Cycle

2.4.2 Groundwater Quality Monitoring

Extensive monitoring has been used to establish baseline groundwater quality and ensure that groundwater quality problems are not developing. This monitoring consists of two elements: 1) the sampling of 6 dedicated monitoring wells twice a year for several potential constituents of concern, and 2) the sampling of 35 production wells every 3 years. The locations of the monitoring wells and production wells are shown on Figure 16.

The sampling of the monitoring wells is mandated by the MOU's. Under this program water samples are analyzed for several potential constituents of concern twice a year as described in the Kern Fan Monitoring Plan. The data is compiled and reported by the Kern Fan Monitoring Committee pursuant to the MOU's. Water quality hydrographs, statistical trend analysis, and salt balance calculations are included. Field procedures are as described in the Kern Fan Purge Pump Water Quality Sampling Procedures (Appendix A-3).

The second element of groundwater monitoring includes sampling the recovery wells according to the monitoring program and Cross Valley Canal (CVC) and Aqueduct pump-in guidelines. In addition to providing extensive information regarding groundwater quality, the results of this sampling are used to model expected changes in water quality in conveyance facilities receiving the recovered water. The model is updated daily and forwarded to DWR and the Facilitation Group as described in Appendix A-4.

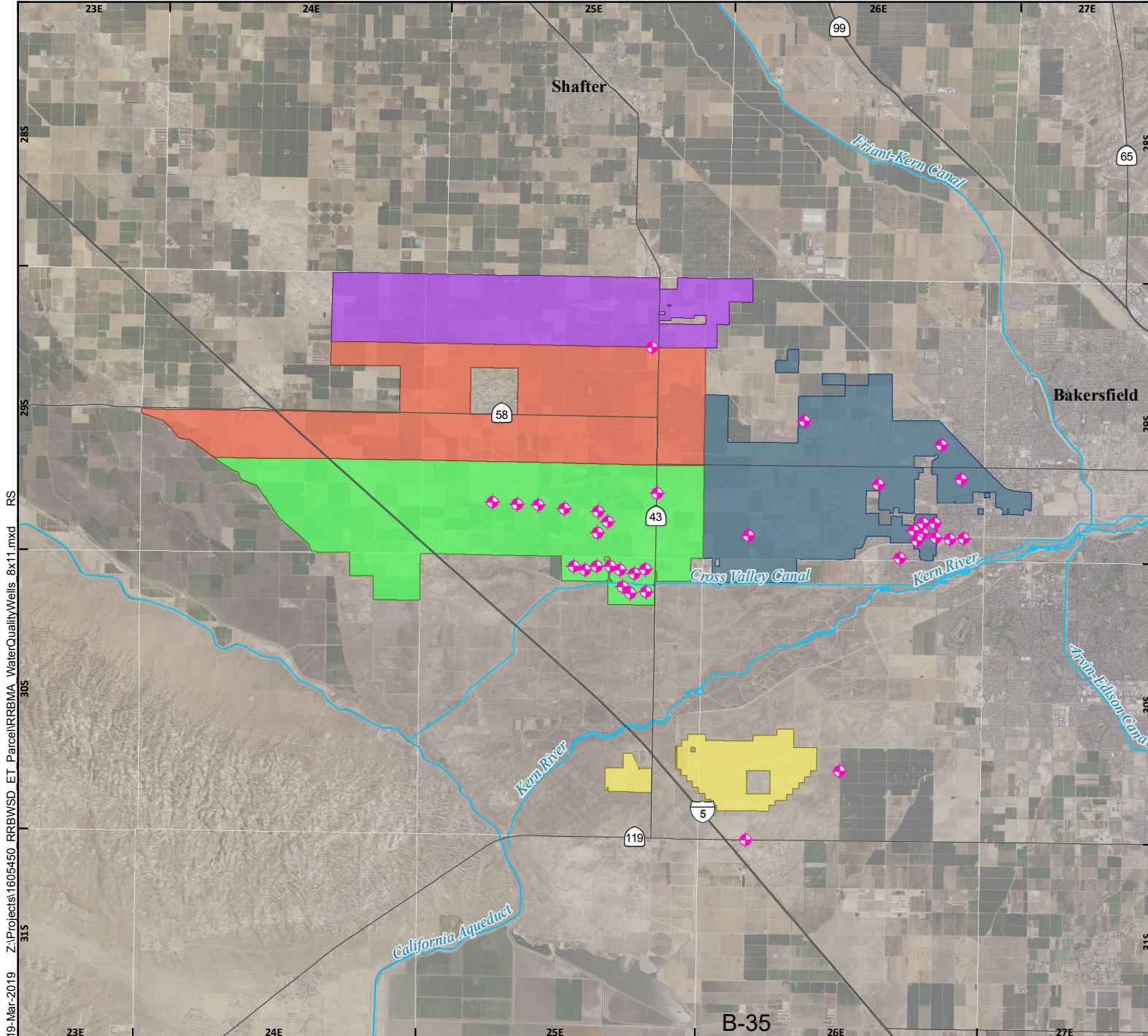
2.4.2.1 Groundwater Quality

Groundwater quality in the Kern Fan aquifer is generally excellent. In addition to testing each RRBWSD recovery well, six monitor wells are tested for the presence of several constituents semiannually. The water in each of RRBWSD Banking project and monitor wells are thoroughly and regularly tested in accordance with protocols developed by the California Department of Health Services for drinking water. Except for a few naturally occurring constituents in a few wells, the water quality of all of the RRBWSD recovery wells meet the Department of Water Resources' Water Quality Policy for Acceptance of Non-Project Water into the State Water Project (See Section 2.8.5).

The concentration of total dissolved solids (TDS) ranges from about 100 mg/ℓ to about 350 mg/ℓ. The TDS in the California Aqueduct can range up to 325 mg/ℓ, and the secondary maximum contaminant level (MCL) for TDS in drinking water is 500 mg/ℓ. The concentration of Nitrate ranges from about 1 mg/ℓ to about 10 mg/ℓ, and the MCL for drinking water is 10 mg/ℓ. The concentration of Arsenic ranges from about 1 µg/ℓ to about 30 µg/ℓ, and the MCL for Arsenic in drinking water is 10 µg/ℓ.

2.4.2.2 Spatial and Temporal Variations in Groundwater Quality

Although water quality across the Kern Fan is generally excellent, there are spatial variations in quality with both depth and locale. For example, arsenic concentrations are locally higher in the southern part of the aquifer; TDS concentrations generally increase to the west; and the concentrations of nitrate and TDS are typically higher in the shallow part of the aquifer and concentrations of arsenic are typically higher in the deeper part of the aquifer.



RRBMA MONITORING ZONES FOR WATER QUALITY WELLS

◆ Water Quality Well

Proposed Monitoring Zones

East Zone

South Zone

Central Zone

North Zone

South of River Zone

All Other Features

— Highway

— Waterway



Rosedale-Rio Bravo Management Area
Kern County, California

Rosedale-Rio Bravo WSD



MARCH 2019

DRAFT

FIGURE 16

Elevated arsenic concentrations appear to be, at least in part, related to the nature of the sediments in the aquifer. California State University, Bakersfield, has investigated the occurrence of arsenic in the vicinity of the Kern Water Bank (Negrini, et. al, 2008). Their studies suggest that the reducing geochemical environment more likely to be found in lacustrine rather than alluvial fan settings may favor the formation of arsenic-bearing pyrite, and these types of sediments have been identified in the southern part of the Kern Fan. A later change to more oxidizing geochemical conditions potentially dissolves the pyrite and releases the arsenic into the groundwater.

The increase in TDS to the west may be related to changes in the types of sediments in the aquifer and/or the influence of groundwater from the western part of the basin. The eastern part of the basin mostly consists of sediments derived from the Sierra Nevada, which are granitic. In the western part of the basin, sediments are increasingly derived from the Coast Ranges which include marine sedimentary rocks. Sediments derived from marine rocks can influence the salt content of groundwater.

The higher nitrate and TDS concentrations in the shallow part of the aquifer are believed to be in large part the result of years of agricultural use. Evapotranspiration of irrigation water adds salts and the addition of fertilizers adds excess nitrate to the root zone. If allowed to accumulate, the salts will inhibit crop growth, so they must be flushed from the root zone. In time, the salts and nitrate can reach groundwater.

Zone sampling while constructing wells reveals increased Arsenic with depth. RRBWSD constructed banking recovery wells reveal Arsenic levels increase with depth, which is the conventional thought in the area. Wells exceed the MCL at depths of about 500-700 ft as shown on Tables 3-6.

Aquifer Property/ Constituent	Units	850 - 870 ft bgs ¹	720 - 740 ft bgs	600 - 620 ft bgs	448 - 518 ft bgs	Drinking Water Standards / MCL ²
Static Water Level	ft bgs	301	264	253	248	
Pumping Water Level	ft bgs	308	511	297	309	
Drawdown	ft	7	247	44	61	
Discharge Rate	gpm ³	60	75	110	140	
Arsenic	µg/L ⁴	30	14	2.5	0.63	10 ^A
Fluoride	mg/L ⁶	0.53	0.34	0.18	<0.05 ⁶	2 ^A
Iron	µg/L	43	740	NA ⁸	NA	300 ^C
Manganese	µg/L	<10	19	7.6	8.4	50 ^{B,C}
Nitrate as N	mg/L	<0.1	0.21	3	7.1	10 ^A
Total Dissolved Solids	mg/L	130	100	200	340	500 ^{B,C}
Turbidity	NTU ⁷	37	10	20	10	5 ^C

Table 3 - WB2 Zone Testing

Aquifer Property/ Constituent	Units	1,200 - 1,220 ft bgs ¹	940 - 960 ft bgs	820 - 840 ft bgs	700 - 720 ft bgs	580 - 600 ft bgs	420 - 440 ft bgs	Drinking Water Standards / MCL ²
Static Water Level	ft bgs	310	317	315	284	277	253	
Pumping Water Level	ft bgs	557	357	537	489	329	276	
Drawdown	ft	247	40	222	205	52	23	
Discharge Rate	gpm ³	20	40	70	90	230	100	
Specific Capacity	gpm/ft	0.1	1.0	0.3	0.4	4.4	4.3	
Arsenic	µg/L ⁴	11	14	6.4	36	8.2	3.1	10 ^A
Fluoride	mg/L ⁵	0.88	0.76	0.79	0.83	0.19	N/A ⁷	2 ^A
Iron	µg/L	78	140	<50	<50	<50	110	300 ^C
Manganese	µg/L	21	11	<10	<10	<10	15	50 ^{B,C}
Nitrate as N	mg/L	<0.2 ⁶	<0.1	<0.1	<0.1	1.8	N/A	10 ^A
Chloride	mg/L	480	200	90	11	9.9	N/A	250 ^C
Total Dissolved Solids	mg/L	880	430	260	130	150	N/A	500 ^{B,C}

Table 4 - SUP1 Zone Testing

Aquifer Property/ Constituent	Units	760 - 780 ft bgs ¹	685 - 705 ft bgs	580 - 600 ft bgs	380 - 400 ft bgs	Drinking Water Standards / MCL ²
Static Water Level	ft bgs	282	279	277	268	
Pumping Water Level	ft bgs	310	298	362	331	
Drawdown	ft	29	19	85	64	
Discharge Rate	gpm ³	180	140	140	180	
Specific Capacity	gpm/ft	6.31	7.3	1.6	2.8	
Arsenic	µg/L ⁴	70	22	18	2.1	10 ^A
Total Dissolved Solids	mg/L	160	110	130	150	500 ^{B,C}

Table 5 - M1 Zone Testing

Aquifer Property/ Constituent	Units	920 - 940 ft bgs ¹	740 - 760 ft bgs	615 - 635 ft bgs	430 - 450 ft bgs	285 - 305 ft bgs	185 - 455 ft bgs	Drinking Water Standards / MCL
		Zone 1 8/26/2009	Zone 4 9/14/2009	Zone 2 8/27/2009	Zone 5 9/16/2009	Zone 3 8/28/2009	Completed Well 10/27/2009	
Arsenic	µg/L ²	20	33	13	2	ND ⁴	1.2	10
Fluoride	mg/L ³	0.6	0.6	0.36	0.06	0.029	0.068	2
Iron	µg/L	180	310	600	66	ND	39	300 ⁵
Nitrate as N	mg/L	0.05 ⁶	0.17	0.32	1.5	6.3	0.52 ⁶	10
Total Dissolved Solids	mg/L	210	180	170	180	470	270	500 ⁵

Table 6 - Enns1 Zone Testing

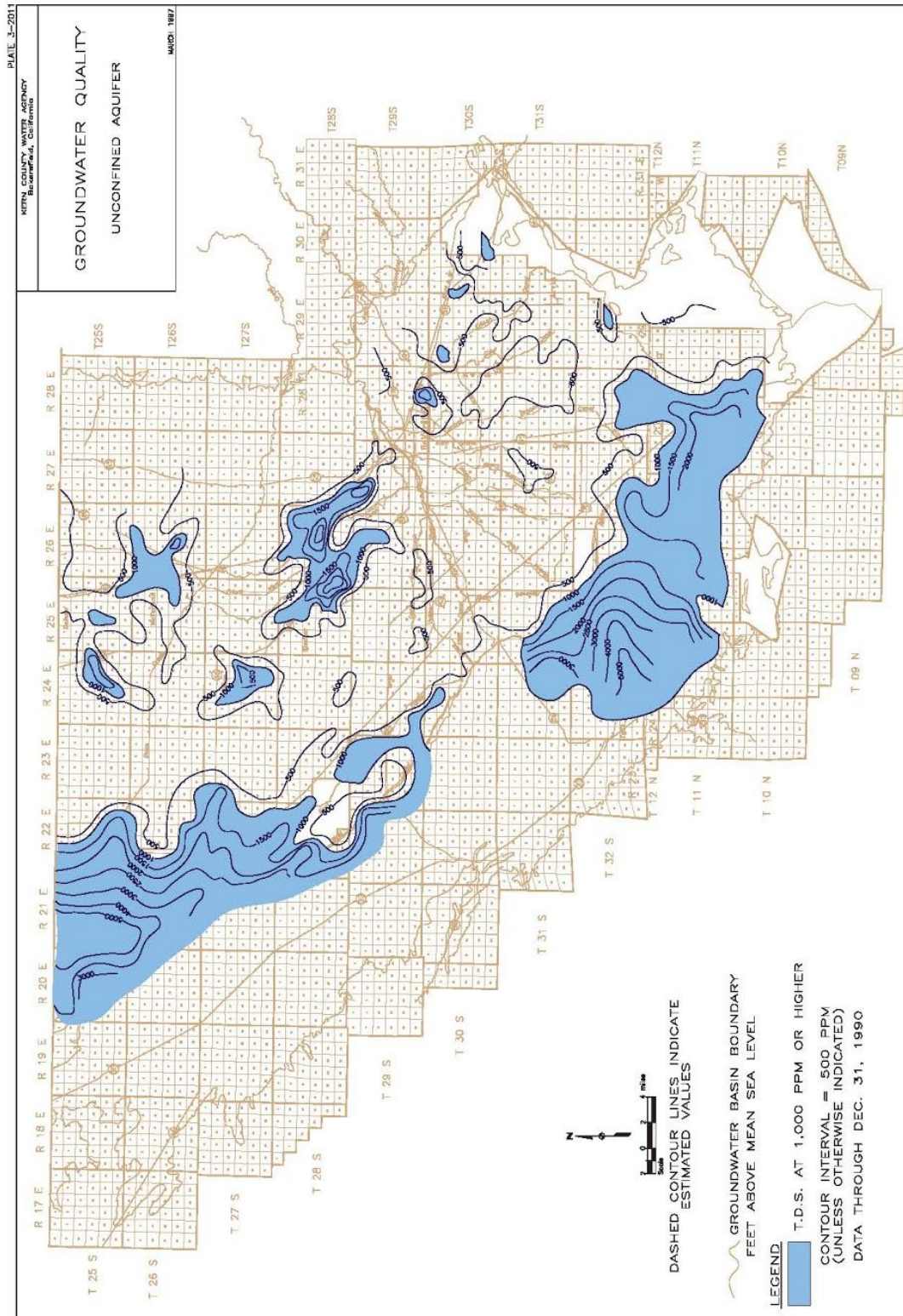


Figure 17. TDS in Unconfined Kern Subbasin

As shown in Figures 17 there is a elevated TDS zone (1000-2500 ppm) just north of the RRBMA. With groundwater flow generally in the northwest direction it is not expected to migrate into the RRBMA.

2.4.2.3 Water Quality Changes

As shown in Figures 18-22 TDS has been stable over the last 20 years and generally below 400 mg/L. There is one elevated level from 300 to 600 mg/L in 29S/25E 27N2, which is a shallow monitor well.

As shown in Figures 23-27 Arsenic levels over the last 20 years have been fairly stable but many wells exceed the MCL of 10 micrograms/L.

As shown in Figures 23-27 Nitrate levels over the last 20 years have been stable and generally below the MCL. As groundwater levels in the northern monitoring zone has deepened the level has exceeded the 10 mg/L MCL.

