DOCKETED	
Docket Number:	26-SPPE-01
Project Title:	RB Inyokern Data Center (RBIDC)
TN #:	269636
Document Title:	RB Inyokern Data Center - SPPE Application - Appendix E - Part 2a of 3
Description:	N/A
Filer:	Kyle Mohr
Organization:	R&L Capital Inc
Submitter Role:	Applicant Representative
Submission Date:	4/25/2026 8:09:43 AM
Docketed Date:	4/27/2026

RB INYOKERN DATA CENTER

Application for Small Power Plant Exemption (SPPE)

Inyokern, Kern County, California

Docket Number - 26-SPPE-01

Supporting Document Appendix E

Subsection(s):

- E.3 - Water Supply Assessment

WATER SUPPLY ASSESSMENT

R&L CAPITAL, INC.

RB INYOKERN DATA CENTER



JANUARY 2026

WATER SUPPLY ASSESSMENT

R&L CAPITAL, INC.
RB INYOKERN DATA CENTER

Prepared for:

R&L Capital, Inc.
PO Box 907
Trona, CA 93592
Contact Person: Robbie Baker, Director
Phone: (760) 264-5760

Consultant:

5080 California Avenue, Suite 220
Bakersfield, CA 93309
Contact: Jaymie Baurer, Principal Planner
Brian Shoener, PE
Phone: (661) 616-2600

January 2025

© Copyright by Quad Knopf, Inc.
Unauthorized use prohibited.
Project #160268.05

Table of Contents

SECTION 1 - Introduction *1-1*

1.1 - Regulatory Requirement 1-1
1.2 - Project Description and Location 1-1
1.3 - Project Water Requirements and Setting 1-5

SECTION 2 - Water Resources/Water Supply *2-1*

2.1 - Proposed Water Supply 2-1
2.2 - Hydrologic Region 2-2
2.2.1 - The South Lahontan Hydrologic Region 2-3
2.2.2 - The Indian Wells Valley Groundwater Subbasin 2-3
2.3 - The Indian Wells Valley Groundwater Authority 2-5
2.4 - Inyokern Community Services District 2-5
2.5 - The Planning Documents 2-5

SECTION 3 - Water Supply Sufficiency *3-1*

3.1 - Physical Availability 3-1
3.2 - The 2025 Indian Wells Valley Groundwater Authority Periodic Evaluation – Water Years Adequacy Projections 3-2

SECTION 4 - Conclusions *4-1*

SECTION 5 - References *5-1*

Appendices

Appendix A – Chapter 643, Statutes of 2001 (Senate Bill 610)
Appendix B – 2020 Groundwater Sustainability Plan – Indian Wells Valley Groundwater Authority and 2025 Periodic Evaluation – Indian Wells Valley Groundwater Authority
Appendix C –RB Inyokern Data Center WSA – Consistency with DWR Guidelines

List of Figures

Figure 1-1 Regional Location 1-2
Figure 1-2 Project Site 1-3
Figure 1-3 Detailed Project Site 1-4
Figure 1-4 Project Location: South Lahontan Hydrologic Region 1-8
Figure 2-1 South Lahontan Groundwater Basin Prioritization 2-4

SECTION 1 - INTRODUCTION

1.1 - Regulatory Requirement

Senate Bill 610 (Chapter 643, Statutes of 2001) amended State law, effective January 1, 2002, to improve the link between information on water supply availability and land use decisions made by cities and counties. The statute requires detailed information regarding water availability to be provided to city and county decision-makers before approval of specified large development projects subject to the California Environmental Quality Act(CEQA) approval. These include well-drilling projects designed to extract oil as an industrial use. The statute also requires this detailed information to be included in the administrative record that serves as the evidentiary basis for an entitlement action by the city or county on such projects. The statute-required Water Supply Assessment (WSA) must examine the availability and sufficiency of an identified water supply under normal year, single-dry year, and multiple-dry year conditions over a 20-year projection, accounting for the projected water demand of the project in addition to other existing and planned future uses of the identified water supply.

The State Department of Water Resources (DWR) "Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001" (Guidebook) and the sample format presented in the Guidebook were used as guides in preparing this WSA. Pertinent excerpts from the law stipulating WSA requirements precede this report's sections. The full text of Chapter 643, Statutes of 2001 (SB 610) is included in Appendix A.

1.2 - Project Description and Location

The project is located in the eastern high desert region of Kern County in the unincorporated community of Inyokern as shown in Figure 1-1. The proposed project is located between United States Route 395 (US 395) to the east and North Brown Road to the west. The data center is located north of Inyokern Road (State Route 178 [SR 178]) while the SCE substation and aboveground transmission lines are located south of Inyokern Road (State Route 178 [SR 178]). US 395 lies east of the project site.

The proposed data center facility be found within Section 29, Township 26 South, Range 39 East, Mount Diablo Base and Meridian (MDB&M). A gas station and hardware store with outdoor storage are located south of the project site. Directly north of the project is undeveloped land owned by the military and a solar facility north of that land. East of the project is undeveloped land.

Figure 1-2, Project Site, depicts the project boundaries. The project consists entirely of privately-owned parcels, under ownership of the project proponent. The site consists of four (4) total parcels that will be merged in order to have one parcel for the data center facility.



Figure 1-1
Regional Location



Figure 1-2
Project Site

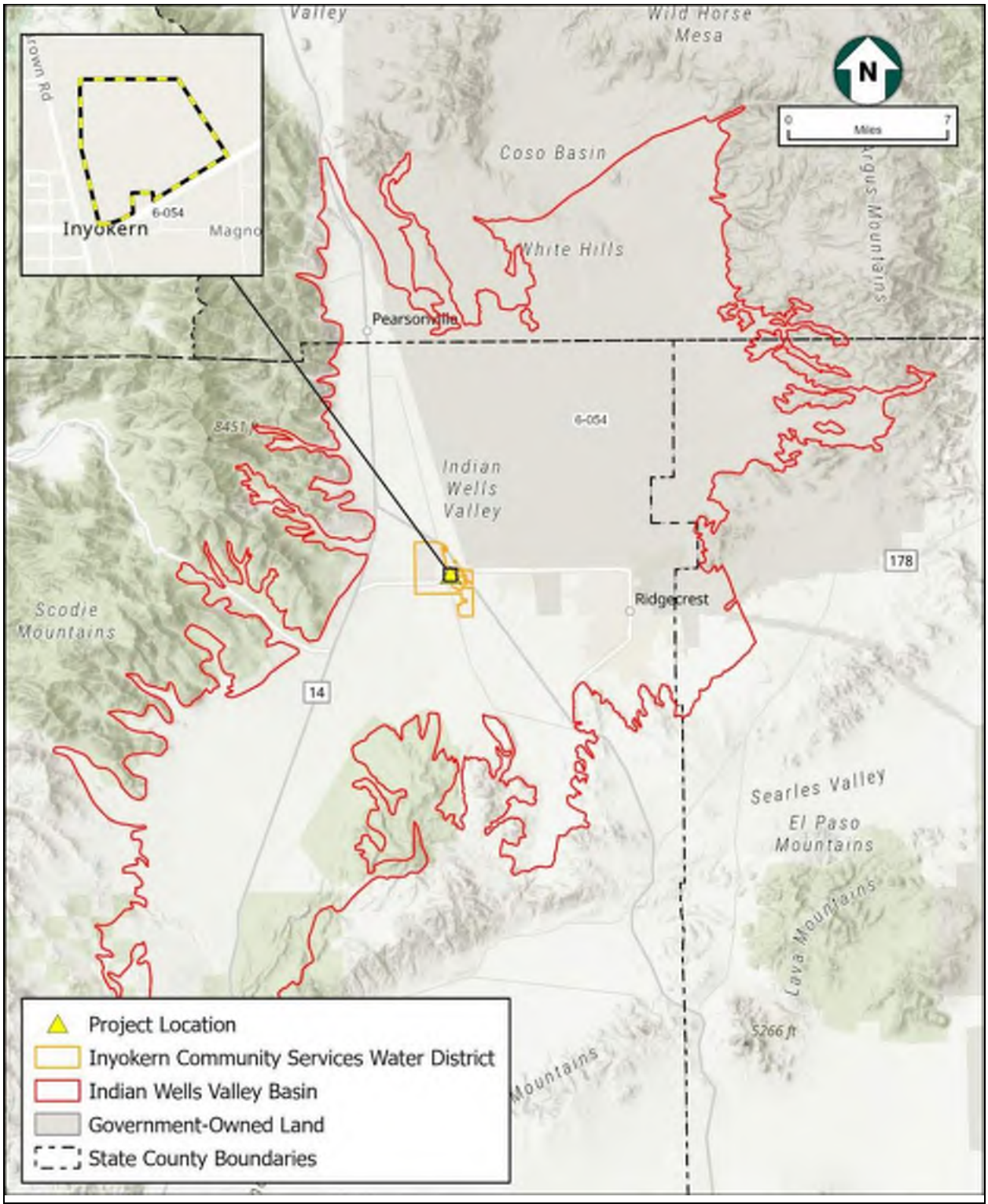


Figure 1-3
Detailed Project Site

The project proposes to develop an approximately 50-acre site with a 24/7 continuously operational 99 megawatts (MW) Teir III hyperscale data center and associated infrastructure, including a new substation that interconnects to Southern California Edison's Inyokern Substation to the east of the data center facility. The data center would be approximately 238,000 square feet, single-story, with a maximum 30 feet height and would contain six modular data suites. The site would have direct access to Digital 395 fiber. The data center would have approximately 10 employees per shift, with three shifts per day, for a total of 30 employees per day. The facility would receive approximately two to three deliveries per week. The project utilizes dual-sided electrical and mechanical systems for concurrent maintainability, high energy efficiency and redundancy.