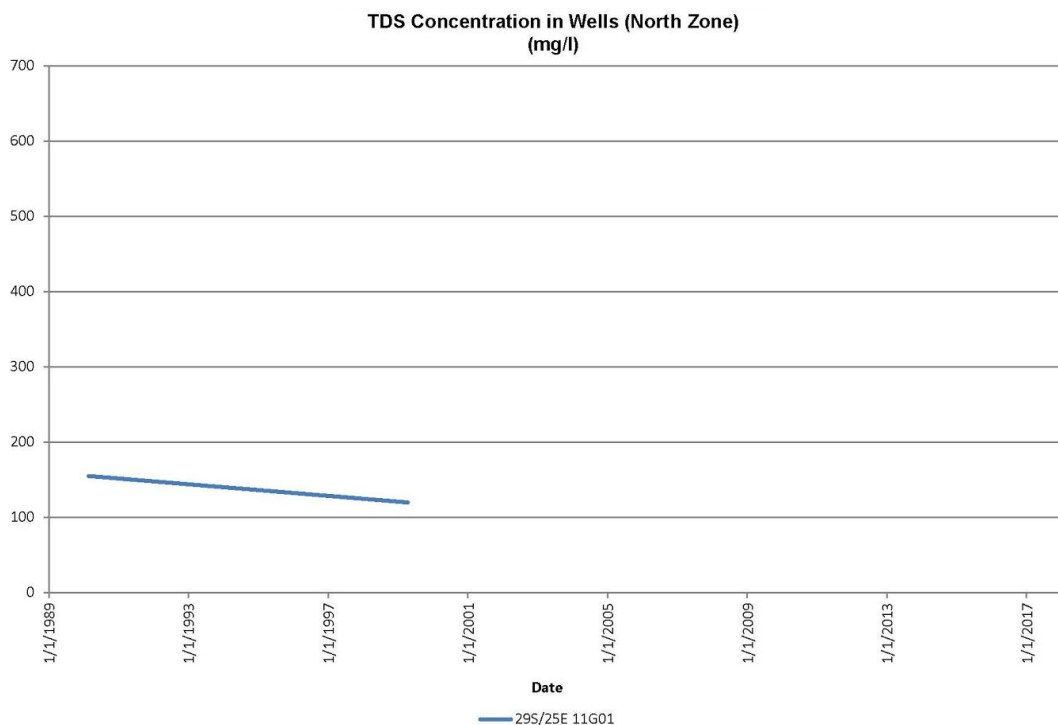


Figure 18. North Monitoring Zone - TDS

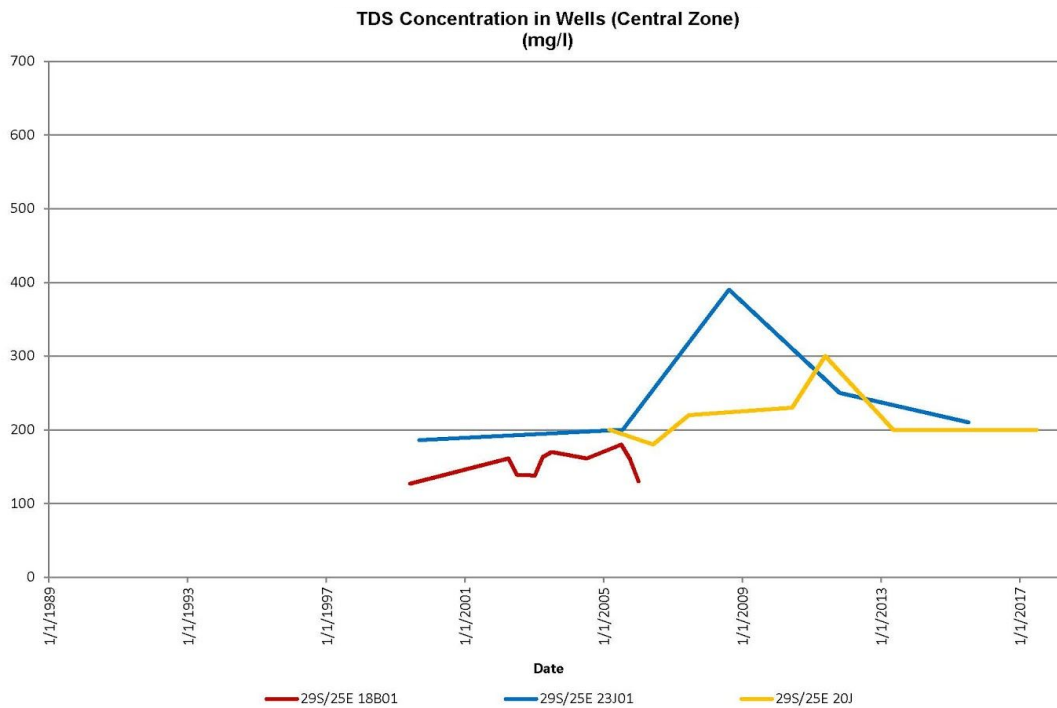


Figure 19. Central Monitoring Zone - TDS

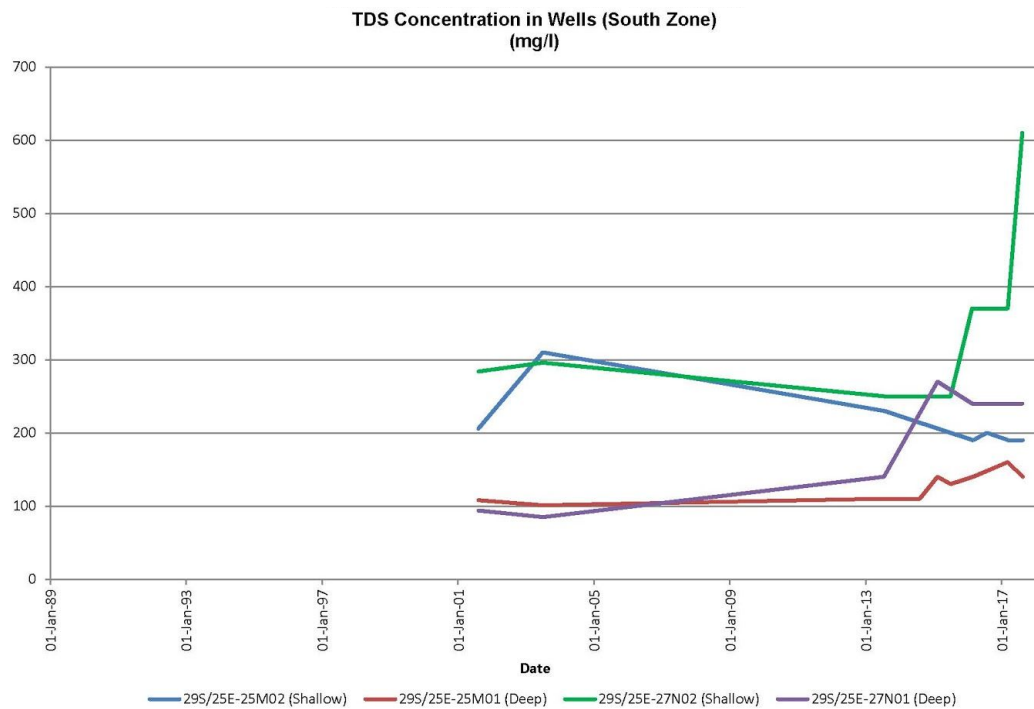


Figure 20. South Monitoring Zone - TDS

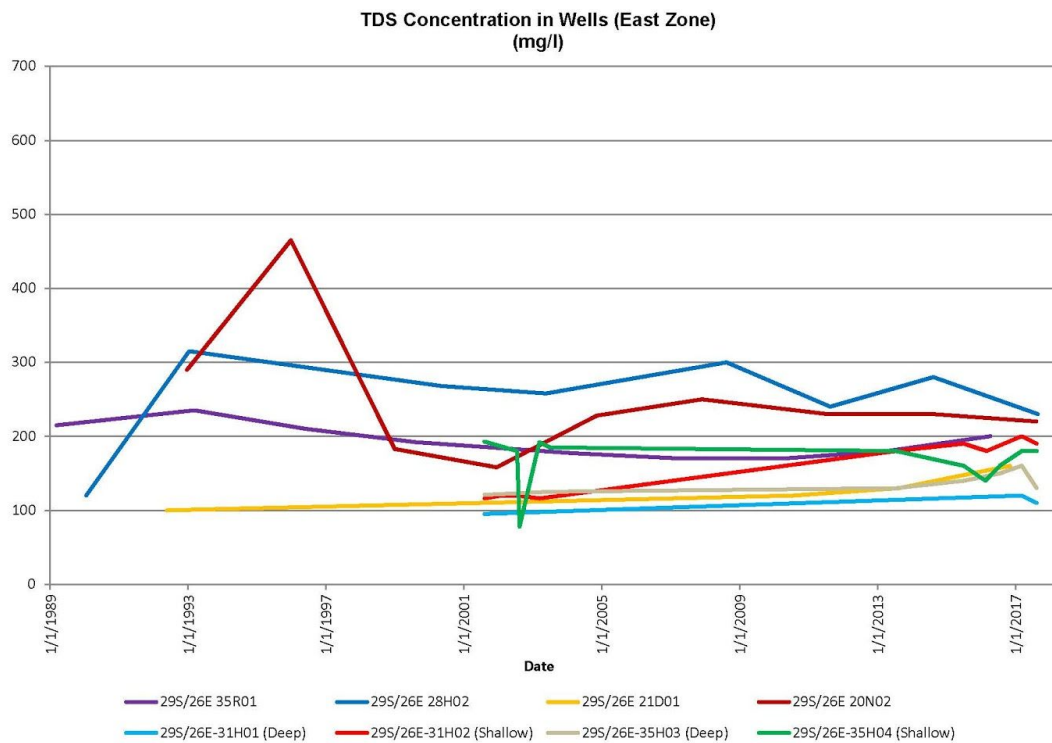


Figure 21. East Monitoring Zone - TDS

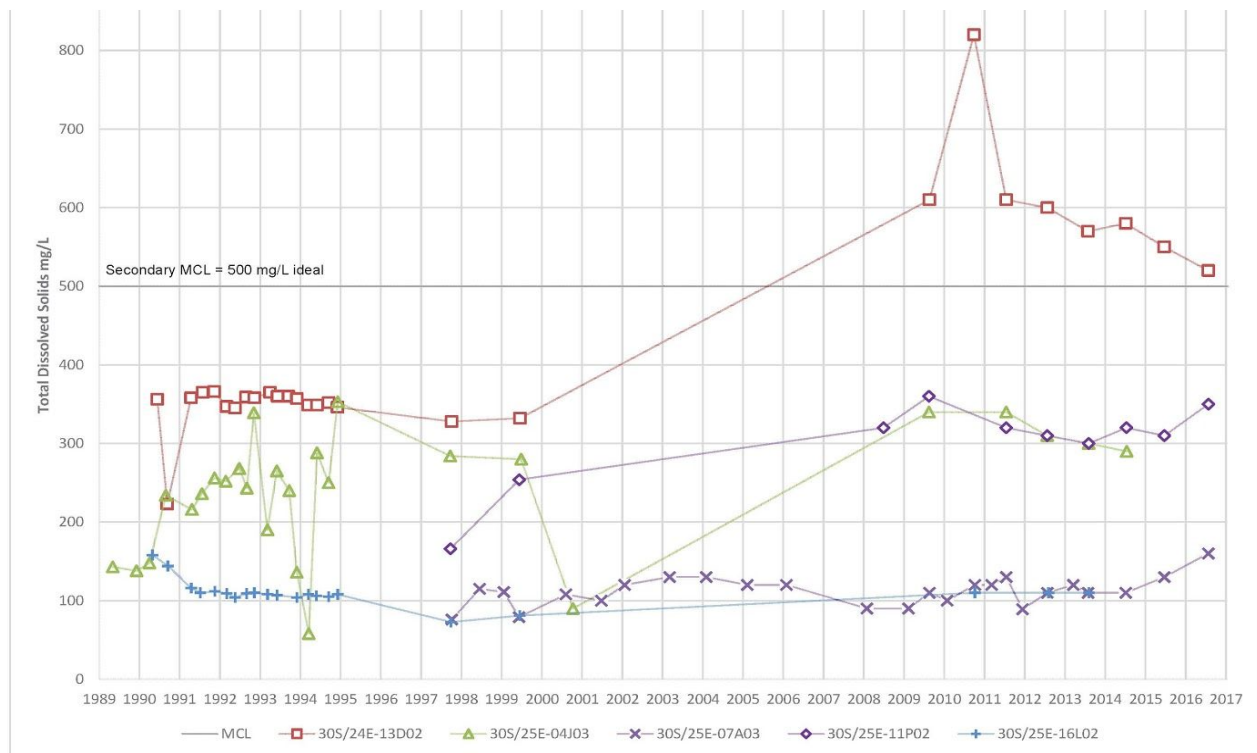


Figure 22. South of River Monitoring Zone - TDS

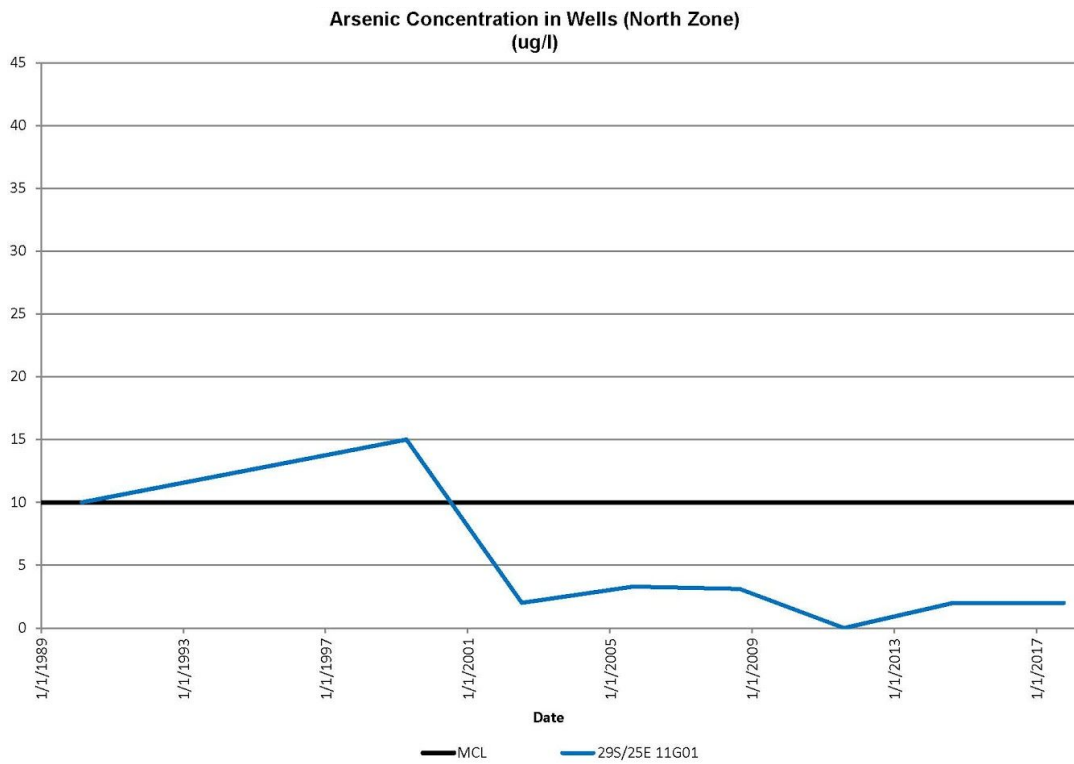


Figure 23 - North Monitoring Zone - Arsenic

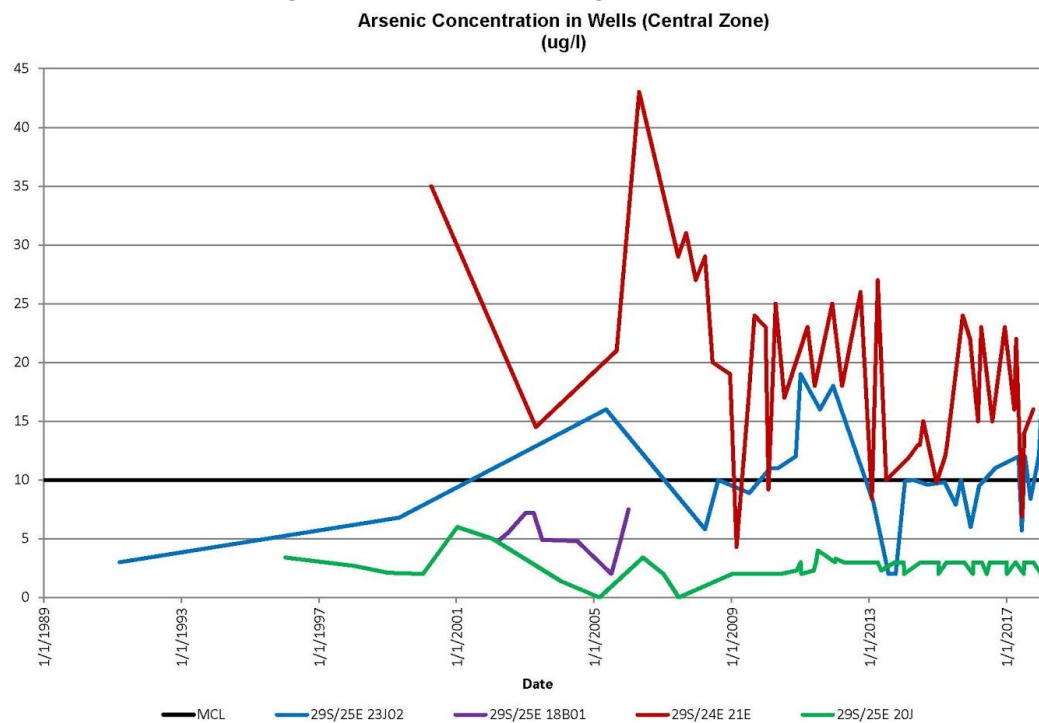


Figure 24 - Central Monitoring Zone - Arsenic

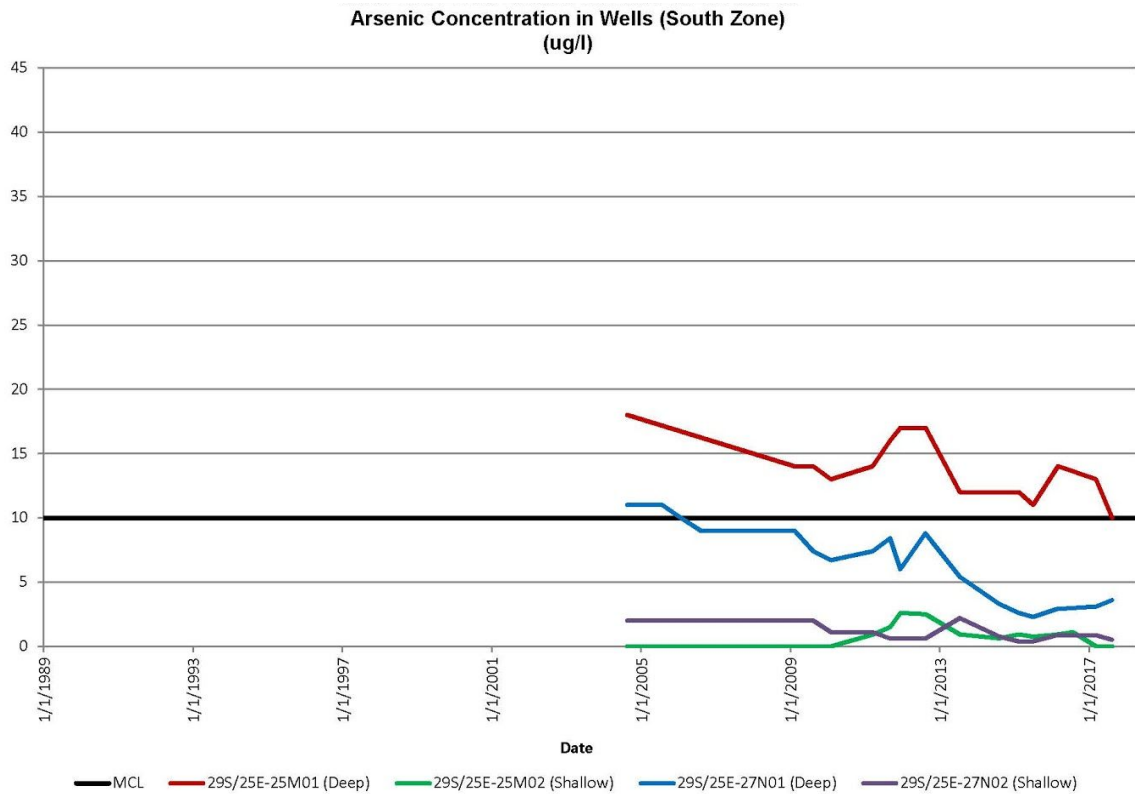


Figure 25 - South Monitoring Zone - Arsenic

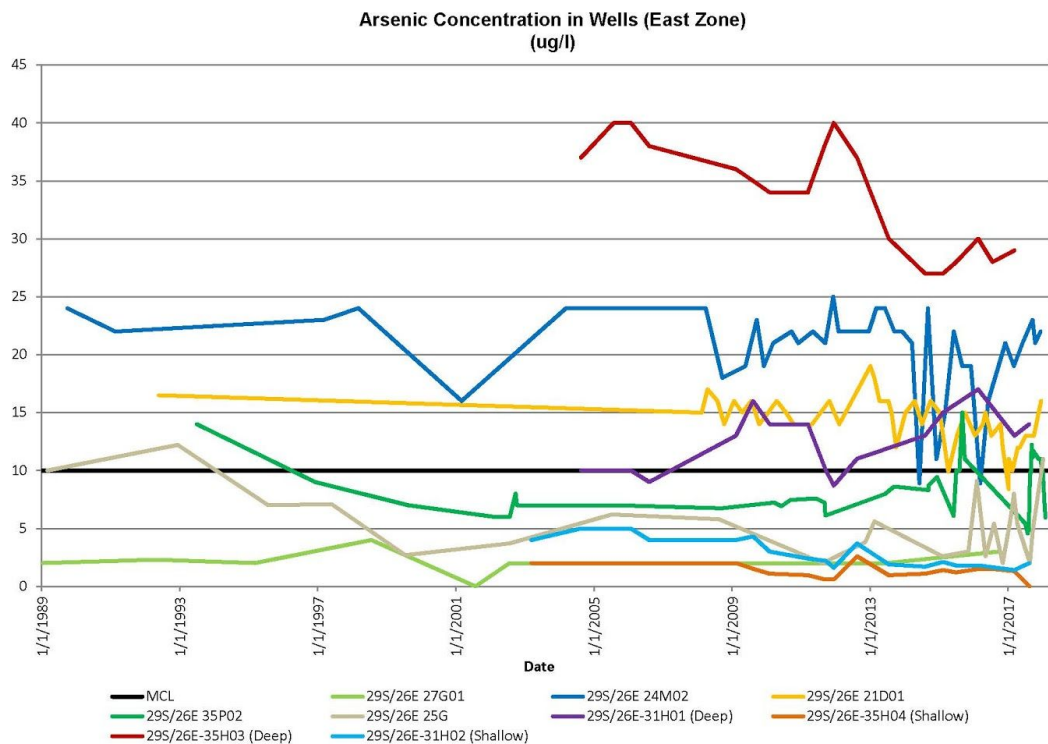


Figure 26 - East Monitoring Zone - Arsenic

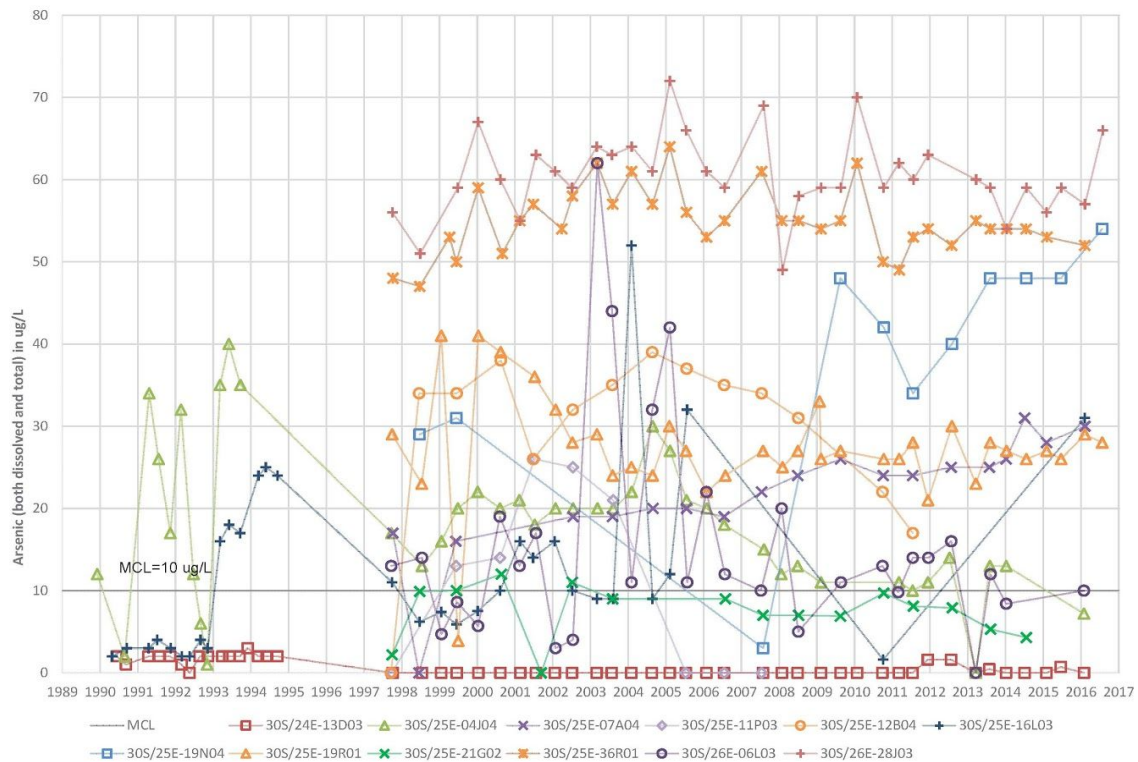


Figure 27 - South of River Monitoring Zone - Arsenic

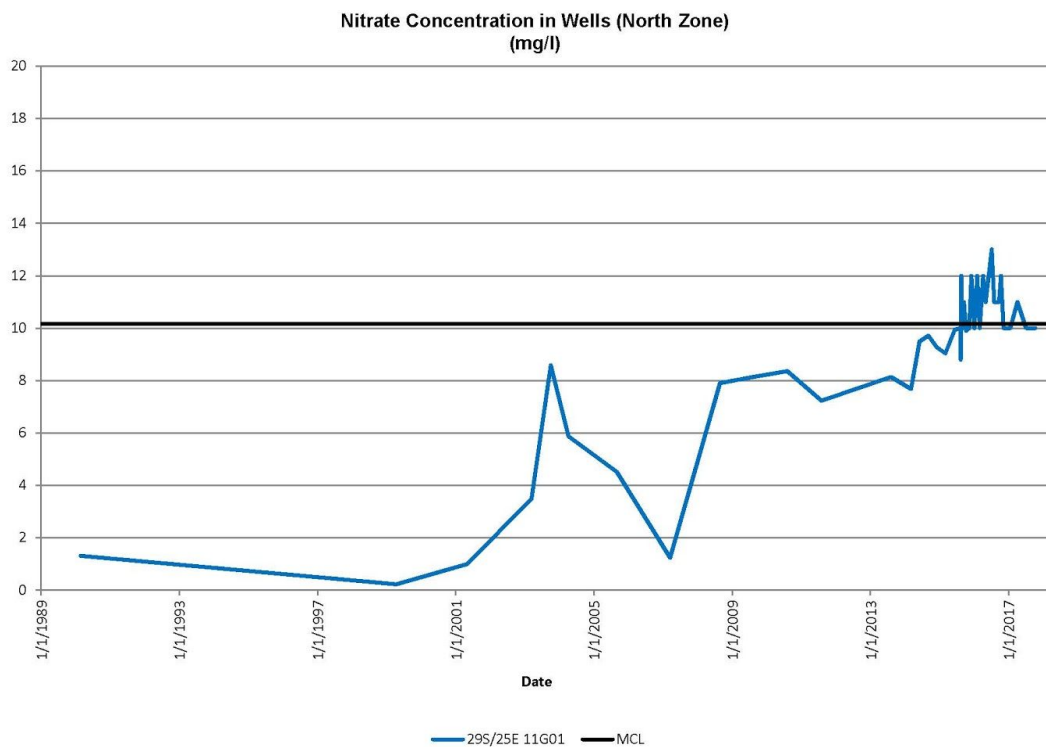


Figure 28 North Monitoring Zone - Nitrate

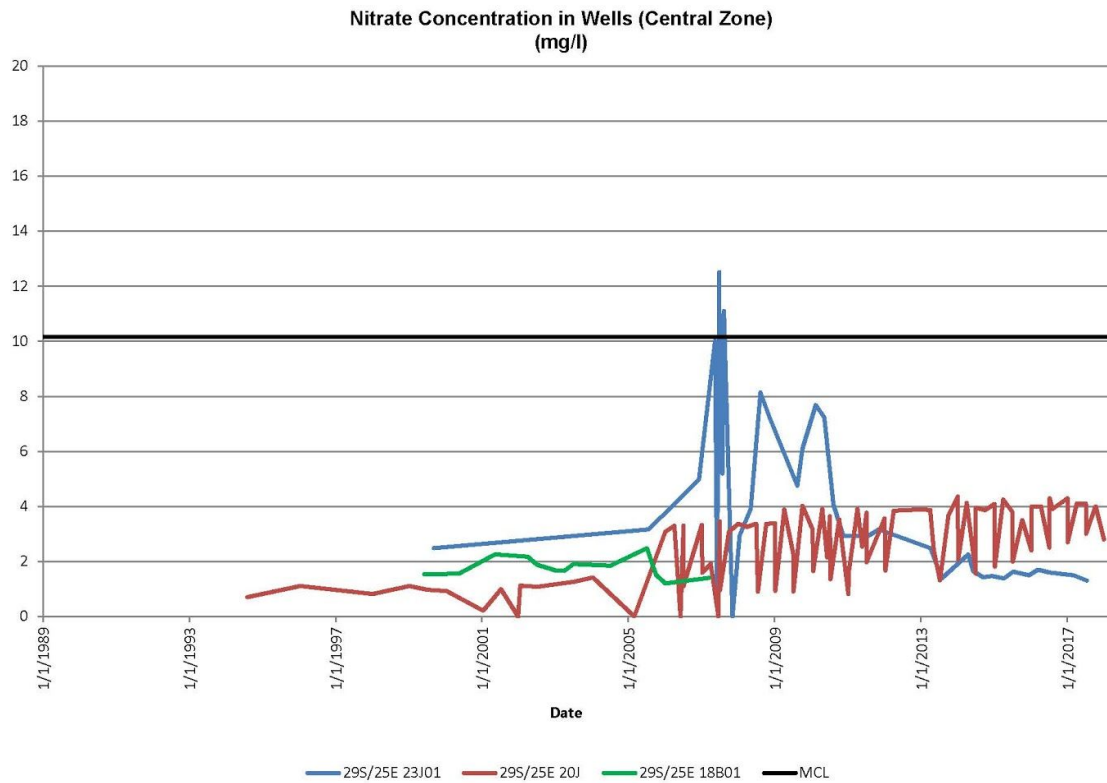


Figure 29 Central Monitoring Zone - Nitrate

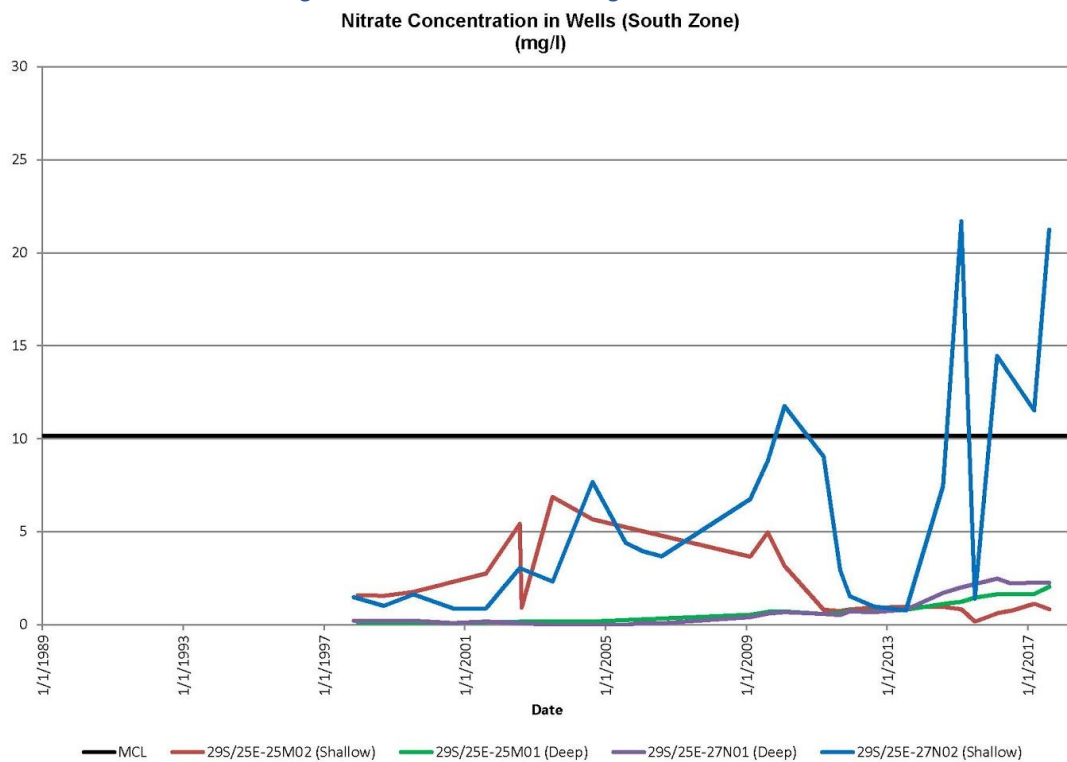


Figure 30 South Monitoring Zone - Nitrate

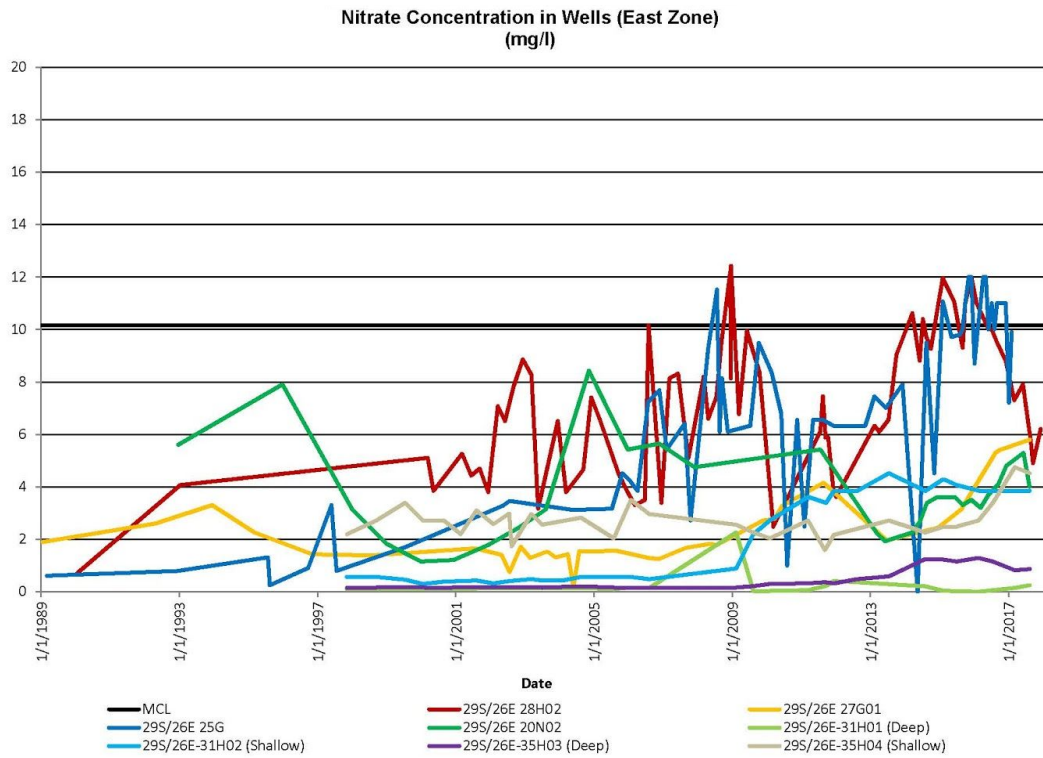


Figure 31 East Monitoring Zone - Nitrate

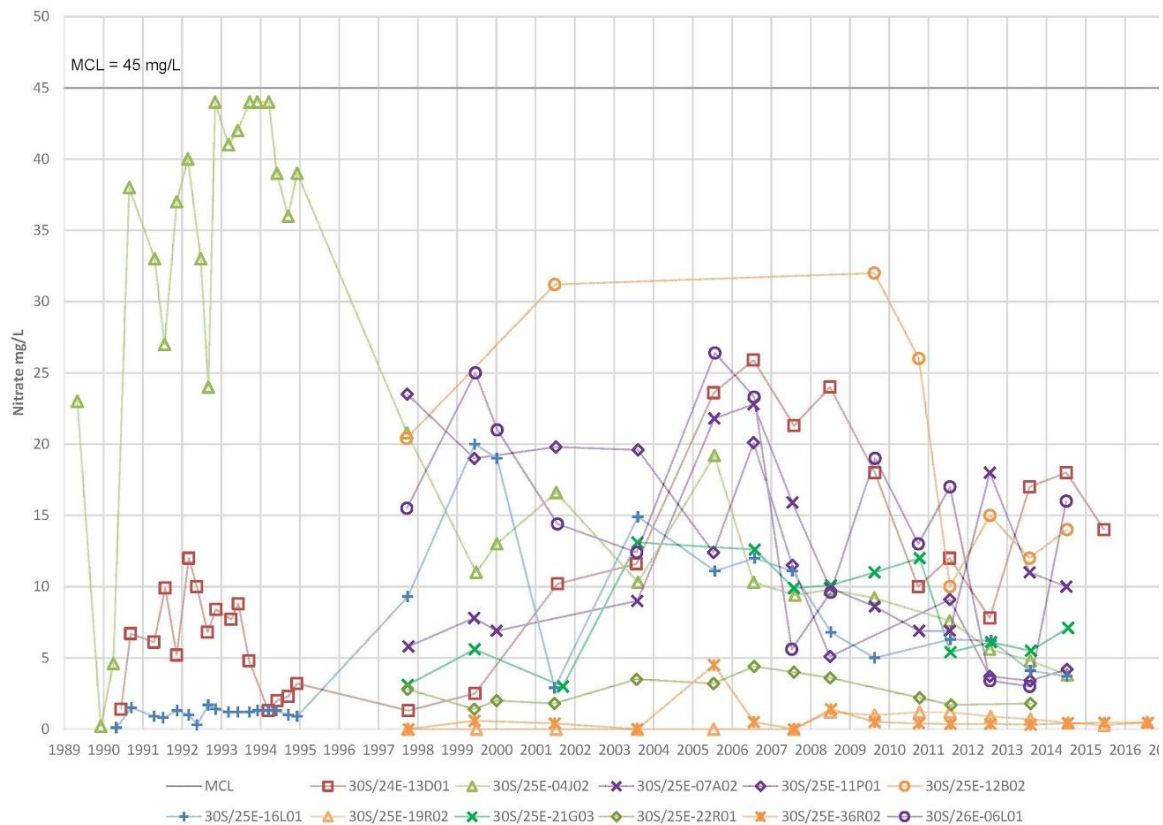


Figure 32 South of River Monitoring Zone - Nitrate

2.4.3 Subsidence Monitoring

Subsidence has occurred historically north and south of the RRBMA, but not in the management area itself, see Figure 25. Subsidence has been continuously monitored by DWR since June 1994 with an extensometer located near the center of the KWB in Section 16, T30S/R25E which is between the South and the South of River monitoring zones as shown on Figure 6. The results of the monitoring indicate both upward and downward changes (of at most 0.1 ft/yr) have occurred within an overall upward trend of inflation as shown on Figure 26. As of June 2018, the land surface was 0.27 feet higher than the land surface in June 1994. The data indicates subsidence has not resulted from KWB recovery operations during extended droughts. No subsidence monitoring has taken place within RRBWSD.



Figure 25 - USGS 1926-1970 Historical Subsidence Areas

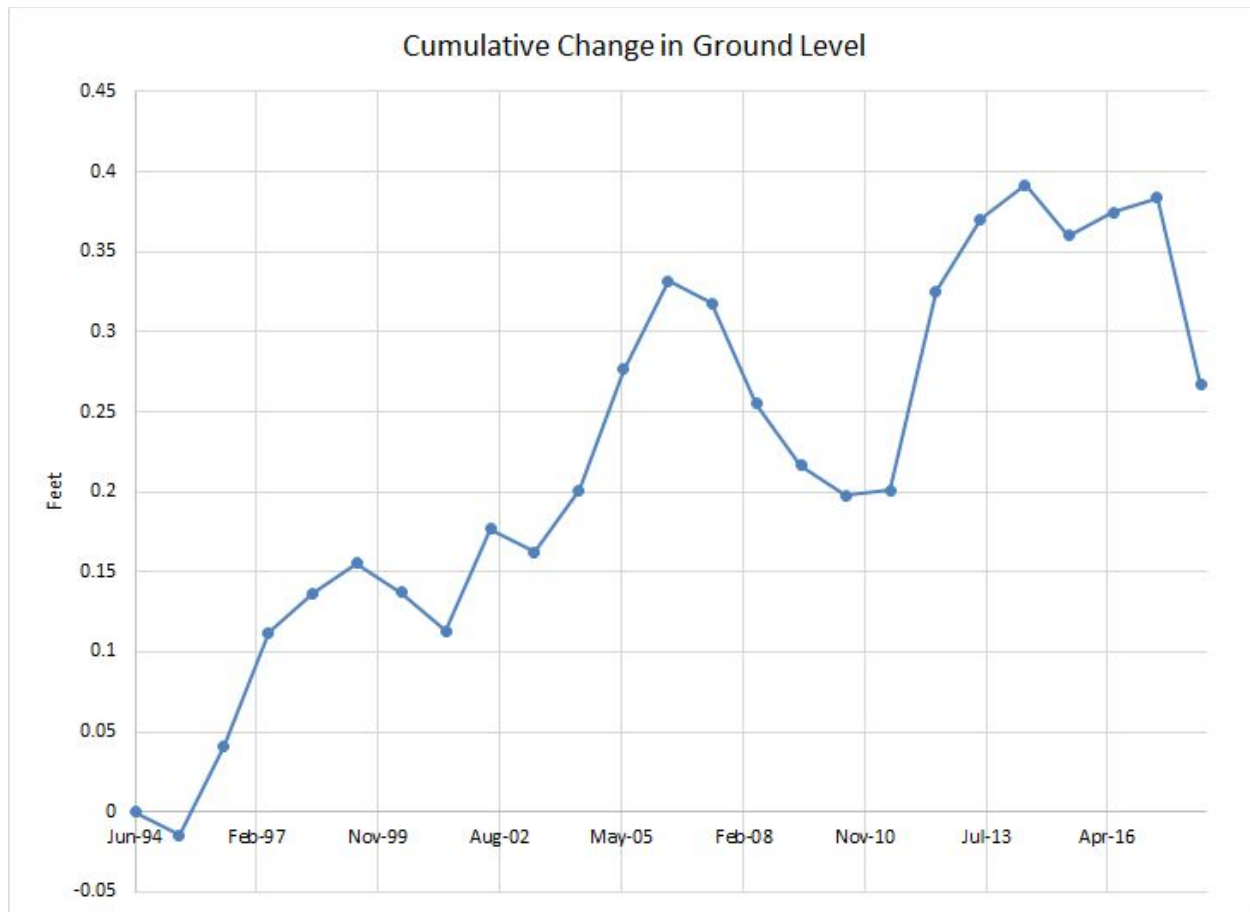


Figure 26 - KWB Extensometer Data

2.4.4 Surface Water Monitoring

The volumes of water delivered to the RRBWSD for storage purposes are measured and reconciled by several agencies, including DWR, KCWA, the City of Bakersfield, Buena Vista Water Storage District, and the Army Corps of Engineers, depending on the source of the water. The results are then tabulated by the RRBWSD and documented in an annual Operations Report by the Kern Fan Monitoring Committee and RRBWSD (see latest Kern Fan Operations report in Appendix A-9) and summarized on Table 7.

RRBWSD does not monitor the quality of water delivered for storage purposes, rather monitoring by others is relied upon. Kern River and CVP (Friant-Kern) water is monitored by Improvement District 4 of the KCWA and reported in annual reports (i.e.

<http://www.kcwa.com/wp-content/uploads/2018/07/ROWC2016.pdf>), and SWP water in the California Aqueduct is monitored by DWR (<https://water.ca.gov/Programs/State-Water-Project/Water-Quality>).

KCWA and DWR monitor the quality of water delivered to the California Aqueduct during recovery operations by collecting samples in delivery conveyances (e.g. the KWB Canal) and at locations upstream and downstream of delivery points at least quarterly as required by the Pump-in Policy (See Appendix A-4). The results are distributed to the Facilitation Group and summarized in annual reports prepared by DWR.

Supplies		Deliveries To	
SWP 2016 Carryover (per KCWA)	530	RRBWSD Kern River Intake	171,625
SWP 2017 Entitlement	25,415	RRBWSD CVC Turnout No. 1	41,876
SWP Article 21	22,186	RRBWSD CVC Turnout No. 2	59,860
SWP Pools	341	RRBWSD via BV Eastside Canal	6,237
Kern River Basic Contract	52,053	Strand Project Facilities	51,714
Kern River Miscellaneous Contract	49,921	Pioneer Project	48,388
BV Kern River Purchase	9,964	Grimmway (RRB Share)	336
Lower River Purchase	10,323	CLWA	9,360
Kern River COB/KCWA Purchases	10,165	CVWD	5,397
Friant-Kern 215 Purchases	1,950	WKWD	6,008
SJR Contractors Purchase	4,113		
AEWSD Banking	10,904		
BV/CLWA Banking	80,000		
DEID Banking	27,905		
KTWD Banking	35,805		
IRWD Banking	19,391		
Grimmway Program (RRB Share)	336		
Homer Program (2:1 Exchange)	23,698		
SJR Contractors (2:1 Exchange)	10,000		
Westside Program (5:2 Exchange)	1,813		
Westside Program (1:1 Exchange)	3,150		
Total	399,963	Total	399,691

Table 7. RRBWSD 2017 Deliveries

2.5 Management Areas Within Chapter

2.5.1 Management Areas Within Chapter (RRBWSD)

The Chapter is divided into two sub-management areas. First the portion of the RRBWSD within the RRBMA, the second are the white lands (non-districted lands) within the RRBMA. Note a portion of the eastern portion of the District is in the Kern River GSA as it is in the City of Bakersfield. It is non-districted lands that contracted with the RRBWSD to be included in the RRBMA. See Figure 1.

2.5.1.1 Reason for Creation

Because of water supply differences and the differences in the District's authority between the district and non-district lands, two distinct management areas were created. The District's authority to fund and implement management actions and projects is also different in each area.

2.5.1.2 Management Areas Conditions

Conditions are very similar between the two management areas. Each area relies on groundwater. The RRBWSD portion of the RRBMA has developed groundwater banking infrastructure, conveyance and surface water supplies. The White Lands portion of the RRBMA has not developed any projects or water

supplies to date. Because projects and management actions will vary between the two different areas they were split into sub-management areas.

2.5.1.3 Minimum Thresholds and Measurable Objectives Differentiation

Minimum Threshold and Measurable Objectives in each management area were developed with the same methodology.

2.5.1.4 Monitoring Differentiation

Monitoring plans in each management area were developed with the same methodology.

3. Sustainable Goal and Undesirable Results

3.1 Reference Umbrella GSP

See section 3. of Umbrella GSP.

3.2 Undesirable Results, Preliminary Monitoring, and Threshold Evaluation

As described in SGMA, undesirable results are one or more of the following effects:

1. **Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon;**
2. **Significant and unreasonable reduction of groundwater storage;**
3. Significant and unreasonable seawater intrusion;
4. **Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies;**
5. **Significant and unreasonable land subsidence that substantially interferes with surface land uses; and/or**
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

As discussed below, seawater intrusion and depletion of interconnected surface waters are conditions that do not exist in the RRBMA.

Historical Monitoring

With respect to the remaining undesirable results discussed in SGMA, extensive monitoring of the operations and operational constraints demonstrate that the RRBMA:

1. Does not cause a chronic lowering of groundwater levels;
2. Does not create a significant or unreasonable depletion of supply or reduction in groundwater storage;
4. May degrade water quality; and