The project site is currently located within the Sphere of Influence (SOI) of the Inyokern Community Services District (Inyokern CSD, District) boundaries and is requesting annexation into District boundaries in order to serve the project site with water and sewer services.

1.3 - Project Water Requirements and Setting

Construction of the proposed data center project is anticipated to begin in 2027 and would require approximately 48 months to complete, based on the integrated construction schedule for site development, structural work, major mechanical and electrical installation, data hall buildout, and commissioning activities. Construction activities for the proposed project are generally organized into the following major categories:

1. Site preparation and infrastructure development,

2. Structural and building shell construction, and

3. Mechanical, electrical, and data hall systems installation, followed by commissioning and closeout.

Based on the construction schedule and equipment/workers analysis, the onsite construction workforce would peak at approximately 600 workers during periods of overlapping structural, mechanical, electrical, and interior buildout activities. The average daily workforce across the full 48-month construction period is expected to be approximately 150–200 personnel, consisting of trade workers, supervisory staff, subcontractor crews, inspection personnel, and construction management teams. Labor demand will vary over the course of the project, with the highest workforce levels occurring between structural steel erection, envelope completion, and MEP (mechanical, electrical, and plumbing) rough-in.

Construction water will be primarily used for dust suppression, soil compaction, utility trench backfill, paving support, equipment washdown, and general housekeeping activities. The overall construction water usage for dust control and site preparation is anticipated during construction is approximately 39.28 acre-feet (AF) (approximately 11 million gallons) during the 8-month earthwork construction period. Water use will be highest

during initial earthwork and will decrease as construction progresses into structural and interior phases. The Project will use best-available water conservation practices and will utilize non-potable or reclaimed water whenever feasible.

Estimated Water Demand

Construction water needs were estimated based on the construction schedule, equipment usage and personnel quantities.

- Peak daily water use (during earthwork): up to 25,000 gallons/day
- Average daily water use (project-wide): 7,000–8,000 gallons/day
- Total construction water use: approximately 9–11 million gallons

These values reflect efficient water management, limit over-watering, and the use of soil binders to reduce water demand when appropriate. The project will implement water management and conservation efforts, such as, but not limited to:

- Operate water trucks only as needed for dust control and compaction
- Use reclaimed or non-potable water when available
- Apply water only to active work areas, avoiding overspray and runoff
- Use dust-control methods that reduce watering needs
- Maintain daily water-use logs to ensure compliance

Water Use by Phase

Table 1-1 outlines the water usage per phase of construction.

Table 1-1
Estimated Water Usage by Phase

Phase	Duration	Estimated Water Usage
Earthwork	8 months	3–3.5 million gallons
Structural / Yard / Utilities / Paving	15–18 months	3–3.5 million gallons
MEP / Electrical / Interior / Commissioning	22+ months	2.5–4 million gallons

Combined, these values align with the overall estimated total of 9–11 million gallons.

Water demand during construction is expected to be the same if the project is constructed during a year with normal precipitation, a year with less-than-average precipitation, or a multi-year period of less than-average precipitation. Water needed for construction is expected to be provided from an on-site water well or supplied through Inyokern Community Service District. The Inyokern Community Services District has provided multiple will-serve letters indicating their ability to provide sufficient water during the construction of the project.

During operation and maintenance of the proposed project, it is anticipated that water would be required primarily for direct liquid cooling of IT racks and air cooling of the data halls. A smaller portion would be required for domestic office and irrigation purposes. The Project will be served by a domestic water supply, with on-site storage tanks and a site well maintained as redundant measures to meet Tier III reliability requirements. Estimated annual water demands range from 30.68 to 33.75 acre-feet per year (AFY) (approximately 10–11 million gallons per year (MGY) for cooling and 3.06 to 6.13 acre-feet per year (approximately 1–2 MGY) for domestic use. Closed-loop mechanical make up, pre-action sprinkler testing/refill and humidification will add an additional water demand of 3.06 to 9.20 acre-feet per year (approximately 1-3 MGY). Irrigation will meet at least a 20% reduction below MAWA (Maximum Allowed Water Allowance). The total estimated annual water usage for the entire site is estimated to be between 36.83 to 49.10 acre-feet per year (12-16 MGY). Water infrastructure will comply with California DWR Well Standards (Bulletin 74) and Kern County Code Title 14.

Water required for proposed project operation would be provided from the Inyokern CSD and an on-site water well for emergency fire suppression and redundancy in the event of a service loss. The CSD has provided multiple will-serve letters indicating their ability to provide sufficient water during the construction of the project and a new will serve letter will be obtained prior to construction.

The source of the water for any from the Inyokern CSD or an on-site well. The CSD obtains their water from only groundwater sources.

Figure 1-4 illustrates the location of the Project site within the South Lahontan Hydrologic Region, Indian Wells Valley (IWV) Groundwater Basin, and the borders of these water resource areas. Construction and operational water for the Project will be from sources pumping groundwater from this Basin. Currenty, the Indian Wells Groundwater Basin does not have any adjudicated areas. However, The Indian Wells Valley Water District ("District") has filed a water rights lawsuit to resolve the long-standing conditions in the IWV Groundwater Basin where water use has exceeded groundwater supply for years. This water rights lawsuit is called a "comprehensive adjudication". The District has sued all persons who own property overlying the Basin or claim a right to pump or store water in the Basin so that all persons with an interest in the Basin can be involved to assert any rights. The adjudication process is not expected to be resolved until after 2026.