5. May cause land subsidence.

RRBWSD “banking” operations may cause a temporary lowering of groundwater levels toward the end of extended recovery periods. However, potential impacts that may result from this temporary lowering of groundwater levels is mitigated pursuant to the requirements described in the MMRP and Joint Operations Plan, which are incorporated into this GSP as potential management actions (see Section 1.4.4; and Appendices A). RRBWSD banking operations cannot create a significant or unreasonable depletion of supply or reduction in groundwater storage because only previously stored supplies can be recovered after the deduction of appropriate losses.

As to RRBMA operations, four modeling scenarios were considered from least to most aggressive to a sustainable RRBMA groundwater supply and demand:

- Delayed Sustainability at 2040 (status quo till 2035)
- Progressive Sustainability by 2040 (limited action 2020-2025)
- Linear Sustainability by 2040 (straight line)
- Regressive Sustainability by 2040 (aggressive 2020-2030)

These four sustainability paths are then analyzed to see which path is required to meet minimum thresholds, measurable objectives, and interim milestones as shown on Figure 27. The RRBMA has committed to the path to sustainability shown on Figure 28 which resembles a Regressive strategy.



Figure 27. Considered Paths to Sustainability

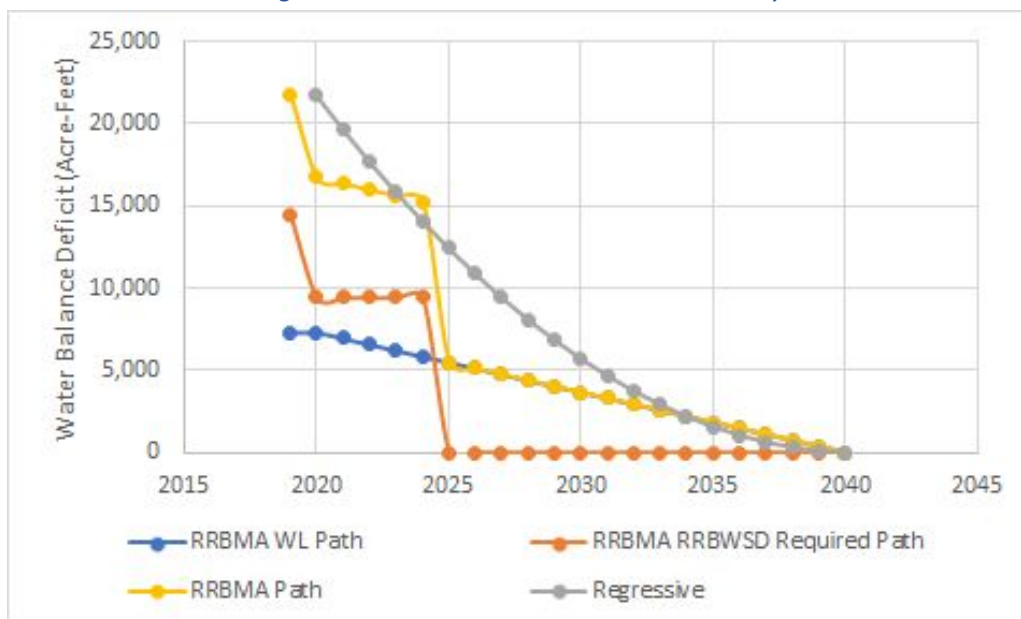


Figure 28. Selected Path to Sustainability

3.2.1 Groundwater Levels

Historical groundwater levels are presented in section 2.4.1. As to projected groundwater levels the RRBMA has cooperated and partially funded a KGA effort to develop a basinwide model using C2VSim which will be incorporated into future plan updates. RRBWSD will utilize its annually updated and calibrated numerical model (hereafter referred to as the Harder Model) originally constructed in 2011.

This model was constructed to evaluate the potential groundwater impacts of RRBWSD, KWB, and Pioneer project operations and is also capable of predicting water levels based on various projected RRBMA operations. The MODFLOW model evaluated the historical operations from 1988 through 2010, with updates made from 2011 to 2019. Various projected operation, project implementation and management activities for the period 2020 through 2070 have been analyzed.

Delayed Sustainability by 2040 - Pages 53-55 waiting on data from T.Harder

This strategy assumes that the RRBMA will make no strides towards a fully sustainable goal until 2035. Under this strategy, with the RRBMA currently facing a water supply versus demand balance deficit of 22,200 AF/yr (Tables 2, 3 and Figure 28), the RRBMA will seek water supply programs and demand reductions at a rate of 450 AF/yr. Under this scenario the projected average water depth would increase from 250 ft to 300 ft by 2040, which remains 50 ft above the RRBMA's selected threshold of 350 ft as shown in Figure 28.

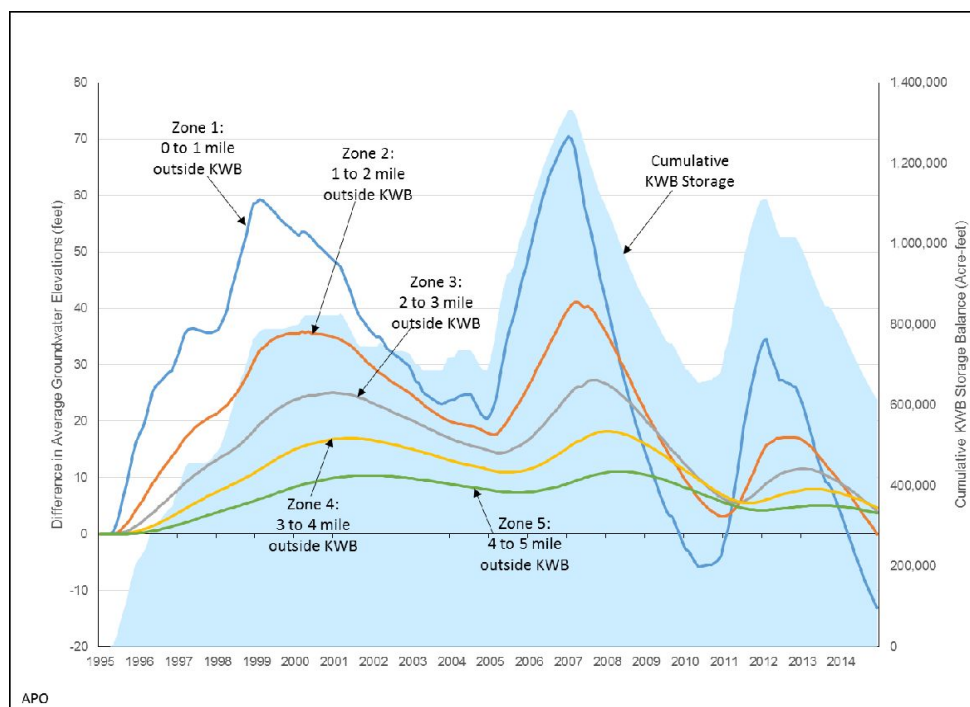


Figure 28. Delayed Path to Sustainability

Progressive Sustainability by 2040

This strategy assumes that the District will make smaller strides initially towards a fully sustainable goal by 2040. Under this strategy, with the RRBMA currently facing a water supply versus demand balance shortfall of 9,000 AF/yr, the RRBMA will seek water supply programs and demand reductions at a rate of 300 AF/yr during the 2020-2030 period and 600 AF/yr during the 2030-2040 period. Under this scenario the projected average water depth would increase from 250 ft to 300 ft by 2040, which remains 50 ft above the RRBMA's selected threshold of 350 ft as shown in Figure 29.

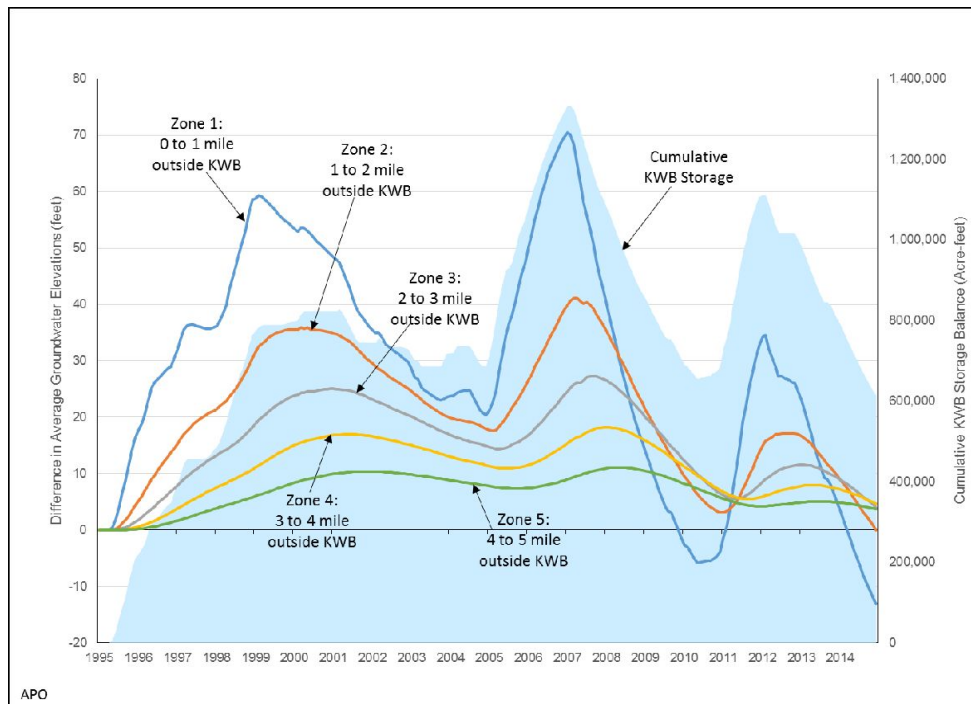


Figure 29. Progressive Path to Sustainability

Linear Sustainability by 2040

This strategy assumes that the RRBMA will make linear strides towards a fully sustainable goal by 2040. Under this strategy, with the RRBMA currently facing a water supply versus demand balance shortfall of 9,000 AF/yr, the RRBMA will seek water supply programs and demand reductions at a rate of 450 AF/yr. Under this scenario the projected average water depth would increase from 250 ft to 300 ft by 2040, which remains 50 ft above the RRBMA's selected threshold of 350 ft as shown on Figure 30.

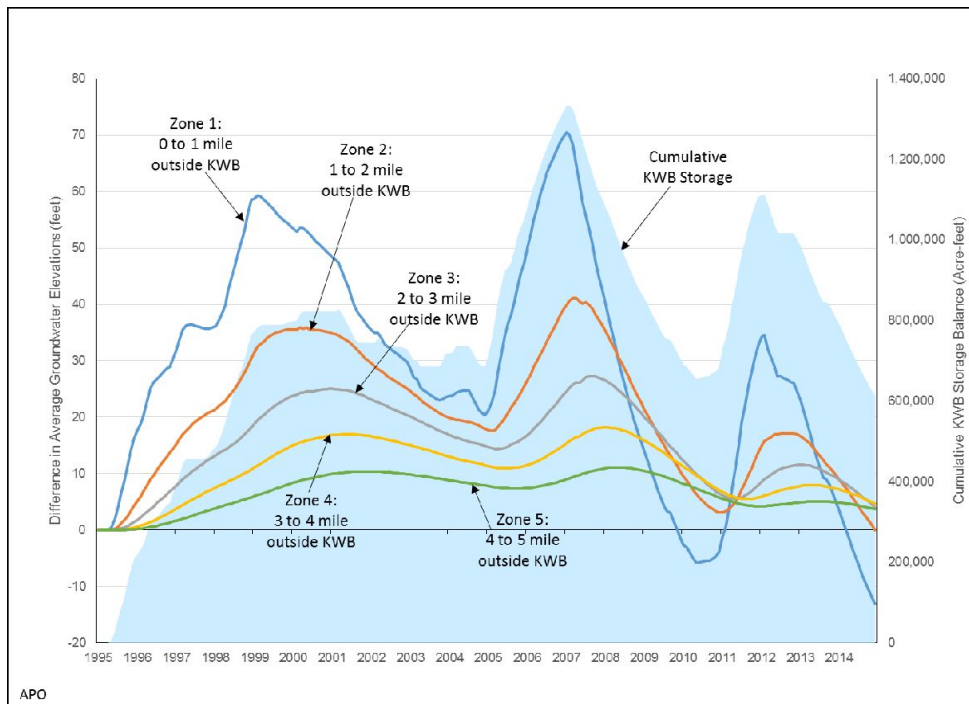


Figure 30. Linear Path to Sustainability

Regressive Sustainability by 2040

This strategy assumes that the District will make larger strides initially towards a fully sustainable goal by 2040. Under this strategy, with the RRBMA currently facing a water supply versus demand balance shortfall of 9,000 AF/yr, the RRBMA will seek water supply programs and demand reductions at a rate of 600 AF/yr during the 2020-2030 period and 300 AF/yr during the 2030-2040 period. Under this scenario the projected average water depth would increase from 250 ft to 300 ft by 2040, which remains 50 ft above the RRBMA's selected threshold of 350 ft.

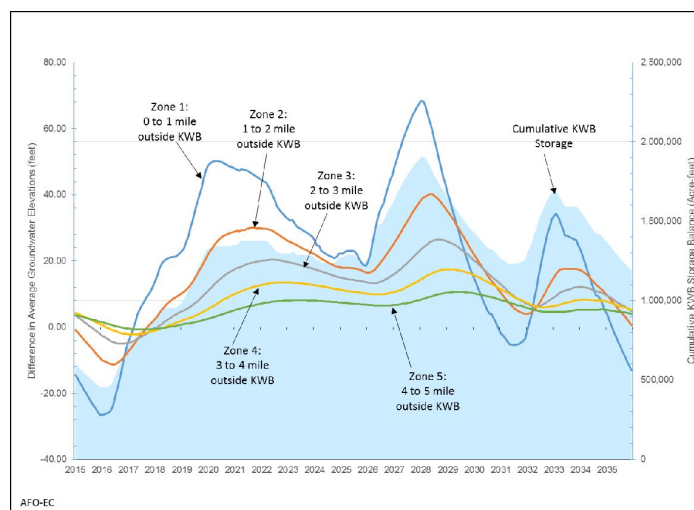


Figure 31. Regressive Path to Sustainability

3.2.2 Groundwater Storage

The RRBMA seeks to have a balanced water supply and positive groundwater storage (surplus) by 2040. The RRBDL could have positive groundwater storage by 2025 and the RRBWL by 2040. It is expected that prolonged drought periods (3-6 years, i.e. 2012-2016) could impact the RRBMA areas ability to have a balanced supply. That being said the RRBMA could draw down as much as 223,000 AF during such a period as shown on the balance sheet in the Operations Report found in Appendix D. The District balance went from 344,461 AF at the end of 2011 down to 121,496 AF at the end of 2016.

3.2.3 Seawater Intrusion (N/A)

The Kern subbasin is not adjacent to the Pacific Ocean, bays, deltas, or inlets and seawater intrusion is not an applicable sustainability indicator, because seawater intrusion does not exist and could not occur. As such, seawater intrusion is not further considered in this document.

3.2.4 Degraded Water Quality

With respect to water quality, RRBMA operations have not degraded groundwater quality as documented by 22 years of groundwater monitoring, which has been reported in the annual RRBWSD Operations Report.

3.2.5 Subsidence

The potential for subsidence in the Kern Fan area is monitored with an extensometer operated by the Department of Water Resources, and no significant inelastic subsidence has been recorded. In fact, since the inception of KWB operations, there has been an overall net rise in the land surface elevation (See Section 2.9.4). No subsidence monitoring has taken place in the RRBMA.

3.2.6 Depletions of Interconnected Surface Water (N/A)

The Kern River is a losing stream where it parallels the RRBMA (see Section 2.2), having only received flows in 6 of the last 22 years, and depletions of interconnected surface water are not an applicable sustainability indicator because depletions do not exist and could not occur. As such, depletions of interconnected surface water are not further considered in this document.

4. Monitoring Networks

4.1 Monitoring Networks Objectives

4.1.1 Temporal Trends

4.2 Groundwater Rationales

4.3 Groundwater Level Monitoring Network

The RRBMA seeks to have a robust water level monitoring network given that this is an important method to measuring groundwater sustainability in the area. Groundwater levels are monitored monthly in 20 locations, six of these locations are multi completion monitor wells at various depth intervals so that water level information is also available vertically within the aquifer. The wells are a combination of agricultural, domestic and dedicated monitor wells of known well construction. The current wells offer reliable long term data.

4.3.1 Management Areas

The RRBMA has two sub-management areas include five monitoring zones (North, Central, South, East, and South of River). Each monitoring zone was selected based on similar groundwater conditions and land use patterns. See Figure 6.

4.3.2 Monitoring Frequency

The RRBWSD currently measures wells monthly which provides abundant data to determine groundwater elevation trends.

4.3.3 Spatial Density

Groundwater levels are monitored monthly in 20 locations, an areal density of 1 well per 3.6 square miles or 28 wells per 100 square miles (Figure 6) across the entire RRBMA. Six of these locations are nested multi completion monitor wells at various depth intervals so that water level information is also available vertically within the aquifer. Each Monitoring Zone has 3-5 monitoring locations within to further provide ample well density. The data is compiled and reported by the Kern Fan Monitoring Committee pursuant to the MOU's (Kern Fan Operations Report - Appendix A) and the RRBWSD annual Operations Report (Appendix D). Groundwater depth and elevation maps, as well as hydrographs for the wells are included. Data is also posted at the RRBWSD website at www.RRBWSD.com.

4.3.4 Maps of Grid for Each Management Area

See Figure 6.

4.3.5 Monitoring Protocols

See section 4. of Umbrella GSP

4.4 Groundwater Storage Monitoring Network

The RRBMA seeks to have a robust groundwater storage monitoring network. The RRBMA will update its groundwater “checkbook balance” and as well as do a “spring to spring” water surface storage calculation using the RRBWSD groundwater model as described in section 2.1.

4.4.1 Management Areas

The RRBMA has two management areas which include five monitoring zones (North, Central, South, East, and South of River). Each monitoring zone was selected based on similar groundwater conditions and land use patterns. See Figure 6. Each management area will be analyzed for groundwater storage as described above.

4.4.2 Monitoring Frequency

The RRBMA will update its groundwater “checkbook balance” and as well as do a “spring to spring” water surface storage calculation using the RRBWSD groundwater model as described in section 2.1. each year.

4.5 Seawater Intrusion Level Monitoring Network (N/A)

4.6 Degraded Water Quality Monitoring Network

The RRBMA seeks to have a robust water quality monitoring network. Groundwater quality is monitored annually in 35 locations, six of these locations are multi completion monitor wells at various depth intervals so that water level information is also available vertically within the aquifer. The wells are a combination of agricultural, domestic and dedicated monitor wells of known well construction. The current wells offer reliable long term data. The following constituents of concern will be sampled and tested for:

<u>COC's</u>	<u>Beneficial Uses by Monitoring Zone</u>
Arsenic	Drinking Water/Banking
Chromium (Total Chromium)	Drinking Water/Banking
Hexavalent Chromium	Drinking Water/Banking
Nickel	Drinking Water/Banking
pH	Ag/Drinking Water/Banking
TDS	Ag/Drinking Water/Banking
Specific Conductance	Ag/Drinking Water/Banking
Chloride	Ag/Drinking Water/Banking
Sulfate	Drinking Water/Banking
Uranium	Drinking Water/Banking
Low Level Bromide	Drinking Water/Banking
Low Level 1,2,3-TCP	Drinking Water/Banking
Dissolved Organic Carbon (DOC)	Drinking Water/Banking
Nitrate as NO3	Drinking Water/Banking

4.6.1 Management Areas

The RRBMA has two management areas which include five monitoring zones (North, Central, South, East, and South of River). Each monitoring zone was selected based on similar groundwater conditions and land use patterns. See Figure 16. Each management area will be analyzed for groundwater quality as described above.

4.6.2 Monitoring Frequency

The RRBWSD currently samples wells annually for constituents of concern which provides abundant data to determine groundwater quality trends.

4.6.3 Spatial Density

Groundwater quality is monitored at 35 locations, an areal density of 0.45 wells per square mile, or 1 well per 2.2 square miles, or 45 wells per 100 square miles (Figure 16) across the entire RRBMA. Six of these locations are nested multi completion monitor wells at various depth intervals so that water level information is also available vertically within the aquifer. The data is compiled and reported by the Kern Fan Monitoring Committee pursuant to the MOU's (Kern Fan Operations Report - Appendix A) and the RRBWSD annual Operation Report (Appendix D) . Groundwater quality hydrographs are included. The District Operations Report is also posted at the RRBWSD website at www.RRBWSD.com.

4.6.4 Maps of Grid for Each Management Area

See Figure 16.

4.6.5 Monitoring Protocols

See section 4. of Umbrella GSP

4.7 Land Subsidence Monitoring Network

See section 4. of Umbrella GSP.

4.8 Depletions of Interconnected Surface Water Monitoring Networks (N/A)

There are no interconnected surface waters in the RRBMA.

4.9 Monitoring Summary

4.10 Monitoring Improvement Plan

4.10.1 Groundwater Level Monitoring Improvements

By 2030 the RRBMA will make efforts to have all sites as dedicated monitor wells.

4.10.2 Groundwater Storage Monitoring Improvements

The RRBMA and RRBWSD will seek to make improvements to the District model and participate in the regional model updates to better estimate groundwater storage. See section 4 of Umbrella GSP.

4.10.3 Seawater Intrusion Monitoring Improvements (N/A)

4.10.4 Degraded Water Quality Monitoring Improvements

By 2030 the RRBMA will make efforts to have all sites converted to dedicated monitor wells.

4.10.5 Land Subsidence Monitoring Improvements

By 2030 the RRBMA will participate in a cooperative regional land subsidence monitoring program as described in KGA Umbrella. See section 4. of Umbrella GSP.

5. Minimum Thresholds, Measurable Objectives, and Interim Milestones

As described in SGMA, undesirable results are one or more of the following effects:

1. **Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon;**
2. **Significant and unreasonable reduction of groundwater storage;**
3. Significant and unreasonable seawater intrusion;
4. **Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies;**
5. **Significant and unreasonable land subsidence that substantially interferes with surface land uses; and/or**
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The Kern subbasin is not adjacent to the Pacific Ocean, bays, deltas, or inlets and seawater intrusion is not an applicable sustainability indicator, because seawater intrusion does not exist and could not occur. Likewise, the Kern River is a losing stream where it parallels the RRBMA, having only received flows in 6 of the last 22 years, and depletions of interconnected surface water is not an applicable sustainability indicator. Therefore, these undesirable results are not discussed in any detail in this chapter..

Minimum thresholds and/or their applicability for each of the remaining categories are described below.

5.1 Chronic Lowering of Groundwater Levels

Historically the RRBWSD has been in water supply balance as described in section 2.2.2; RRBWSD's operations have not contributed to the chronic lowering of groundwater levels, nor are the projected future operations of the RRBWSD expected to cause the chronic lowering of groundwater levels as the District seeks to always have a balance water supply with its demand. The RRBMA does, however, include RRBWL's (White Lands) and is bordered on two sides by lands without or with limited water supplies and almost completely dependent on groundwater pumping. These factors and others have caused groundwater levels to decline 3-5 feet per year on average over time. The RRBWSD anticipates that adjacent groundwater sustainability plans will contain projects and management actions that reach a sustainable level over the next 20 years, thereby lessening their impacts within the RRBMA.