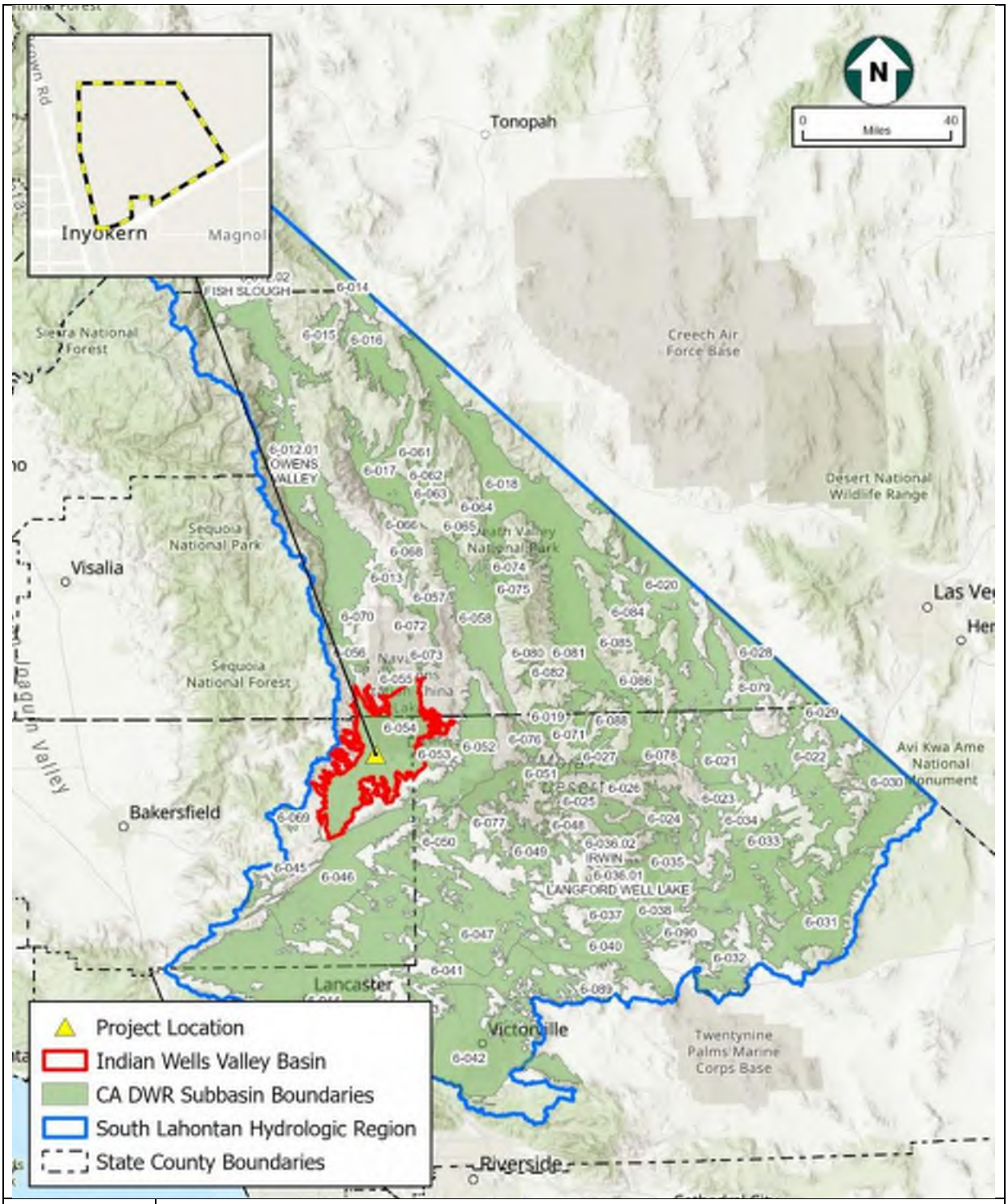


Figure 1-4
Project Location: South Lahontan Hydrologic Region

SECTION 2 - WATER RESOURCES/WATER SUPPLY

2.1 - Proposed Water Supply

The Project will not be served by a public water system and therefore is preparing this WSA as required by Water Code Section 10910(b). The purpose of the WSA is to determine whether "the total projected water supplies, determined to be available by Kern County for the Project during normal, single-dry, and multiple-dry water years during a 20-year projection, will meet the projected water demand associated with the proposed Project, in addition to existing and planned future uses, including agricultural and manufacturing uses." Water Code Section 10910(c)(4).

In making the sufficiency determination, the County shall include an assessment of the following.

Water Code Section 10910

(d)(1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.

(2) An identification of existing water supply entitlements, water rights, or water service contracts held by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall be demonstrated by providing information related to all of the following:

(A) Written contracts or other proof of entitlement to an identified water supply.

(B) Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system.

(C) Federal, State, and local permits for construction of necessary infrastructure associated with delivering the water supply.

(D) Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.

Existing land use outside of the Project Area includes a gas station and hardware store with outdoor storage south of the project site. Directly north of the project is undeveloped land owned by the military and a solar facility north of that land. East of the project is undeveloped land.

The project proposes to develop an approximately 50-acre site with a 24/7 continuously operational 99 megawatts (MW) Teir III hyperscale data center and associated infrastructure, including a new substation that interconnects to Southern California Edison's Inyokern Substation to the east of the data center facility. The data center would be approximately 238,000 square feet. As described in Section 1, the Project's potable water supply is proposed to be supplied to the Project site from the Inyokern CSD water system.

2.2 - Hydrologic Region

The WSA evaluates the physical availability of an adequate groundwater supply, in all "water years" for a 20-year period.

This Assessment describes the relevant Hydrologic Region and Basin, describes the principal groundwater agency serving and regulating Basin water planning and surface water importation, and lists water sufficiency and planning documents regarding the Basin. Section 3 includes the latest (January 2020) Indian Wells Valley Groundwater Authority (IWVGA) projection of water availability (ground) for the Basin for a 20-year period under the normal, single-dry, and multiple-dry year scenarios, as required by SB 610.

Water Code Section 10910

(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water assessment:

(1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.

(2)(A) A description of any groundwater basin or basins from which the proposed project will be supplied.

(B) For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree.

(C) For a basin that has not been adjudicated, that is a basin designated as high- or medium-priority pursuant to Section 10722.4, information regarding the following:

(i) Whether the department has identified the basin as being subject to critical conditions of overdraft pursuant to Section 12924.

(ii) If a groundwater sustainability agency has adopted a groundwater sustainability plan or has an approved alternative, a copy of that alternative or plan.

(D) For a basin that has not been adjudicated that is a basin designated as low- or very low priority pursuant to Section 10722.4, information as to whether the

department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long-term overdraft condition.

2.2.1 - THE SOUTH LAHONTAN HYDROLOGIC REGION

The California DWR has divided the State into 10 Hydrologic Regions. The Project site is located within the South Lahontan Hydrologic Region in a Basin ranked as "high priority" in a statewide ranking of groundwater importance. Additionally, the Basin is listed as being in "critical overdraft." The Region encompasses approximately 26,700 square miles (see Figure 1-4).

2.2.2 - THE INDIAN WELLS VALLEY GROUNDWATER SUBBASIN

The Project site is located above the South Lahontan Hydrologic Region, for which the IWVGSA is the principal groundwater management agency. Groundwater in the Basin will be used to supply water for the Project. The Indian Wells Valley Subbasin is the specific groundwater subbasin in which the Project resides and has a surface area of approximately 382,000 acres (see Figure 2-1 – Basin 6-54). The internally drained basin is located east of the southern Sierra Nevada and is bounded by the Coso Range to the north, Argus Range to the east, and El Paso Mountains to the south. The basin is filled with sediment eroded from the surrounding highlands to an average depth of 4,000 feet, although the sediment can be as thick as 7,000 feet in the western portion of the valley. As of 2010, the DWR estimated the total water supply for the subbasin is 30,000 acre-feet.

The Indian Wells Valley Groundwater Subbasin is not currently an adjudicated groundwater basin.

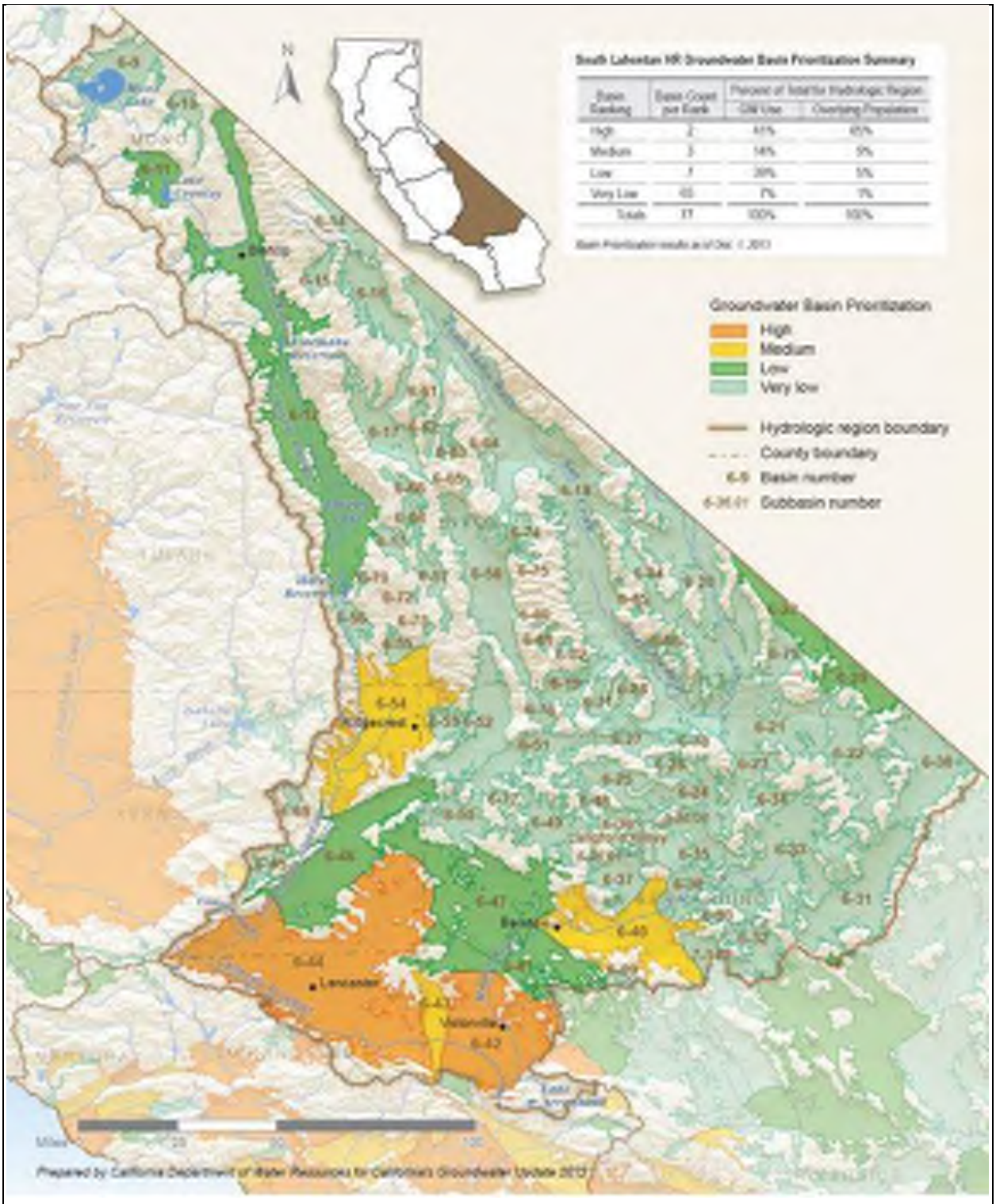


Figure 2-1
South Lahontan Groundwater Basin Prioritization

2.3 - The Indian Wells Valley Groundwater Authority

The proposed source to provide water for the Project is located within the IWVGA. As such, the IWVGA has detailed information regarding groundwater conditions in the vicinity of the proposed Project site.