Despite RRBWSD's expanding water management efforts, average groundwater depths dropped from 175 ft down to 250 ft below ground surface during the 2012-2016 drought cycle. The RRBWSD's ability to maintain groundwater levels are drastically diminished by deep and persistent groundwater pumping depression existing northwest of RRBMA, which results in a steep groundwater gradient across the RRBMA from southeast to northwest of about 15 ft per mile. This dewatering coupled with banking project extractions resulted in significant expense to most all landowners in the RRBMA in terms of pump lowering, well replacement, well-head treatment, and increased energy costs. That reinvestment now allows most RRBMA landowners to tolerate average groundwater depths of about 300 ft below ground surface, which was the depth at the end of the 2012-2016 drought. To the extent that further

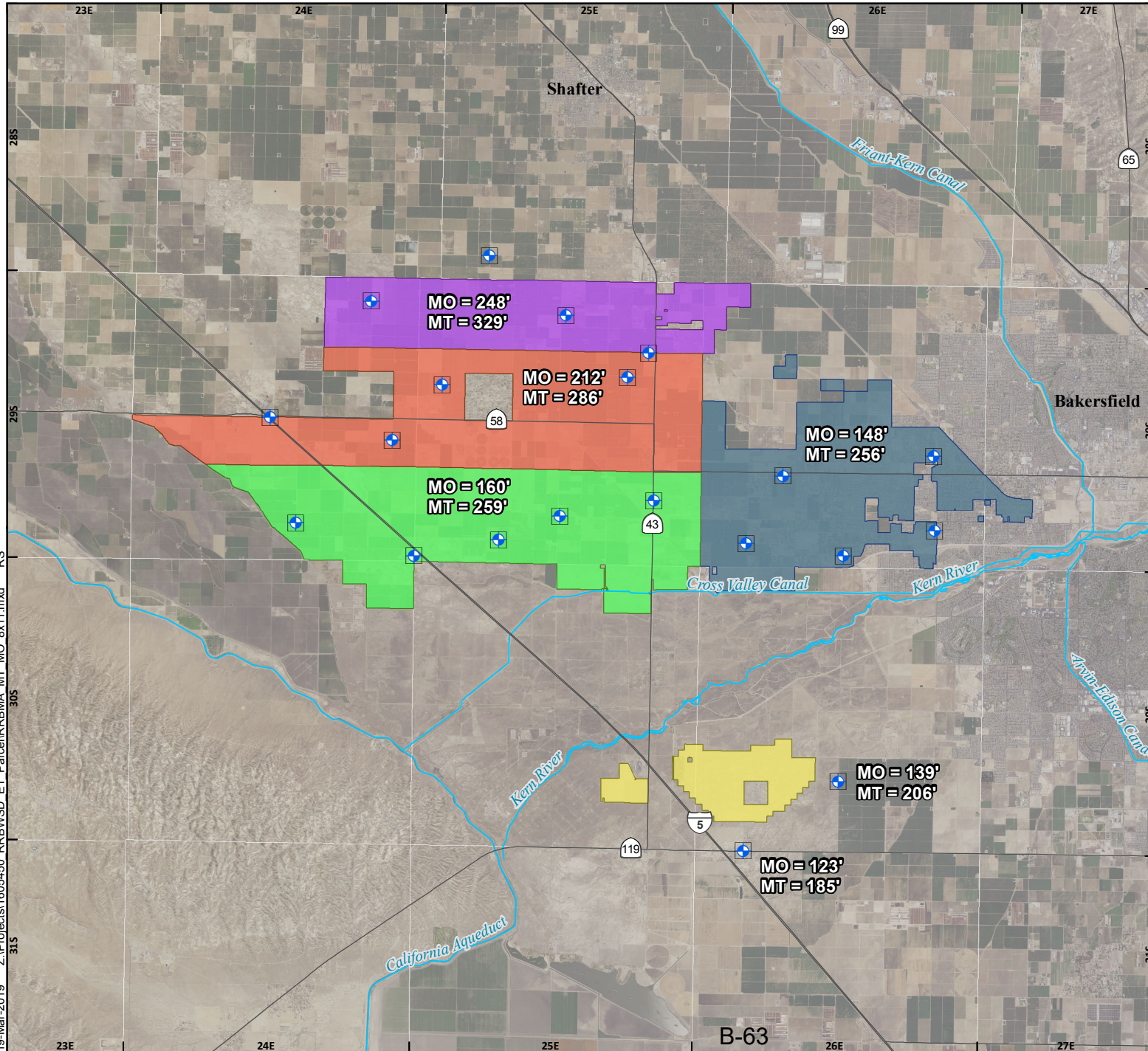
water level declines are experienced another major round of reinvestment would be required, which would be deemed an undesirable result. Table 8 depicts the financial impact of a threshold of 50, 100, and 150 feet deeper than 2016 levels (\$20.3M, \$56.3M, and \$83.4M) as found in Appendix H. The financial impacts include typical well infrastructure improvement costs and extra energy lift costs for domestic, agricultural and municipal wells. The impacts also include arsenic treatment costs for domestic, municipal and groundwater banking wells. A secondary threshold of arsenic impact was evaluated in order to understand at what depth to groundwater would Arsenic treatment be required (report found in Appendix H). As was discussed in section 2.4.2.2, arsenic increases with depth.

Reference GW Depth	Scenario #0	Scenario #1	Scenario #2	No Action
	300	350	400	450
Domestic				
Pumps Lowered	0	0	143	143
Pump Lowering	\$ -	\$ -	\$ 1,298,333	\$ 2,077,333
Wells Rehabilitated	0	46	49	59
Well Rehabilitation	\$ -	\$ 418,333	\$ 443,333	\$ 533,333
Wells Replaced	0	27	71	81
Well Replacement	\$ -	\$ 1,319,913	\$ 3,537,649	\$ 4,098,792
Extra Lift	\$ -	\$ 37,230	\$ 74,460	\$ 111,690
Total Cost	\$ -	\$ 1,775,476	\$ 5,353,776	\$ 6,821,149
Agricultural				
Pumps Lowered	0	0	217	217
Pump Lowering	\$ -	\$ -	\$ 9,458,333	\$ 15,133,333
Wells Rehabilitated	0	31	39	44
Well Rehabilitation	\$ -	\$ 2,062,500	\$ 2,475,000	\$ 2,850,000
Wells Replaced	0	9	47	69
Well Replacement	\$ -	\$ 1,088,250	\$ 6,039,450	\$ 9,536,250
Extra Lift	\$ -	\$ 13,018,599	\$ 26,037,197	\$ 39,055,796
Total Cost	\$ -	\$ 16,169,349	\$ 44,009,981	\$ 66,575,379
Municipal/Public				
Pumps Lowered	0	0	25	25
Pump Lowering	\$ -	\$ -	\$ 1,687,500	\$ 2,700,000
Wells Rehabilitated	0	3	7	7
Well Rehabilitation	\$ -	\$ 500,000	\$ 1,300,000	\$ 1,300,000
Wells Replaced	0	2	4	6
Well Replacement	\$ -	\$ 332,500	\$ 822,500	\$ 1,372,500
Extra Lift	\$ -	\$ 1,548,468	\$ 3,096,935	\$ 4,645,403
Total Cost	\$ -	\$ 2,380,968	\$ 6,906,935	\$ 10,017,903
Total	\$ -	\$ 20,325,792	\$ 56,270,692	\$ 83,414,431

Table 8. Financial Impacts at various Threshold Levels

Recognizing that an increase in groundwater depth of 50 feet can create a \$400/acre impact, the RRBMA has set its minimum threshold at recent historic drought levels (2012-2016) as shown in Figures 32-37 below. The RRBMA will seek to maintain water levels above the minimum thresholds with a goal of meeting the measurable objectives (Figures 32-37), which are levels that maintain recovery capacity

and efficiency and minimize water costs. Reasonable management actions and projects will be implemented in an effort to meet these goals, recognizing that adjacent banking projects and management area actions must also take action in order for these goals to be achieved. Because water levels are already at or near the minimum thresholds, interim milestones were not assigned.



RRBMA MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES

MO - Measurable Objective
MT - Minimum Threshold

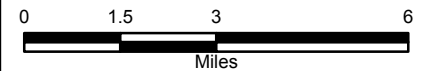
RRBMA Water Level Well

Proposed Monitoring Zones

- East Zone
- South Zone
- Central Zone
- North Zone
- South of River Zone

All Other Features

- Highway
- Waterway



Rosedale-Rio Bravo Management Area
Kern County, California

Rosedale-Rio Bravo WSD



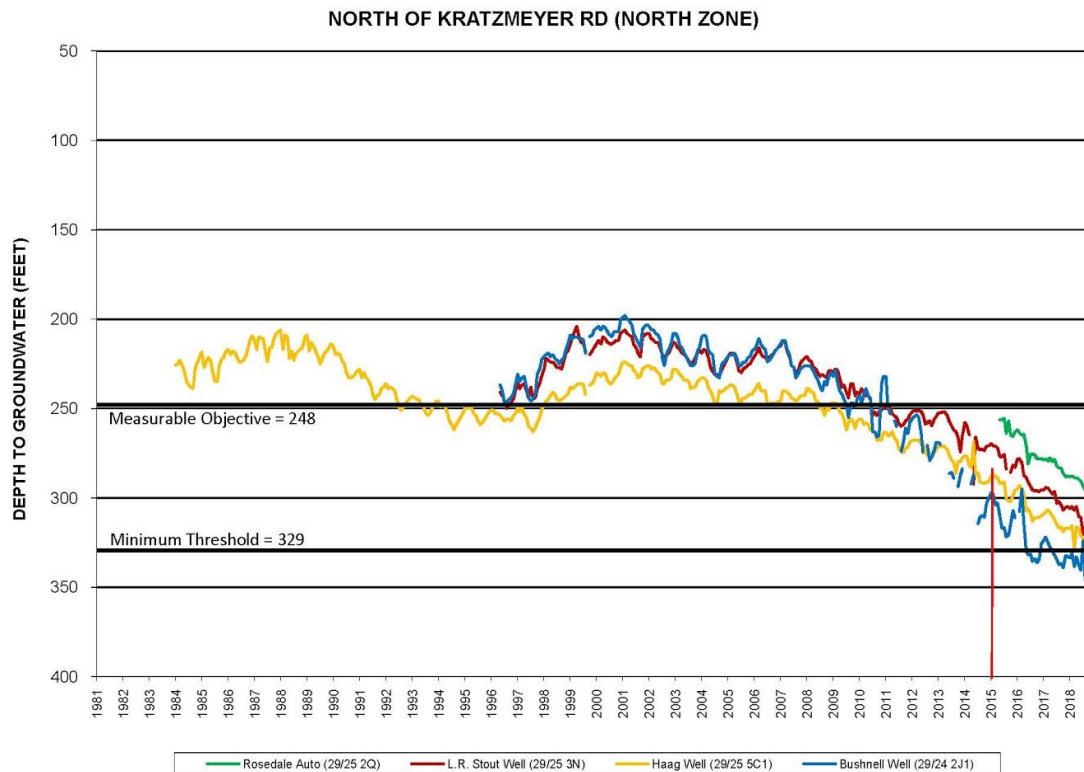


Figure 33. North Monitoring Zone Minimum Thresholds and Measurable Objectives

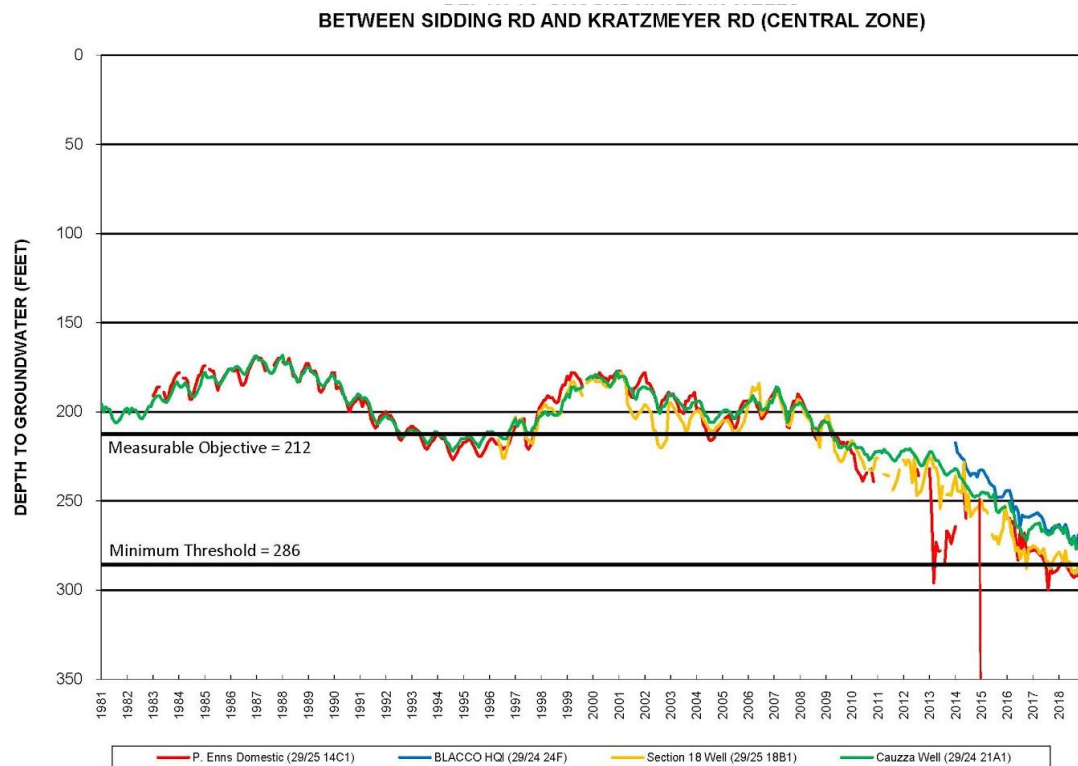


Figure 34. Central Monitoring Zone Minimum Thresholds and Measurable Objectives

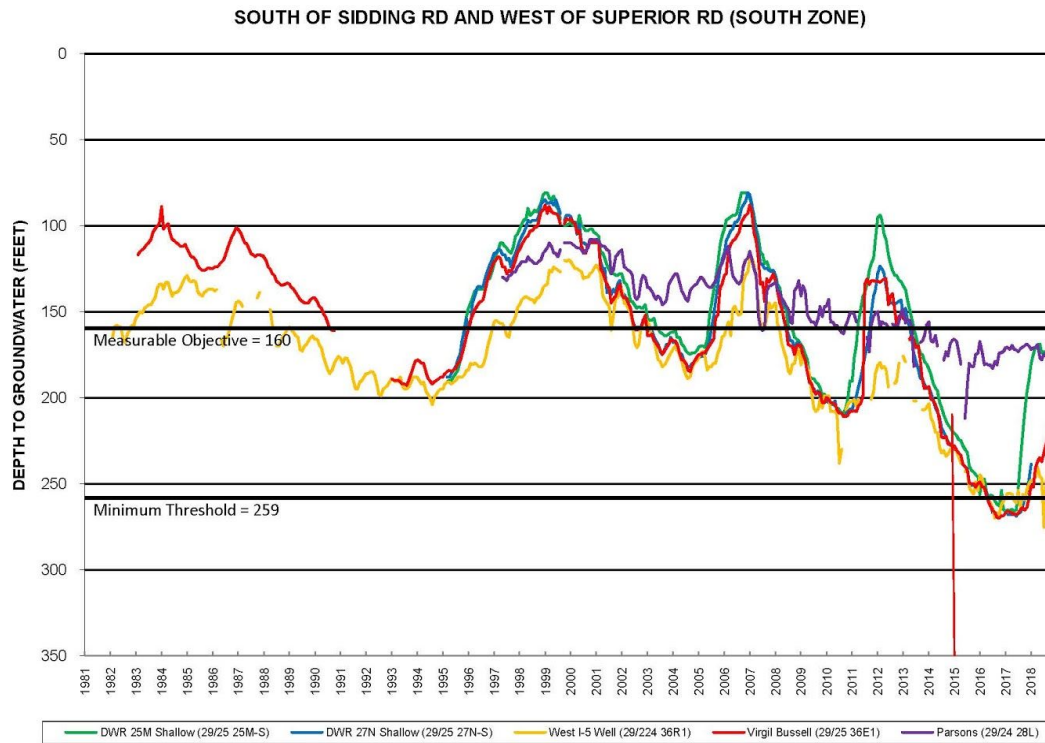


Figure 35. South Monitoring Zone Minimum Thresholds and Measurable Objectives

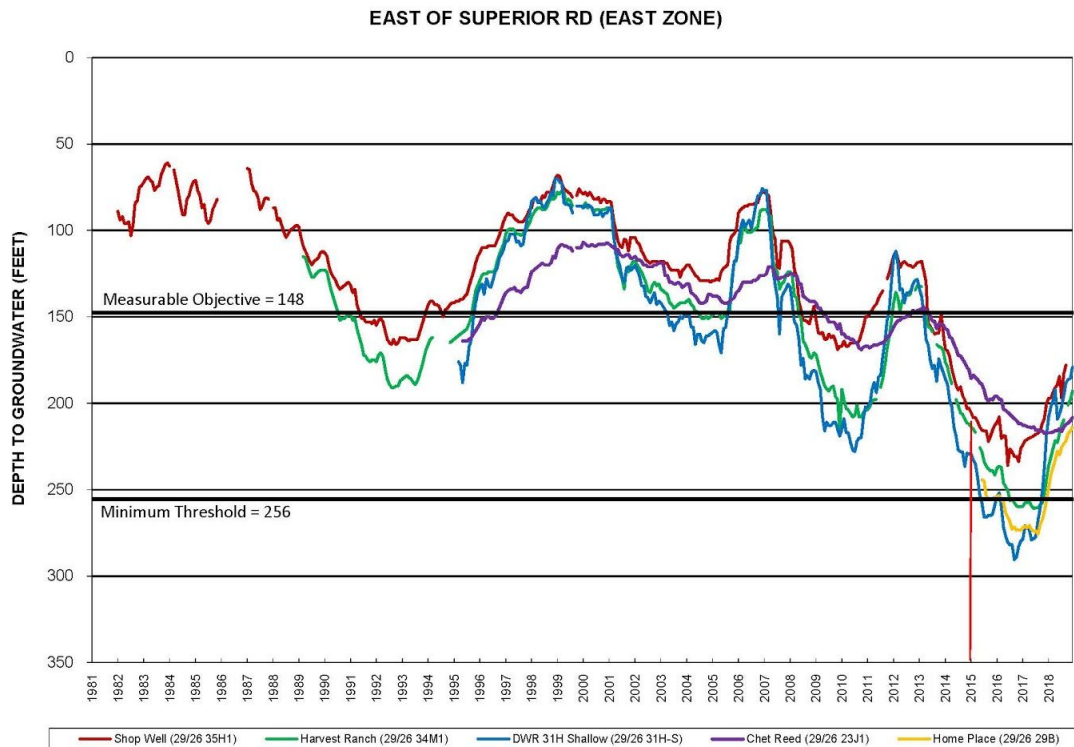
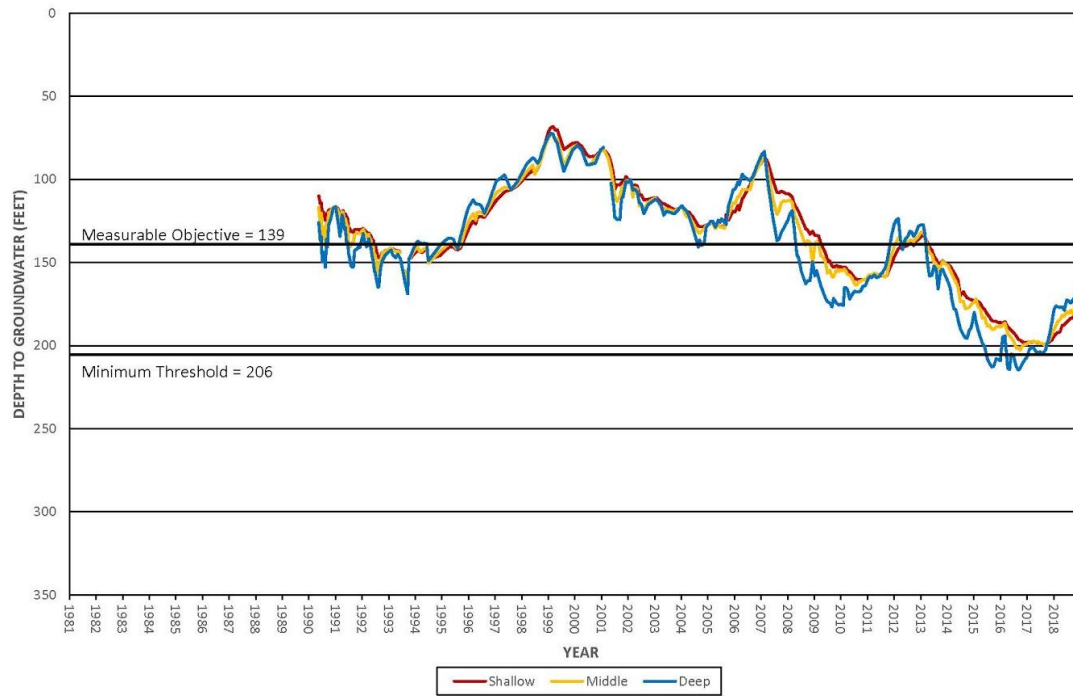


Figure 36. East Monitoring Zone Minimum Thresholds and Measurable Objectives

30S/R26E 28J (South of River Zone)



30S/R26E 32N (South of River Zone)

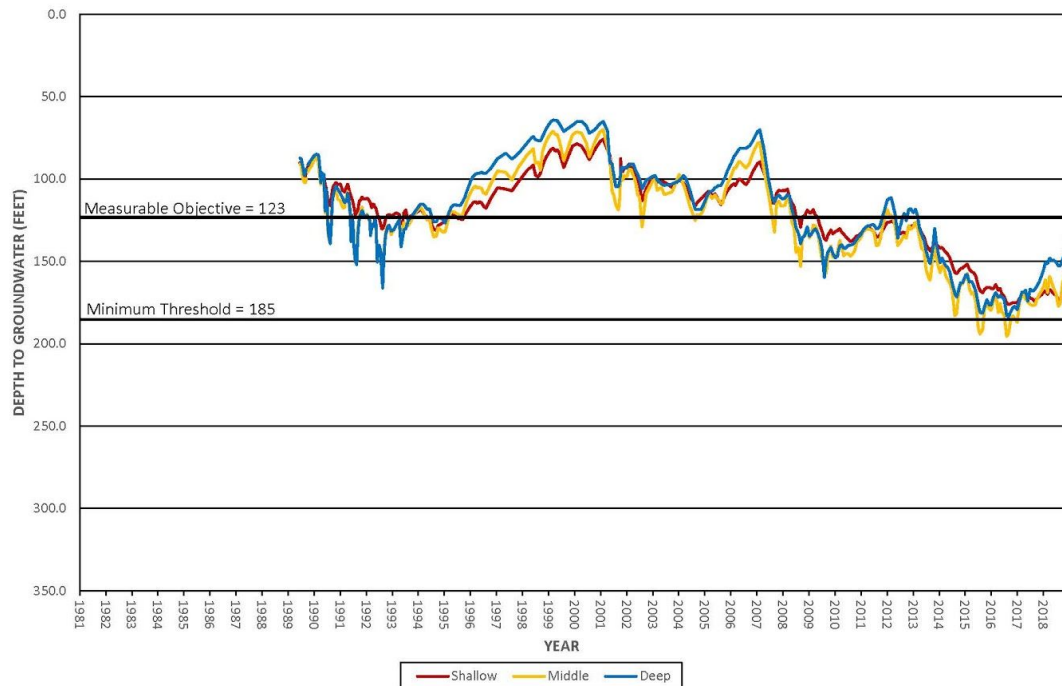


Figure 37. South of River Monitoring Zone Minimum Thresholds and Measurable Objectives

5.2 Reduction of Groundwater Storage

The RRBMA seeks to have a balanced water supply and has accomplished this goal to date (as documented in its annual Operations Report - shown on Table 2 of Appendix D with a end of 2017 balance of 186,784 AF). Despite a historical positive balance, water levels in the RRBMA have declined. The RRBMA has calculated the amount of groundwater storage between the groundwater level Minimum Threshold and the Measurable Objective in the RRBMA to be 450,000 AF. The Minimum Threshold for the RRBMA groundwater storage as calculated by its cumulative checkbook balance (Appendix D) will be 0 AF and its Measurable Objective is 450,000 AF. The storage level with respect to the calculated water surface calculations will assume the level Minimum Threshold to be 0. Water surface elevations and calculated storage will be compared to the checkbook balance and reported in plan updates. Differences between the two would likely point to adjoining Management Area actions or inactions impacting water levels within the RRBMA.

5.3 Seawater Intrusion (N/A)

5.4 Degraded Water Quality

Groundwater quality in the RRBMA is monitored annually 35 locations; six of these locations are multi completion monitor wells at various depth intervals so that water level information is also available vertically within the aquifer as shown on Figure 16. These wells are sampled and analyzed for constituents of concerns (COC's) including:

<u>COC's</u>	<u>Beneficial Uses by Monitoring Zone</u>
Arsenic	Drinking Water/Banking
Chromium (Total Chromium)	Drinking Water/Banking
Hexavalent Chromium	Drinking Water/Banking
Nickel	Drinking Water/Banking
pH	Ag/Drinking Water/Banking
TDS	Ag/Drinking Water/Banking
Specific Conductance	Ag/Drinking Water/Banking
Chloride	Ag/Drinking Water/Banking
Sulfate	Drinking Water/Banking
Uranium	Drinking Water/Banking
Low Level Bromide	Drinking Water/Banking
Low Level 1,2,3-TCP	Drinking Water/Banking
Dissolved Organic Carbon (DOC)	Drinking Water/Banking
Nitrate as NO3	Drinking Water/Banking

The measurable objective will be any applicable beneficial use COC value that is less than the MCL and a value increase less than 10% of the 2015-2020 value. An Undesirable Result will exist if any applicable beneficial use COC value that is greater than the current MCL and value increase of greater than 10% from the 2015-2020 value.

5.5 Land Subsidence

Historic operations during four significant storage cycles and two significant recovery cycles have actually resulted in a cumulative land surface rise of about 0.27 feet (see Section 2.7.3), indicating the

Kern Fan Aquifer is not susceptible to land subsidence due to stored water recovery. Subsidence is not an applicable sustainability indicator in the RRBMA because subsidence has not occurred. Extensometer monitoring will continue. RRBMA will participate in a regional effort with the KGA and other GSA's overlying the basin.

Until a regional a program is developed, a threshold of 2 feet will be assigned given that there is not a history of subsidence in the RRBMA. A measurable objective of < 1 foot will be assigned and a 2030 milestone of < 1.5 feet will be assigned.

5.6 Interconnected Surface Water (N/A)

5.7 Potential Effects Beyond Management Area

The RRBWSD has sought for many years to be in balance as to water supplies and demands, and forecasts to operate in the same manner going forward. There should be no lasting effects from RRBWSD's operations outside the management area. The RRBWL operations do have an effect on the RRBMA and adjacent management areas because those lands rely solely on groundwater pumping and have not historically recharged or obtained any additional water supplies.

6. Water Supply Accounting

6.1 Allocation from Umbrella GSP

Per section ?? of the Umbrella GSP has allocated ??? AF/acre of native yield (not including precipitation and project water) to all developed lands.

6.2 Water Accounting Framework

The RRBMA has developed a simple framework by which landowners may track their path to sustainability. The RRBMA will track net demand by means of METRIC satellite imagery techniques. To the extent that imported water supply allocated to the landowner, precipitation, and allocated portion of native yield are less than the net demand, a water supply imbalance will be calculated as follows:

$$\text{Native Yield} + \text{Precipitation} + \text{Imported Supply} = \text{Sustainable Yield} - \text{Demand} = \text{Balance}$$

6.2.1 Landowner Allocations

The RRBMA will allocate the same amount of native yield and precipitation to all developed lands.

6.2.2 Accounting Tools

The RRBMA is developing a web based water supply accounting database system on a APN (assessor's parcel number) basis that will provide parcel allocation of Native Yield, Precipitation, and Project Water supply as compared to consumptive use on a monthly time step by the end of the following month. This will enable landowners to track water supply and usage so as to meet management action demand reduction objectives. Currently the RRBMA is working with the Environmental Defense Fund (EDF) to provide the RRBWSD with a water accounting platform.

6.2.2 Allocation Among Management Areas

The RRBMA will allocate Native Yield and Precipitation to both sub-management areas (White Land and RRBWSD) in the same manner. However RRBWSD lands in the RRBMA will be allocated a proportionate share of Project Water to offset and even potentially eliminate imbalance. White Lands will not be

allocated a portion of RRBWSD Project Water but will be able to access imported water supplies and projects that create water supplies on a mutually agreeable basis.

6.2.3 Changes Over Time

The native yield allocation to developed lands is expected to be revisited by the KGA and other Kern Subbasin GSA's to evaluate its accuracy and sustainability.

7.0 Projects, Management Actions, and Adaptive Management

7.1 Sustainability Target

7.2 Water Accounting Framework

7.3 Projects

RRBWSD is developing several projects in order to meet its measurable objectives and achieve sustainability.

7.3.1 West Basin Improvements

The West Basins Improvement Project is the improvement of existing recharge ponds and development of an additional 50 acre project west of Bakersfield designed to recharge, store and recover water to provide a cost-effective and reliable water supply for landowners within the RRBWSD. RRBWSD purchased the properties in 2009-2015. This project has the potential to recharge up to 5,000 acre feet of water in wet years. This could provide the RRBWSD with up to 1000 acre-feet per year. Project construction was completed in 2016 at a total capital cost of approximately \$1M; annual O&M costs are estimated to be \$20,000. Total annualized cost is \$81,000, or \$61/acre-foot (plus water cost).



7.3.2 Stockdale East Groundwater Storage and Recovery Project

The Stockdale East Groundwater Storage and Recovery Project is a developed 200 acre project west of Bakersfield designed to recharge, store and recover water to provide a cost-effective and reliable water supply for landowners within the RRBWSD. RRBWSD purchased the property in 2010. This project has

the potential to recharge up to 25,000 acre feet of water in wet years. This could provide the RRBWSD with up to 4,000 acre-feet per year on average. Project status is 90% complete, it will be operational by 2020. Estimated total capital cost is \$12.2M and annual O&M costs of \$366,000. Total annualized cost is \$1.26M or \$330/acre-foot (plus water cost).



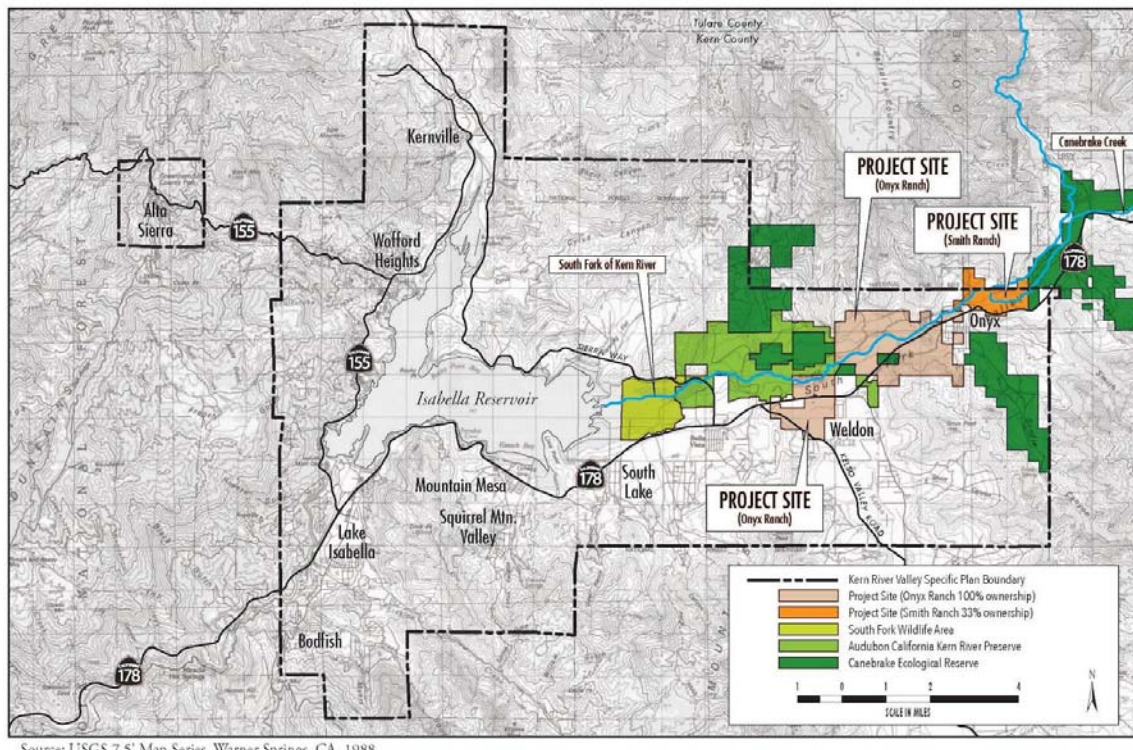
7.3.3 Pilot Projects

In 2017 the RRBWSD developed four pilot recharge projects under which it leased properties for temporary recharge activities. During that year approximately 10,000 acre-feet was recharged in these projects. Since that time the District has invested in a Groundwater Recharge Assessment Tool (Grat) in order to identify similar project sites in the future. These efforts could provide RRBWSD with up to 2,000 acre-feet per year. These projects could be on-line as early as 2025. Estimated total capital cost is \$2M; annual O&M costs are estimated to be \$100,000. Total annualized cost is \$223,000, or \$61/acre-foot (plus water cost).



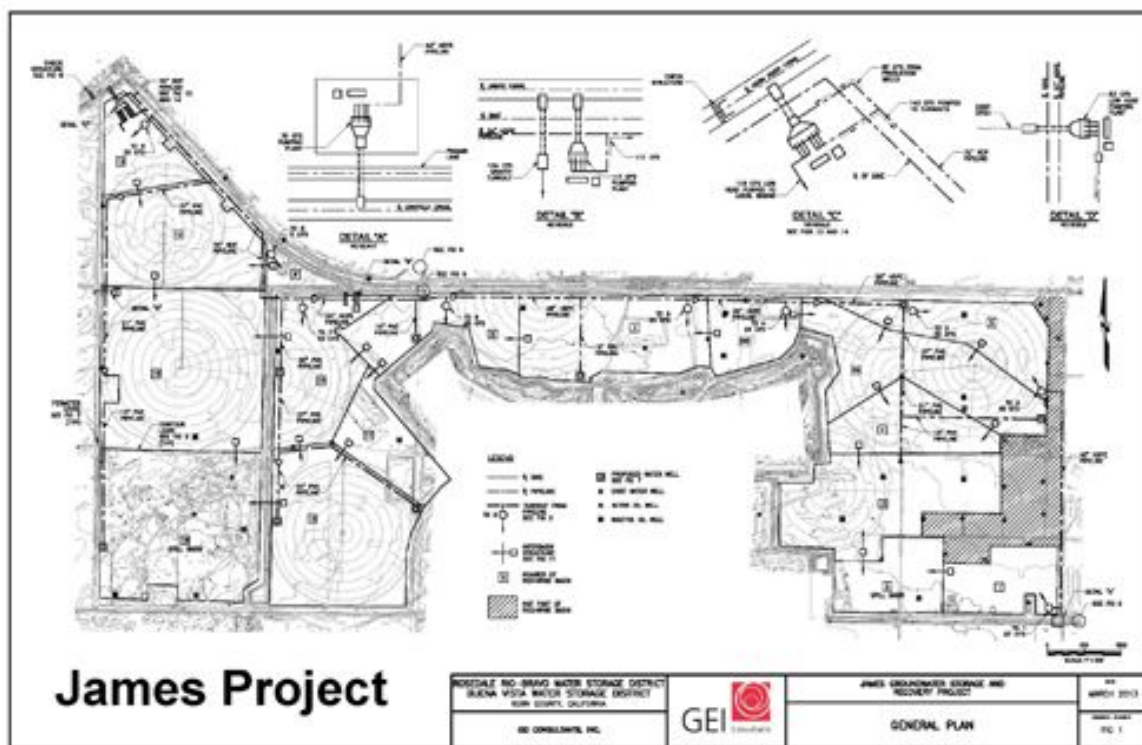
7.3.4 Onyx Ranch

The RRBWSD owns several parcels of land and the associated water rights for the Onyx Ranch and the Smith Ranch. These parcels are located along the South Fork of the Kern River in the Kern River Valley, in and around the communities of Weldon and Onyx, in an unincorporated area of northeastern Kern County. These parcels together comprise the 4,109.18-acre project site. The RRBWSD is currently conducting an analysis of a proposed change in the point of diversion and place of use of the water rights associated with these parcels so that the water can be delivered in the RRBWSD service area on the San Joaquin Valley floor and used for irrigation and groundwater recharge. The project would reduce the diversion of water on the project site and convert the irrigated fields to lower water use crops, or allow the fields to return to their native vegetative state. With the proposed project, RRBWSD would allow the water that would have been diverted on the project site to remain in the South Fork of the Kern River and flow downstream. This could result in a net increase in flows within the South Fork of the Kern River, and the Isabella Reservoir where the water would be released through the Isabella Dam and flow downstream in the lower Kern River until the water is diverted at the RRBWSD diversion point. From there, the RRBWSD would deliver the water to recharge basins and channels within and near its service area west of the City of Bakersfield (City) in unincorporated Kern County within the San Joaquin Valley. The net increase in water supplies to the RRBWSD's service area as a result of the proposed project would help mitigate the shortages in RRBWSD's contracted State Water Project (SWP) water supply from the State of California, which has steadily reduced due to environmental constraints in the Sacramento/San Joaquin Delta. The proposed project would provide the RRBWSD with approximately 6,500 acre-feet per year. The project is currently undergoing a feasibility and environmental analysis. The project could be on-line as early as 2025. Estimated total capital cost is \$30M; annual O&M costs are estimated to be \$450,000. Annualized cost is \$2.3M, or \$356/acre-foot.