The IWV GSA covers approximately 382,000 acres of the Subbasin. The Subbasin has an overdraft of 24,990 acre-feet per year over the baseline conditions,.

The IWV GSP has noted there are no reliable sources of supplemental water available to help achieve sustainability. The reliability of the Projects water source (Inyokern CSD within the IWVGA) is described in Section 3.2. The CSDs water source, the IWVGB is expected to provide adequate, reliable water supply for the CSD's service area for the foreseeable future. Although the IWVGB is in a condition of overdraft, implementation of the projects and management measures included in the GSP are anticipated to reduce the condition of overdraft and achieve basin sustainability. The anticipated implementation timeline for the projects and management actions ranges from 2020 to 2035.

2.4 - Inyokern Community Services District

The Inyokern CSD, established in 1983, provides water, wastewater, and street lighting services to the community of Inyokern, located approximately 7 miles west of Ridgecrest. The Inyokern CSD operates service facilities including approximately 277 water service connections, one active groundwater production well, one 425,000 gallon storage tank, distribution pipelines, and a wastewater treatment plant. The Inyokern CSD serves a primarily residential population of approximately 1,000.

Due to the number of connections and the volume of water delivered, the Inyokern CSD is not required to issue an Urban Water Management Plan (UWMP).

2.5 - The Planning Documents

The following documents were essential to the development of this report:

- The Indian Wells Valley Groundwater Authority Sustainability Plan – January 2020
- The Indian Wells Valley Groundwater Authority 2025 Periodic Evaluation – March 2025
- Department of Water Resources Bulletin 118

SECTION 3 - WATER SUPPLY SUFFICIENCY

Water Code Section 10910, Section 4.5

…(c)(3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

The sufficiency of the Project water supply is analyzed on three bases: the physical availability of the Project Area aquifer, and wells drilled therein, to provide groundwater in the amounts required for Project construction and operation; the estimates (in the 2020 GSP and 2025 Periodic Evaluation) of normal water years, single-dry water years, and multiple-dry water years, water supply and demand-related water availability; the availability of groundwater for the Project in compliance with SB610.

3.1 - Physical Availability

The available information regarding the physical availability of groundwater at and near the Project site (Section 2.1) verifies that the groundwater aquifer is sufficient for both Project construction and Project operation. Based on the 2020 IWVGA GSP future water budget, approximately 26,511 acre-feet per year are expected to be extracted in 2040.

Construction water needs were estimated based on the construction schedule, equipment usage and personnel quantities is approximately 9–11 million gallons over an approximate two year period (5.5 MGY or 16.9 AFY).

During operation and maintenance of the proposed project, it is anticipated that water would be required primarily for direct liquid cooling of IT racks and air cooling of the data halls. A smaller portion would be required for domestic office and irrigation purposes. The Project will be served by a domestic water supply, with on-site storage tanks and a site well maintained as redundant measures to meet Tier III reliability requirements. Estimated annual water demands range from 30.68 to 33.75 acre-feet per year (AFY) (approximately 10–11 million gallons per year (MGY) for cooling and 3.06 to 6.13 acre-feet per year (approximately 1–2 MGY) for domestic use. Closed-loop mechanical make up, pre-action sprinkler testing/refill and humidification will add an additional water demand of 3.06 to 9.20 acre-feet per year (approximately 1-3 MGY). Irrigation will meet at least a 20% reduction below MAWA (Maximum Allowed Water Allowance). The total estimated annual water usage for the entire site is estimated to be between 36.83 to 49.10 acre-feet per year (12-16 MGY).

The maximum water demand for this Project is estimated at 49.10 acre-feet (16 MG)/year or 0.185% of the projected available yearly supply of 26,511 acre-feet. The Project will have very little impact on groundwater use in the area.

3.2 - The 2025 Indian Wells Valley Groundwater Authority Periodic Evaluation – Water Years Adequacy Projections

The following is an excerpt from the IWVGA 2025 Periodic Evaluation that illustrates the description of groundwater resources available to the IWV basin, including the Inyokern CSD. The following tables and text extracts (Section 4 from the Periodic Evaluation) explain the water availability during drought periods.

Baseline

The 2025 Model baseline scenario was run to evaluate Basin conditions under a "no action" conditions in which current pumping under current GSP implementation progress continues and that no further GSP Projects and Management Actions will be implemented. The water budget for this Baseline scenario is shown in Table 4-2, which illustrates that even if there is no further GSP implementation in the Basin, the loss of groundwater in storage will have decreased from the loss of groundwater in storage in the 2020 GSP for current conditions (Table 3-7 of the 2020 GSP).

Table 4-2. Simulated Baseline Water Budget

Water Budget Element	WY 2030 Estimated Volume (AFY)	WY 2040 Estimated Volume (AFY)	WY 2070 Estimated Volume (AFY)
Inflows			
Mountain Front Recharge[1]	7,650	7,672	7,650
Interbasin Subsurface Flow	1	4	28
Total Inflow	**7,651**	**7,676**	**7,678**
Outflows			
ET + Evap	3,731	3,232	1,925
Interbasin Subsurface Flow	5	1	0
Groundwater Extractions	22,466	23,277	26,206
Total Outflow	**26,201**	**26,511**	**28,131**
Change of Groundwater in Storage	**-18,550**	**-18,835**	**-20,453**

[1] *Projected annual Mountain Front Recharge varies to capture the seasonal variability and trends. Model scenarios are based on a 51-year average recharge of 7,650 AFY.*

The IWVGA has further developed and evaluated some of the Projects and Management Actions presented in the 2020 GSP, resulting in some modifications, as described in Section 3. A new Implementation Scenario to reflect the progress made in implementing other modifications to the Projects and Management Actions was developed. Importantly, direct

use of imported water is expected, and modeled, to initiate in 2030, thereby reducing groundwater production to the sustainable yield of 7,650 AFY. As suggested by DWR staff in RCA #3, the GSP will be amended to clarify the water budget elements and reflect that there is no planned artificial recharge of imported water to create a "Future Sustainable Yield" greater than 7,650 AFY. The water budget for this Implementation Scenario is shown in Table 4-3. The results on the Implementation Scenario model run were evaluated and confirm that the currently planned Projects and Management Actions will lead to sustainable management of the Basin.

Table 4-3. Simulated 2025 Implementation Water Budget

Water Budget Element	WY 2030 Estimated Volume (AFY)	WY 2040 Estimated Volume (AFY)	WY 2070 Estimated Volume (AFY)
Inflows			
Mountain Front Recharge[1]	7,650	7,672	7,650
Interbasin Subsurface Flow	1	4	15
Total Inflow	**7,651**	**7,676**	**7,665**
Outflows			
ET + Evap	3,731	3,274	2,503
Interbasin Subsurface Flow	5	1	0
Groundwater Extractions	7,650	7,650	7,650
Total Outflow	**11,386**	**10,925**	**10,153**
Change of Groundwater in Storage	**-3,735**	**-3,250**	**-2,488**

[1] *Projected annual Mountain Front Recharge varies to capture the seasonal variability and trends. Model scenarios are based on a 51-year average recharge of 7,650 AFY.*

Groundwater production in the IWVGB has decreased since adoption of the 2020 GSP. The water use sectors that saw the largest decrease in annual pumping were urban and agriculture water users, as shown in Table 4-9. Though the general trend for groundwater pumping in the IWVGB has decreased, domestic and rural water production saw an increase in pumping since WY 2019; however, this water sector has the most uncertainty, due to limited reported data. The IWVWD, which is included in the urban water sector, has implemented water conservation measures that have allowed the IWVWD to reduce their pumping significantly, despite population growth. The IWVGA has been actively engaged in efforts to determine annual groundwater production in the Basin and improve the accuracy of production estimates including requiring the installation of flow meters on all non-de minimis and non-federal wells in the Basin and conducting a pumping verification review process. Consequently, the accuracy of reported groundwater production in the Basin has improved each year.