7.3.5 James Groundwater Storage and Recovery Project

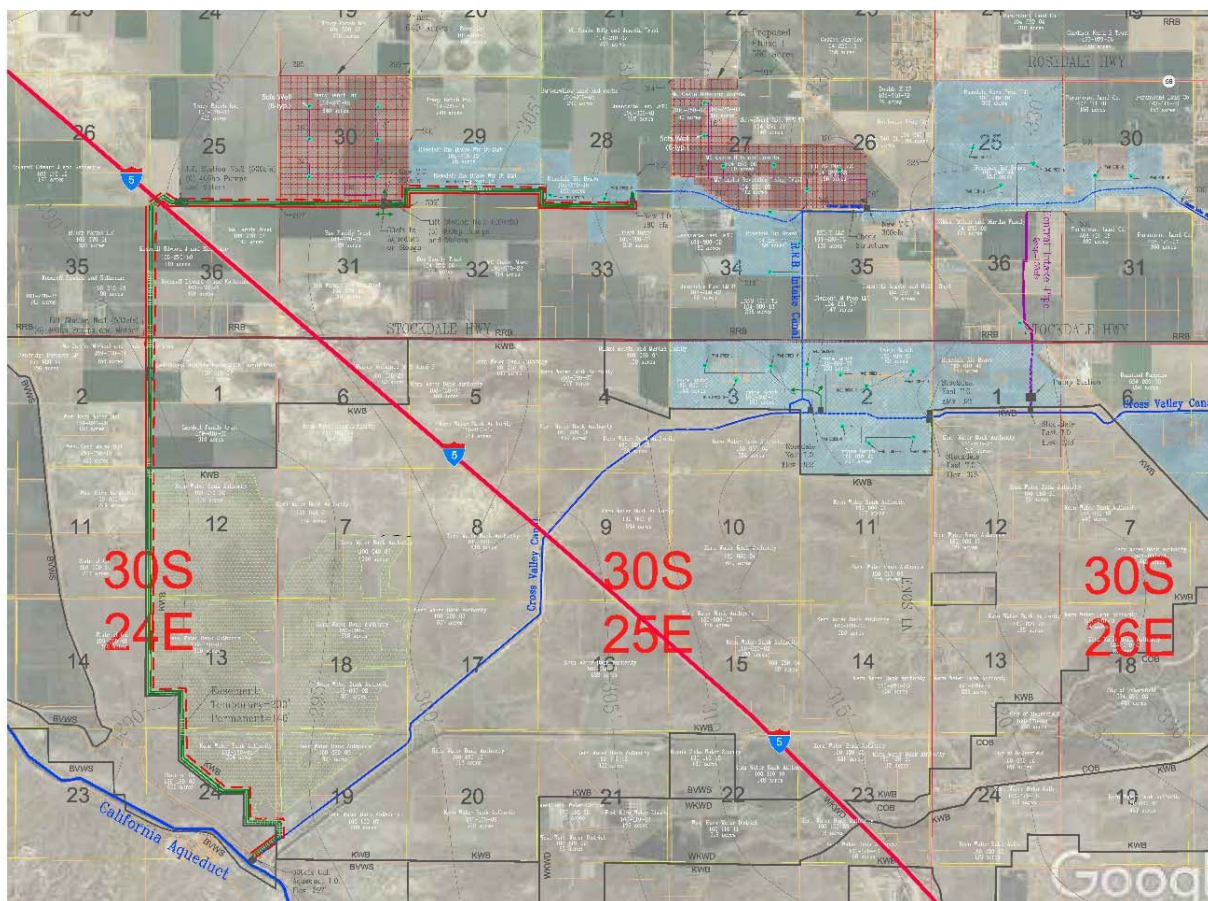
The James Groundwater Storage and Recovery Project is a proposed 2,070 acre project in southwest Bakersfield designed to recharge, store and recover water to provide a cost-effective and reliable water supply for landowners within the RRBWSD (and elsewhere). The project property, known locally as McAllister Ranch, was formerly a planned residential development that was in the early stages of construction. Due to the downturn in the real estate market and project financing issues, development was discontinued and the property sat idle for several years until it was sold in a bankruptcy proceeding. Rosedale and Buena Vista Water Storage District jointly purchase the property in 2011. This project has the potential to recharge up to 150,000 acre feet of water in wet years. This could provide the RRBWSD with up to 3,000 acre-feet per year. Current project status is feasibility and environmental analysis. This project could be on line as early as 2025. Estimated total capital cost is \$6.8M; annual O&M costs are estimated to be \$200,000. Annualized cost is \$700,000, or \$235/acre-foot (plus water costs).



7.3.6 Kern Fan Groundwater Storage Project.

The District has evaluated a conceptual Kern Fan Groundwater Storage Project (Kern Fan Project). This project would serve to develop a regional water bank in the Kern Fan to capture and store Article 21 water via the State Water Project (SWP) during conditions when surface water is abundant. A two-phased approach would be taken to the development of the Kern Fan Project. The first phase would be to develop a project site, including the purchase of approximately 640 acres of land in the Kern Fan area. The first phase would also include constructing conveyance facilities, recharge facilities, and recovery facilities as necessary to develop a fully functioning water banking project. The second phase of the Kern Fan project would involve acquiring an additional 640 acres of land for expansion of the water

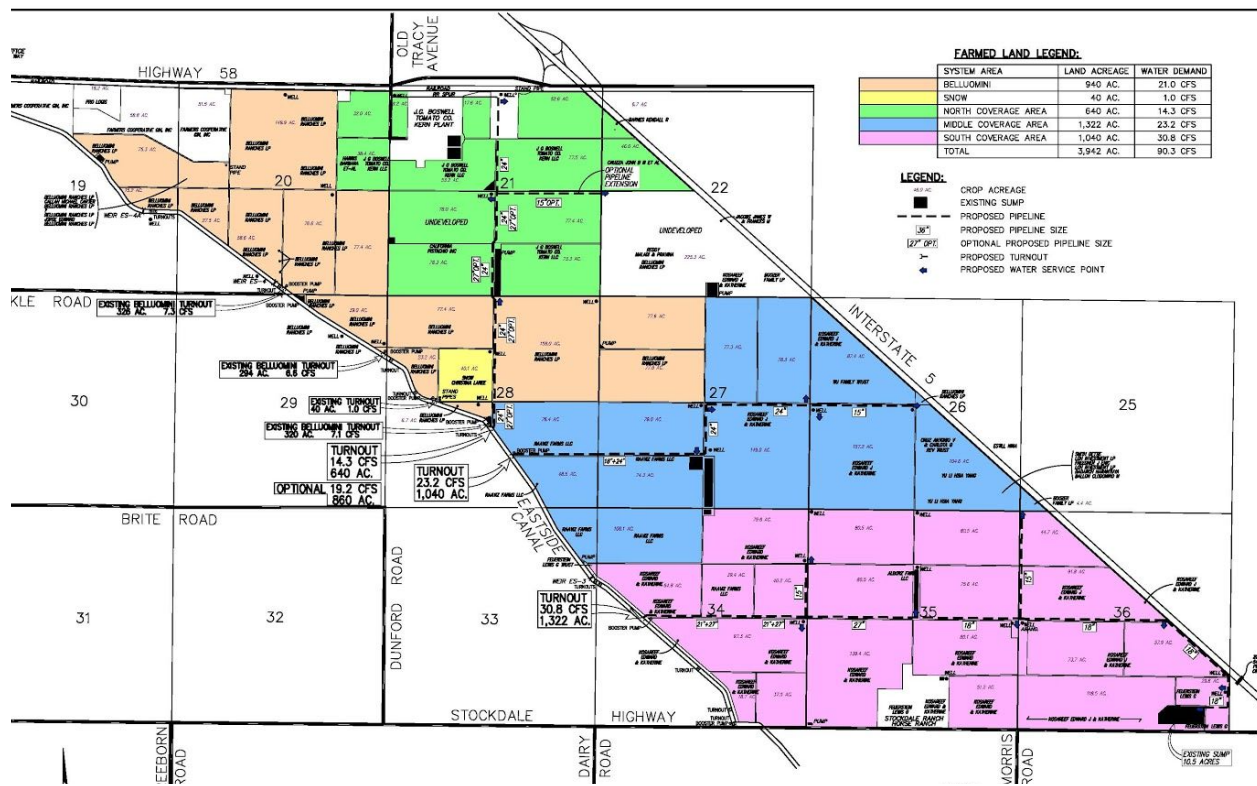
banking facilities and developing the associated recharge and recovery facilities. On July 24, 2018 the California Water Commission approved \$2.7B of Proposition 1 funding to eight water storage projects, including \$67.5M towards the District's sponsored Kern Fan Groundwater Storage Project. This could provide the RRBWSD with up to 10,000 acre-feet per year. Project status is feasibility analysis. This project could be on-line as early as 2030. Estimated total capital cost is \$45M; annual O&M costs are estimated to be \$1.35M. Annualized cost is \$4.7M or \$468/acre-foot (plus water costs).



7.3.7 Western Rosedale In-Lieu Service Area

The Western Rosedale Lands In-Lieu Service Area Project (the Project) includes construction and operation of up to ten miles of water conveyance pipelines, including appurtenant facilities (such as pumps and valves), and a joint service area agreement between RRBWSD and BVWSD in order to increase delivery of water to agricultural water users within the portion of RRBWSD's service area located westerly of Interstate 5 in close proximity to Buena Vista Water Storage District's East Side Canal.

This could provide the RRBWSD with up to 1,000 acre-feet per year. Project status is shovel ready; feasibility and environmental analysis is complete. This project could be on-line as early as 2035. Estimated total capital cost is \$5.1M; annual O&M costs are estimated to be \$152,000. Annualized cost is \$526,000, or \$467/acre-foot (plus water costs).



7.4 Management Actions

7.4.1 Water Charge Demand Reduction

The “Water Charge” (as described in section 1.3.1) would be expected to result in demand reduction in the RRBWSD. For market reasons it is probable that landowners will opt to fallow ground in order to trade water supplies to other District landowners, as well as fallow lands (or limit double cropping) to avoid the Water Charge all together. With an agricultural water consumptive-use demand of about 84,000 acre-feet per year we conservatively expect a 5% demand reduction as a result of the water charge which results in about 4,000 acre-feet/yr of reduced demand. This management action could be on-line as early as 2025. This management action also provides funding for projects described in section 7.3. The unit Water Charge is calculated as the estimated land cost per acre (\$25,000) divided by the avoided water use per acre (2.6 AF/ac) divided by the planning horizon in years (20 yrs). Using these assumptions, a maximum initial unit Water Charge could be as much as \$480 per acre-foot.

7.4.2 RRBWL (White Land) Water Supplies and Demand Imbalance Reduction

White Lands (non-RRBWSD lands) within the RRBMA will correct the water supply imbalance on a linear basis over the planning period of 2020-2040. Like RRBWSD lands, the white lands will start with the “native yield” of 0.3 acre-feet/acre as described in section 2.2.2. Demands for white lands in the RRBMA is about 14,000 acre-feet/year with an average “Farming Unit” demand of 2.6 acre-feet per acre (not done yet) according to METRIC studies. It is expected that white lands would seek to acquire water supplies for in-lieu and direct groundwater recharge via banking agreements RRBWSD to offset demands. Demand reduction will occur as follows over the 2020-2040 period, the imbalance will be reduced by 1/20 each year (5%) as shown on Table 9. To the extent the imbalance is not met during the current year it will be deducted from the subsequent. To the extent that white land landowners import water supplies their respective farming unit net demands are offset.

Native Yield + Precipitation + Imported Supply = Sustainable Yield - Demand = Imbalance

1,486 AF	+ 3,500 AF	+ 0 AF	= 6,166 AF	- 14,000 AF = 7,834 AF
0.3 AF/acre	+ .48 AF/acre	+ 0 AF/acre	= 0.78 AF/acre	- 2.6 AF/acre = 1.82 AF/acre

<u>Allowable Imbalance</u>		<u>Allowable Demand</u>
Allowed 2020 Imbalance = $1.82 \times 20/20 = 1.82$ AF/acre		2.6 AF/acre
Allowed 2021 Imbalance = $1.82 \times 19/20 = 1.73$ AF/acre		2.51 AF/acre
Allowed 2022 Imbalance = $1.82 \times 18/20 = 1.64$ AF/acre		2.42 AF/acre
Allowed 2023 Imbalance = $1.82 \times 17/20 = 1.55$ AF/acre		2.33 AF/acre
<u>Allowed 2024 Imbalance = $1.82 \times 16/20 = 1.46$ AF/acre</u>		<u>2.24 AF/acre</u>
Allowed 2020-2024 Imbalance = 8.2 AF/acre		12.1 AF/acre
Allowed 2040 Imbalance = $1.82 \times 0/20 = 0.0$ AF/acre		0.78 AF/acre

Table 9. Projected RRBWL Demand Reduction Milestones

This approach will result in about 391 AF of imbalance reduction each year and 3,917 AF/yr by 2030 and a total of 7,834 AF/yr by the 2040 sustainability planning period. This management action could be on-line as early as 2020.

7.5 Adaptive Management Actions

To the extent that projects and management actions described in sections 7.3 and 7.4 are unable to prevent undesirable effects that are caused by RRBMA activities, further actions will be evaluated and considered. For example, if either the projects or management actions are unable to produce the projected supplies, or other better options are found that prove more cost effective the RRBMA may deviate from the actions as described above. At each 5 year planning window each previously described project and action will be evaluated as well as new ones included. The RRBMA will enact projects and actions to accomplish a linear path to sustainability as described on Figure 27 in section 3.2.

RRBWL's Water Supplies and Demand Imbalance Reduction.

Because the "White Lands" are located outside of the political boundaries of the RRBWSD, assessment and water charges are not likely to be imposed unless voluntarily created by those landowners. Currently, there is a contractual relationship with the RRBWSD and the specific landowners that provides the landowners with a method to comply with SGMA. Compliance with demand reduction management action will initially be voluntary in nature. However, to the extent that a landowner refuses to comply, the RRBWSD may terminate the contractual relationship that provides the landowner with SGMA compliance and remove the landowner from the RRBMA. The RRBMA will be performing annual demand estimates as described in section 2.2.2, and will each year evaluate RRBWL compliance. The RRBWSD will in the future provide the RRBWL's with opportunities to participate in water supply programs that RRBWSD does not participate in; there will likely be opportunities for those lands and landowners to generate additional water supplies through these efforts.

7.6 Summary

2020 Projects.

It is estimated that approximately **5,000 AF/yr** of additional supply could be developed by 2020 by the West Basin Improvements and Stockdale East projects. Total capital cost are approximately \$13.2M and annual O&M costs are approximately \$386,000. Total annualized cost is \$1,341,000 or \$268/acre-foot (plus water cost).

2020 Management Actions.

It is estimated that the RRBWL demand reductions described above will result in approximately 391 AF/yr of demand reduction starting in 2020. This approach would result in an imbalance reduction of **3917 AF/yr** by 2030 and a total of **7,834 AF/yr** by the 2040 sustainability planning period.

2025 Projects.

It is estimated that approximately **11,500 AF/yr** could be on-line by 2025 through the implementation of Pilot Projects, James Groundwater Storage Project, and the Onyx Project. Total capital cost are approximately \$38.8M and annual O&M costs are approximately \$753,000. Total annualized cost is \$3,223,000 or \$280/AF (plus water cost for direct recharge projects).

2025 Management Actions.

It is estimated that the District demand reduction Water Charge could result in approximately **4,000 AF/yr** starting by 2025.

2030 Projects.

It is estimated that another potential **10,000 AF/yr** is in development and could be on-line by 2030 through the implementation of the Kern Fan Project. Total capital cost are approximately \$45M and annual O&M costs are approximately \$1,350,000. Total annualized cost is \$4,700,000 or \$468/AF (plus water cost).

2030 Management Actions.

No Additional Envisioned at this time.

2035 Projects.

It is estimated that another potential **1,000 AF/yr** is in project development and could be on-line by 2035 (Western Rosedale In-Lieu Service Area). Total capital cost is estimated to be approximately \$5,100,000; annual O&M costs are estimated to be \$152,000. Total annualized cost is \$526,000, or \$467/AF (plus water cost).

2035 Management Actions.

It is estimated that another potential **1,000 AF/yr** is in project development and could be on-line by 2035 (Western Rosedale In-Lieu Service Area). Total capital cost was approximately \$5,100,000 and annual O&M costs are approximately \$152,000. Total annualized cost is \$526,000 or \$467/AF (plus water cost).

2040 Projects.

No Additional Envisioned at this time.

2040 Management Actions.

No Additional Envisioned at this time.

See table 10. for 5 year milestones.

	<u>Projects</u>	<u>Management Actions</u>	<u>Total</u>
2020	5,000 AF/yr	0 AF/yr	5,000 AF/yr
2025	11,500 AF/yr	7,187 AF/yr	18,687 AF/yr
2030	10,000 AF/yr	3187 AF/yr	13,187 AF/yr
2035	1000 AF/yr	3188 AF/yr	4,188 AF/yr
<u>2040</u>	<u>0 AF/yr</u>	<u>3188 AF/yr</u>	<u>3,188 AF/yr</u>
Total	27,500 AF/yr	16,750 AF/yr	44,250 AF/yr

Table 10. Projected Project and Management Action Milestones

Appendix A-1 RRBWSD Banking MOU