Future groundwater production is expected to decrease even further as a result of agriculture groundwater users exhausting their allotments of the Transient Pool and

agricultural activity in the Basin generally decreasing due to the requirement to pay the Replenishment Fee on groundwater production to provide for the purchase of imported water to allow the Basin to reach sustainability.

Table 4-9. Estimated Annual Water Year Pumping

Water Use Sector	WY 2019	WY 2020	WY 2021	WY 2022	WY 2023
Urban	6,360	6,510	6,530	6,060	5,620
Industrial	2,690	2,820	2,180	2,370	2,570
Agriculture	10,920	9,850	8,900	9,570	8,110
Federal	1,460	1,410	1,770	1,710	1,380
Domestic and Rural	1,380	1,410	1,420	1,450	1,470
Total (AF)	**22,810**	**22,000**	**20,800**	**21,160**	**19,150**

The water to be used for the Project has been included in the above demand volumes in the GSA.

SECTION 4 - CONCLUSIONS

This WSA has provided the data and analysis needed to verify that a sufficient Project water supply is physically available (Section 3.1) and that the Project water supply is in accord with SB 610's normal year/dry-year/multiple-dry year requirements, sufficient (Section 3.2).

The maximum water demand for this Project is estimated at 49.10 acre-feet/year or 0.185% of the projected available yearly supply of 26,511 acre-feet. The Project will have very little impact on groundwater use in the area.

This conclusion is based on the fact that maximum water demand for this Project is estimated at 49.10 acre-feet (16 MG)/year or 0.185% of the projected available yearly supply of 26,511 acre-feet. The Project will have very little impact on groundwater use in the area. Compliance with the DWR Guidelines for the Project is included in Appendix C.

It is recommended that the County of Kern conclude that the proposed water supplies for the Project are sufficient to meet the projected Project water demand.

SECTION 5 - REFERENCES

CalEPA (California Environmental Protection Agency), 2015. The Water Rights Process: Groundwater Rights. (online): http://www.swrcb.ca.gov/waterrights/board_info/water_rights_process.shtml#rights. Accessed December 2, 2015

2003. Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001. (online): http://www.water.ca.gov/pubs/use/sb_610_sb_221_guidebook/guidebook.pdf. Accessed June 23, 2023

California Department of Water Resources (DWR). 2015. California's Groundwater Bulletin 118.135 p.

Indian Wells Valley Groundwater Authority Sustainability Plan (GSP) – January 2020

Indian Wells Valley Groundwater Authority 2025 Periodic Evaluation – March 2025

APPENDIX A

CHAPTER 643, STATUTES OF 2001 (SENATE BILL 610)

Senate Bill No. 610
CHAPTER 643

An act to amend Section 21151.9 of the Public Resources Code, and to amend Sections 10631, 10656, 10910, 10911, 10912, and 10915 of, to repeal Section 10913 of, and to add and repeal Section 10657 of, the Water Code, relating to water.

[Filed with Secretary of State October 09, 2001. Approved by Governor October 09, 2001.]

LEGISLATIVE COUNSEL'S DIGEST

SB 610, Costa. Water supply planning.

(1) Existing law requires every urban water supplier to identify, as part of its urban water management plan, the existing and planned sources of water available to the supplier over a prescribed 5-year period. Existing law prohibits an urban water supplier that fails to prepare or submit its urban water management plan to the Department of Water Resources from receiving drought assistance from the state until the plan is submitted.

This bill would require additional information to be included as part of an urban water management plan if groundwater is identified as a source of water available to the supplier. The bill would require an urban water supplier to include in the plan a description of all water supply projects and programs that may be undertaken to meet total projected water use. The bill would prohibit an urban water supplier that fails to prepare or submit the plan to the department from receiving funding made available from specified bond acts until the plan is submitted. The bill, until January 1, 2006, would require the department to take into consideration whether the urban water supplier has submitted an updated plan, as specified, in determining eligibility for funds made available pursuant to any program administered by the department.

(2) Existing law, under certain circumstances, requires a city or county that determines an environmental impact report is required in connection with a project, as defined, to request each public water system that may supply water for the project to assess, among other things, whether its total projected water supplies will meet the projected water demand associated with the proposed project. Existing law requires the public water system to submit the assessment to the city or county not later than 30 days from the date on which the request was received and, in the absence of the submittal of an assessment, provides that it shall be assumed that the public water system has no information to submit. Existing law makes legislative findings and declarations concerning "Proposition C," a measure approved by the voters of San Diego County relating to regional growth management, and provides that the procedures established by a specified review board established in connection with that measure are deemed to comply with the requirements described above relating to water supply planning by a city or county.

This bill would revise those provisions. The bill, instead, would require a city or county that determines a project is subject to the California Environmental Quality Act to identify any public water system that may supply water for the project and to request those public water systems to

prepare a specified water supply assessment, except as otherwise specified. The bill would require the assessment to include, among other information, an identification of existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project and water received in prior years pursuant to those entitlements, rights, and contracts. The bill would require the city or county, if it is not able to identify any public water system that may supply water for the project, to prepare the water supply assessment after a prescribed consultation. The bill would revise the definition of "project," for the purposes of these provisions, and make related changes.

The bill would prescribe a timeframe within which a public water system is required to submit the assessment to the city or county and would authorize the city or county to seek a writ of mandamus to compel the public water system to comply with requirements relating to the submission of the assessment.

The bill would require the public water system, or the city or county, as applicable, if that entity concludes that water supplies are, or will be, insufficient, to submit the plans for acquiring additional water supplies.

The bill would require the city or county to include the water supply assessment and certain other information in any environmental document prepared for the project pursuant to the act. By establishing duties for counties and cities, the bill would impose a state-mandated local program.

The bill would provide that the County of San Diego is deemed to comply with these water supply planning requirements if the Office of Planning and Research determines that certain requirements have been met in connection with the implementation of "Proposition C."

(3) The bill would incorporate additional changes in Section 10631 of the Water Code proposed by AB 901, to be operative only if this bill and AB 901 are enacted and become effective on or before January 1, 2002, each bill amends Section 10631 of the Water Code, and this bill is enacted last.
(4) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

DIGEST KEY

BILL TEXT

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1.

(a) The Legislature finds and declares all of the following:

(1) The length and severity of droughts in California cannot be predicted with any accuracy.

(2) There are various factors that affect the ability to ensure that adequate water supplies are available to meet all of California's water demands, now and in the future.

(3) Because of these factors, it is not possible to guarantee a permanent water supply for all water users in California in the amounts requested.

(4) Therefore, it is critical that California's water agencies carefully assess the reliability of their water supply and delivery systems.

(5) Furthermore, California's overall water delivery system has become less reliable over the last 20 years because demand for water has continued to grow while new supplies have not been developed in amounts sufficient to meet the increased demand.

(6) There are a variety of measures for developing new water supplies including water reclamation, water conservation, conjunctive use, water transfers, seawater desalination, and surface water and groundwater storage.

(7) With increasing frequency, California's water agencies are required to impose water rationing on their residential and business customers during this state's frequent and severe periods of drought.

(8) The identification and development of water supplies needed during multiple-year droughts is vital to California's business climate, as well as to the health of the agricultural industry, environment, rural communities, and residents who continue to face the possibility of severe water cutbacks during water shortage periods.

(9) A recent study indicates that the water supply and land use planning linkage, established by Part 2.10 (commencing with Section 10910) of Division 6 of the Water Code, has not been implemented in a manner that ensures the appropriate level of communication between water agencies and planning agencies, and this act is intended to remedy that deficiency in communication.

(b) It is the intent of the Legislature to strengthen the process pursuant to which local agencies determine the adequacy of existing and planned future water supplies to meet existing and planned future demands on those water supplies.

SEC. 2.

Section 21151.9 of the Public Resources Code is amended to read:

21151.9.

Whenever a city or county determines that a project, as defined in Section 10912 of the Water Code, is subject to this division, it shall comply with Part 2.10 (commencing with Section 10910) of Division 6 of the Water Code.

SEC. 3.

Section 10631 of the Water Code is amended to read:

10631.

A plan shall be adopted in accordance with this chapter and shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments as described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.

(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the amount and location of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the location, amount, and sufficiency of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(1) An average water year.

(2) A single dry water year.

(3) Multiple dry water years.

For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to replace that source with alternative sources or water demand management measures, to the extent practicable.

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:

(A) Single-family residential.

(B) Multifamily.

(C) Commercial.

(D) Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(2) The water use projections shall be in the same five-year increments as described in subdivision (a).

(f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

(A) Water survey programs for single-family residential and multifamily residential customers.

(B) Residential plumbing retrofit.

(C) System water audits, leak detection, and repair.

(D) Metering with commodity rates for all new connections and retrofit of existing connections.

(E) Large landscape conservation programs and incentives.

(F) High-efficiency washing machine rebate programs.

(G) Public information programs.

(H) School education programs.

(I) Conservation programs for commercial, industrial, and institutional accounts.

(J) Wholesale agency programs.

(K) Conservation pricing.

(L) Water conservation coordinator.

(M) Water waste prohibition.

(N) Residential ultra-low-flush toilet replacement programs.

(2) A schedule of implementation for all water demand management measures proposed or described in the plan.

(3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.

(4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of such savings on the supplier's ability to further reduce demand.

(g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:

(1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors.

(2) Include a cost-benefit analysis, identifying total benefits and total costs.

(3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.

(4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.

(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single dry, and multiple dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(i) Urban water suppliers that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g).

SEC. 3.5.

Section 10631 of the Water Code is amended to read:

10631.

A plan shall be adopted in accordance with this chapter and shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments as described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.

(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that

characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(1) An average water year.

(2) A single dry water year.

(3) Multiple dry water years.

For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:

(A) Single-family residential.

(B) Multifamily.

(C) Commercial.

(D) Industrial.

(E) Institutional and governmental.

(F) Landscape.

(G) Sales to other agencies.

(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.

(I) Agricultural.

(2) The water use projections shall be in the same five-year increments as described in subdivision (a).

(f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

(A) Water survey programs for single-family residential and multifamily residential customers.

(B) Residential plumbing retrofit.

(C) System water audits, leak detection, and repair.

(D) Metering with commodity rates for all new connections and retrofit of existing connections.

(E) Large landscape conservation programs and incentives.

(F) High-efficiency washing machine rebate programs.

(G) Public information programs.

(H) School education programs.

(I) Conservation programs for commercial, industrial, and institutional accounts.

(J) Wholesale agency programs.

(K) Conservation pricing.

(L) Water conservation coordinator.

(M) Water waste prohibition.

(N) Residential ultra-low-flush toilet replacement programs.

(2) A schedule of implementation for all water demand management measures proposed or described in the plan.

(3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.

(4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand.

(g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:

(1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors.

(2) Include a cost-benefit analysis, identifying total benefits and total costs.

(3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.

(4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.

(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed

description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single dry, and multiple dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(i) Urban water suppliers that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the "Memorandum of Understanding Regarding Urban Water Conservation in California," dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g).

SEC. 4.

Section 10656 of the Water Code is amended to read:

10656.

An urban water supplier that does not prepare, adopt, and submit its urban water management plan to the department in accordance with this part, is ineligible to receive funding pursuant to Division 24 (commencing with Section 78500) or Division 26 (commencing with Section 79000), or receive drought assistance from the state until the urban water management plan is submitted pursuant to this article.

SEC. 4.3.

Section 10657 is added to the Water Code, to read:

10657.

(a) The department shall take into consideration whether the urban water supplier has submitted an updated urban water management plan that is consistent with Section 10631, as amended by the act that adds this section, in determining whether the urban water supplier is eligible for funds made available pursuant to any program administered by the department.

(b) This section shall remain in effect only until January 1, 2006, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2006, deletes or extends that date.

SEC. 4.5.

Section 10910 of the Water Code is amended to read:

10910.

(a) Any city or county that determines that a project, as defined in Section 10912, is subject to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) under Section 21080 of the Public Resources Code shall comply with this part.

(b) The city or county, at the time that it determines whether an environmental impact report, a negative declaration, or a mitigated negative declaration is required for any project subject to the California Environmental Quality Act pursuant to Section 21080.1 of the Public Resources Code, shall identify any water system that is, or may become as a result of supplying water to the project identified pursuant to this subdivision, a public water system, as defined in Section 10912, that may supply water for the project. If the city or county is not able to identify any public water system that may supply water for the project, the city or county shall prepare the water assessment required by this part after consulting with any entity serving domestic water supplies whose service area includes the project site, the local agency formation commission, and any public water system adjacent to the project site.

(c) (1) The city or county, at the time it makes the determination required under Section 21080.1 of the Public Resources Code, shall request each public water system identified pursuant to subdivision (b) to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted urban water management plan adopted pursuant to Part 2.6 (commencing with Section 10610).

(2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f), and (g).

(3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

(4) If the city or county is required to comply with this part pursuant to subdivision (b), the water supply assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses.

(d) (1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.

(2) An identification of existing water supply entitlements, water rights, or water service contracts held by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall be demonstrated by providing information related to all of the following:

(A) Written contracts or other proof of entitlement to an identified water supply.

(B) Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system.

(C) Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply.

(D) Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.

(e) If no water has been received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts, the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall also include in its water supply assessment pursuant to subdivision (c), an identification of the other public water

systems or water service contractholders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has identified as a source of water supply within its water supply assessments.

(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water supply assessment:

(1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.

(2) A description of any groundwater basin or basins from which the proposed project will be supplied. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the amount and location of groundwater pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), for the past five years from any groundwater basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), from any basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(5) An analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project. A water supply assessment shall not be required to include the information required by this paragraph if the public water system determines, as part of the review required by paragraph (1), that the sufficiency of groundwater necessary to meet the initial and projected water demand associated with the project was addressed in the description and analysis required by paragraph (4) of subdivision (b) of Section 10631.

(g) (1) Subject to paragraph (2), the governing body of each public water system shall submit the assessment to the city or county not later than 90 days from the date on which the request was received. The governing body of each public water system, or the city or county if either is required to comply with this act pursuant to subdivision (b), shall approve the assessment prepared pursuant to this section at a regular or special meeting.

(2) Prior to the expiration of the 90-day period, if the public water system intends to request an extension of time to prepare and adopt the assessment, the public water system shall meet with the city or county to request an extension of time, which shall not exceed 30 days, to prepare and adopt the assessment.

(3) If the public water system fails to request an extension of time, or fails to submit the assessment notwithstanding the extension of time granted pursuant to paragraph (2), the city or county may seek a writ of mandamus to compel the governing body of the public water system to comply with the requirements of this part relating to the submission of the water supply assessment.

(h) Notwithstanding any other provision of this part, if a project has been the subject of a water supply assessment that complies with the requirements of this part, no additional water supply assessment shall be required for subsequent projects that were part of a larger project for which a water supply assessment was completed and that has complied with the requirements of this part and for which the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has concluded that its water supplies are sufficient to meet the projected water demand associated with the proposed project, in addition to the existing and planned future uses, including, but not limited to, agricultural and industrial uses, unless one or more of the following changes occurs:

(1) Changes in the project that result in a substantial increase in water demand for the project.

(2) Changes in the circumstances or conditions substantially affecting the ability of the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), to provide a sufficient supply of water for the project.

(3) Significant new information becomes available which was not known and could not have been known at the time when the assessment was prepared.

SEC. 5.

Section 10911 of the Water Code is amended to read:

10911.

(a) If, as a result of its assessment, the public water system concludes that its water supplies are, or will be, insufficient, the public water system shall provide to the city or county its plans for acquiring additional water supplies, setting forth the measures that are being undertaken to acquire and develop those water supplies. If the city or county, if either is required to comply with this part pursuant to subdivision (b), concludes as a result of its assessment, that water supplies are, or will be, insufficient, the city or county shall include in its water supply assessment its plans for acquiring additional water supplies, setting forth the measures that are being undertaken to acquire and develop those water supplies. Those plans may include, but are not limited to, information concerning all of the following:

(1) The estimated total costs, and the proposed method of financing the costs, associated with acquiring the additional water supplies.

(2) All federal, state, and local permits, approvals, or entitlements that are anticipated to be required in order to acquire and develop the additional water supplies.

(3) Based on the considerations set forth in paragraphs (1) and (2), the estimated timeframes within which the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), expects to be able to acquire additional water supplies.

(b) The city or county shall include the water supply assessment provided pursuant to Section 10910, and any information provided pursuant to subdivision (a), in any environmental document prepared for the project pursuant to Division 13 (commencing with Section 21000) of the Public Resources Code.

(c) The city or county may include in any environmental document an evaluation of any information included in that environmental document provided pursuant to subdivision (b). The city or county shall determine, based on the entire record, whether projected water supplies will be sufficient to satisfy the demands of the project, in addition to existing and planned future uses. If the city or county determines that water supplies will not be sufficient, the city or county shall include that determination in its findings for the project.

SEC. 6.

Section 10912 of the Water Code is amended to read:

10912.

For the purposes of this part, the following terms have the following meanings:

(a) "Project" means any of the following:

(1) A proposed residential development of more than 500 dwelling units.

(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.

(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.

(4) A proposed hotel or motel, or both, having more than 500 rooms.

(5) A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.

(6) A mixed-use project that includes one or more of the projects specified in this subdivision.

(7) A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.

(b) If a public water system has fewer than 5,000 service connections, then "project" means any proposed residential, business, commercial, hotel or motel, or industrial development that would account for an increase of 10 percent or more in the number of the public water system's existing service connections, or a mixed-use project that would demand an amount of water equivalent to, or greater than, the amount of water required by residential development that would represent an increase of 10 percent or more in the number of the public water system's existing service connections.

(c) "Public water system" means a system for the provision of piped water to the public for human consumption that has 3000 or more service connections. A public water system includes all of the following:

(1) Any collection, treatment, storage, and distribution facility under control of the operator of the system which is used primarily in connection with the system.

(2) Any collection or pretreatment storage facility not under the control of the operator that is used primarily in connection with the system.

(3) Any person who treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

SEC. 7.

Section 10913 of the Water Code is repealed.

SEC. 8.

Section 10915 of the Water Code is amended to read:

10915.

The County of San Diego is deemed to comply with this part if the Office of Planning and Research determines that all of the following conditions have been met:

(a) Proposition C, as approved by the voters of the County of San Diego in November 1988, requires the development of a regional growth management plan and directs the establishment of a regional planning and growth management review board.

(b) The County of San Diego and the cities in the county, by agreement, designate the San Diego Association of Governments as that review board.

(c) A regional growth management strategy that provides for a comprehensive regional strategy and a coordinated economic development and growth management program has been developed pursuant to Proposition C.

(d) The regional growth management strategy includes a water element to coordinate planning for water that is consistent with the requirements of this part.

(e) The San Diego County Water Authority, by agreement with the San Diego Association of Governments in its capacity as the review board, uses the association's most recent regional growth forecasts for planning purposes and to implement the water element of the strategy.

(f) The procedures established by the review board for the development and approval of the regional growth management strategy, including the water element and any certification process established to ensure that a project is consistent with that element, comply with the requirements of this part.

(g) The environmental documents for a project located in the County of San Diego include information that accomplishes the same purposes as a water supply assessment that is prepared pursuant to Section 10910.

SEC. 9.

Section 3.5 of this bill incorporates amendments to Section 10631 of the Water Code proposed by both this bill and AB 901. It shall only become operative if (1) both bills are enacted and become effective on or before January 1, 2002, (2) each bill amends Section 10631 of the Water Code, and (3) this bill is enacted after AB 901, in which case Section 3 of this bill shall not become operative.

SEC. 10.

No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.

APPENDIX B

2020 GROUNDWATER SUSTAINABILITY PLAN – INDIAN WELLS VALLEY GROUNDWATER AUTHORITY

2025 PERIODIC EVALUATION – INDIAN WELLS VALLEY GROUNDWATER AUTHORITY

KERN

GROUNDWATER AUTHORITY



Groundwater Sustainability Plan

Kern County, CA

This Page is Intentionally Blank

Response to DWR Determination Letter

July 27, 2022

Mr. Paul Gosselin, Deputy Director
Department of Water Resources
Sustainable Groundwater Management Office
PO Box 942836
Sacramento, CA 94236-0001

RE: Submittal of Amended KGA Groundwater Sustainability Plan (GSP)

In response to the Statement of Findings regarding the Determination of Incomplete Status of the San Joaquin Valley – Kern County Subbasin Groundwater Sustainability Plans, State of California, Department of Water Resources, January 28, 2022

The Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) is pleased to submit this Amended KGA Groundwater Sustainability Plan to the Department of Water Resources (DWR) for review. Amendments have been developed in response to the incomplete determination letter received on January 28, 2022, for the Kern Subbasin GSA pertaining to the 2020 Groundwater Sustainability Plans submitted for the Kern County Subbasin. DWR reviewed the Kern Subbasin GSPs as one plan including the Coordination Agreement (Water Code 10727), and as such all the Kern Subbasin GSAs coordinated and contributed to the responses and solutions as generally described herein with more detail that is relevant to the KGA as presented in this amended GSP as submitted.

Upon receipt of the determination letter, the Kern Subbasin GSAs including all members of the KGA, participated in weekly coordination meetings, along with coordination meetings between adjacent GSAs and KGA members, coordination meetings between adjacent KGA members, monthly Coordination Committee meetings, and monthly KGA Board meetings. At the monthly KGA board meetings, updates were provided to the stakeholders, beneficial users, and public as well as final draft documents that were provided in the board packages for review seeking input and comments. The KGA board meetings were/are available to attend either in-person or via Zoom. The KGA members also held their monthly board meetings with open public discussions on the status of how the response to the DWR determination letter was being developed and coordinated.

Another opportunity presented to assist in this process, DWR staff held several consultation meetings with the Kern Subbasin GSAs, which included the KGA is and was greatly appreciated by all participants. From those meetings and working collaboratively with all the Kern Subbasin GSAs, the KGA believes that the amended GSP along with all the other amended GSPs in the Kern Subbasin, will achieve and address the deficiencies identified in the determination letter. As stated in the DWR determination letter, the Kern Subbasin is the “largest and arguably most complicated Subbasin in terms of entities involved and demands placed on the Subbasin” (page 11). DWR’s understanding of the Kern Subbasin being the most complicated is quite the understatement considering that each water district has access to different surface water supply portfolios, which may include water from either the State Water Project, the Friant Water Project, the Central Valley

Project, the Kern River, or combination of these supplies. Then you take into consideration the largest subbasin and you then have different beneficial users in different areas with no two water districts having the same ration of beneficial users by management area. With having submitted the original GSPs in 2020 and now with two years of submitting annual reports and implementation of the GSPs moving forward, the DWR determination letter shed light on those areas back in 2018 & 2019, that the Kern Subbasin was struggling with however now, with the coordinated efforts along with better understanding, the KGA sees this as an opportunity to improve on their GSP and prepare for the 2025 update.

The DWR determination letter focused on three primary deficiencies and provided Corrective Actions for the Kern Subbasin GSAs to consider, coordinate and focus on:

1. *The GSPs do not establish undesirable results that are consistent for the entire Subbasin. Key issues include:*
    a) *The Coordination Agreement should be revised to explain how the undesirable results definitions are consistent with the requirements of SGMA and the GSP regulations, which specify that the undesirable results represent effects caused by groundwater conditions occurring throughout the Subbasin.*
    b) *The GSAs must commit to comprehensively reporting on the status of minimum thresholds exceedances by area in the annual reports and impacts to the beneficial users.*
    c) *The GSAs must adopt clear and consistent terminology to ensure various plans are comparable and reviewable by the GSAs, interested parties and DWR staff.*
2. *The GSAs must adopt clear and consistent terminology to ensure various plans are comparable and reviewable by the GSAs, interested parties and DWR staff. The Plan does not set minimum thresholds for chronic lowering of groundwater levels in a manner consistent with the requirements of SGMA and the GSP Regulations.*
    a) *For deficiency 2, DWR staff provided Table 2 that provided individual and helpful specific concerns and suggestive corrective actions for the GSAs and their members to address.*
    b) *All the GSPs must demonstrate the relationship between the minimum thresholds for each sustainability indicator.*
3. *The Plan's land subsidence sustainable management criteria do not satisfy the requirement of SGMA and the GSP regulations.*

    a) *The Subbasin's GSAs should coordinate and collectively satisfy the requirements of SGMA and the GSP regulations to develop the sustainable management criteria for land subsidence.*

Deficiency 1 - The GSPs Do Not Establish Undesirable Results that are Consistent for the Entire Basin

DWR indicated that this deficiency relates to the Plan's lack of an explanation of the specific effects, occurring throughout the Subbasin, that, when significant and unreasonable would be an undesirable result. DWR continues to state that this should be reflected in the framework of the Coordination Agreement thus the recommended corrective actions.

> *a) The Plan's Coordination Agreement should be revised to explain how the undesirable results definitions are consistent with the requirements of SGMA and the GSP Regulations, which specify that undesirable results represent effects caused by groundwater conditions occurring throughout the Subbasin.*

During the weekly coordinated GSA/KGA managers meeting, the following definitions were clarified and adjusted to be used by all GSA/KGA covering the entire basin. These definitions took into consideration the vast differences in the distribution of beneficial users between management areas, water right holders, hydrology, and day to day operations. These weekly meetings also accomplished confirming that all are using the same definitions to prevent further confusion as well as revising the monitoring protocols, and specifically addressing the process for determination of an undesirable result. The Coordination Agreement is reflective of these coordinated efforts in Appendix 3 and for ease, the definitions are listed below as well:

Kern Subbasin Definitions

Management Area: management Areas are areas that will be considered against the determination of an undesirable result at the basin level.

Watch Areas: areas with no significant groundwater use and no planned groundwater use as documented in the MAP. Watch areas will be monitored for land use changes and groundwater conditions that could change its designation to a "management area" with specified SMCs.

Monitoring Areas: areas that have significance within a Management Area for monitoring groundwater conditions or impacts to certain beneficial users but are not considered towards the determination of an Undesirable Result.

MT Exceedance: where a single representative monitoring well exceeds its minimum threshold.

MT Trigger: a management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events (Definition for Chronic Lowering of Groundwater).

Management Area Exceedance: exceeding the MT Trigger (i.e., 40% of wells) with a management area is a "management area exceedance", not an Undesirable Result which is defined at the basin level.

Undesirable Result: the basin-wide definition of unreasonable impacts to beneficial uses and users of groundwater. Should only be referred to as a basin-wide conditions and not a management area

condition. The equivalent designation at the management area is a "Management Area Exceedance."

Urban Management Area Exceedance*: A* management area exceedance is triggered when groundwater levels decline below established MTs in any RMW for more than three conservative months.

b) The GSAs must commit to comprehensively reporting on the status of minimum threshold exceedances by area in the annual reports and describe how groundwater conditions at or below the minimum thresholds may impact beneficial uses and users prior to the occurrence of a formal undesirable result.

The Kern Subbasin GSAs/KGA already are committed to comprehensively reporting on the status of minimum threshold exceedances by area in the annual report and to further describe how groundwater conditions may impact beneficial users and uses as well as providing in the annual report management actions/projects being implemented to correct or contain the exceedance. The Kern Subbasin GSAs/KGA have already submitted three annual reports with the exceedances addressed in the last two reports along with corrective actions to address. The Kern Subbasin/KGA's annual reports cover the entire basin and utilize a common methodology for determining demand and supply to update the C2VSim model use the same demand methodologies, water supply, and update the C2VSim model to provide an update basin wide status to assess how the basin is progressing towards sustainability.

The Kern Subbasin GSAs/KGA have also developed, designed, and released a data management system (DMS) that provides current seasonal data reflective by monitoring well locations for groundwater levels. This DMS also sends alerts when any GSA/KGA enters any seasonal data that exceeds the minimum thresholds so to alert all to the exceedance. The KGA has also developed an exceedance policy that prescribes immediate attention to an exceedance at a monitoring location (one exceedance triggers the KGA call to action process). Refer to the *KGA Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater* inserted into this letter on page 6.

c) The GSAs must adopt clear and consistent terminology to ensure the various plans are comparable and reviewable by the GSAs, interested parties, and Department staff. Department staff recommend the revisions should include, at a minimum:

- A map of the entire Subbasin showing each of the GSP areas, including management areas and the management areas within the management area plans, associated monitoring zones, etc. that have a locally defined "undesirable result" that can contribute to the Subbasin's undesirable result area-based definitions described in the Coordination Agreement.
- A comprehensive table or another organized form of identifying each of the areas, the land coverage – both absolutely and as a percentage – of each of those listed areas in comparison to the Subbasin in total, and a clear and concise description of the conditions that would cause the area to trigger a localized undesirable result (i.e., watch

area, etc.). These materials should demonstrate that 100 percent of the Subbasin area is being managed under the various GSPs with reasonable definitions for undesirable results.

In addition to the graphical and tabular representation of the definition of the Subbasin-wide undesirable results, and if the GSAs elect to maintain the percentage of land area definition for undesirable results, the GSAs need to provide a comprehensive description of the groundwater conditions that would lead to localized undesirable results in the GSAs and other management areas which ultimately contribute to the 15 percent or 30 percent of land area criteria.

Accomplished at the weekly coordination meetings, KGA developed the matrix below reflecting the triggers of an undesirable result as it relates to groundwater level exceedances and the process associated to handling an exceedance in management areas and how the basin enters an undesirable result for the entire basin. The KGA decided to take this process one step further by the development of an exceedance policy for just one exceedance and thus setting a "call to action" to avert beneficial uses and users impacts. The KGA developed sustainable management criteria that meets the GSP Regulations and enhances the process by including additional steps to better manage political, operational, and diverse demographic of beneficial user conditions found across the Kern Subbasin. This process is proactive in identifying individual MT Exceedances and intervenes before a Management Area Exceedance occurs and/or progresses to an undesirable result condition.

The complexity of groundwater management in the Kern Subbasin required that the KGA and other Subbasin GSAs coordinate this process that recognizes the diversity found across the Subbasin. The core of this process is the identification of key beneficial users within each management area and the conditions that create significant and unreasonable impacts to those beneficial users from groundwater operations in that management area.

KGA Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater

The Groundwater Sustainability Plans (GSPs) in the Kern County Subbasin (Subbasin) define sustainability under the Sustainable Groundwater Management Act (SGMA) as the avoidance of undesirable results. Undesirable results for the chronic lowering of groundwater occur when a certain number of minimum thresholds are exceeded at representative monitoring well sites. While a single or isolated exceedance of a minimum threshold will not, by itself, cause an undesirable result, such an exceedance may be indicative of future or trending exceedances which could result in undesirable results for chronic lowering of groundwater.

The Kern Groundwater Authority (KGA) GSP defines undesirable results within each Management Area Plan (MAP) developed by respective KGA members. Each KGA member is responsible for monitoring groundwater conditions, complying with GSP requirements and coordinating with other agencies and entities (cities, small systems, etc.) within their respective MAPs. The KGA also coordinates with its member agencies to facilitate SGMA compliance. As part of this coordination, the KGA works with other groundwater sustainability agencies (GSAs) in the Subbasin to compile an annual report and submit that report to the Department of Water Resources (DWR) each year on April 1. Information that reflects compliance with or exceedance of minimum thresholds is included in each annual report, if present.

It is important to monitor compliance with minimum thresholds over time to understand the Subbasin's likelihood of achieving sustainability. The following five-step action plan is proposed to address a minimum threshold exceedance for the chronic lowering of groundwater levels at a single representative monitoring well, including coordination between KGA member districts.

1. Identify Exceedance and Investigate the RMW Area

After each annual report, the KGA managers team will review data and identify any exceedances of minimum thresholds for each RMW and will compile a summary of minimum threshold exceedances, as noted in the annual report, for review by the KGA Board.

Various conditions surrounding the RMW will be considered. For example: Are water levels declining in nearby wells? If so, how large of an area is affected? Has a new well been installed nearby or localized groundwater extraction increased? Is the problem related to area-wide drought conditions? Has local demand increased? If increased demand is responsible for the exceedance, then is a sustainable water budget needed and/or being adhered to in the area?

2. Evaluate Outside MAP Contributing Factors

Provided the aquifer connectivity between MAP areas and groundwater impacts crossing MAP boundaries, declining groundwater levels in an area may be the result of operations in an adjacent MAP and/or an adjacent GSA. In this situation, the KGA member may not be able to resolve any

exceedances unilaterally. KGA members in adjacent MAPs agree to coordinate. Updates or proposals shall be reported back to the KGA.

3. Consider Developing Management Actions and/or Projects

Any KGA member with a minimum threshold exceedance may develop or modify existing management actions or projects to mitigate a minimum threshold exceedance and avoid undesirable results ("mitigation plan"). Any mitigation plan should be submitted to the KGA managers team for review. The mitigation plan along with any KGA managers team comments shall be submitted to the KGA Board. To the extent the mitigation plan includes any new management actions, any proposed modifications to an existing management action or new projects, the KGA will consider how those changes will be incorporated into any update to the KGA GSP.

4. Consider Enforcement Plan

In the event of a management area exceedance the KGA member or contributing member(s) will consider developing and/or implementing policies and programs intended to eliminate or mitigate the exceedance (enforcement plan). The enforcement plan(s) must be submitted to the KGA and the KGA will have 90 days to determine whether the enforcement plan is sufficient to demonstrate the avoidance of undesirable results. If no enforcement plan is submitted to KGA, the KGA Board may recommend policies or programs to the member(s) that could, in its discretion, take to remedy the existence of a management area exceedance(s) and to avoid undesirable results.

KGA Member Agencies are committed to managing groundwater levels at or above the MO. Groundwater elevations between the MO and MT provide operational flexibility that balances short-term water level declines due to drought conditions, while allowing access to previously banked surface water that provides a critical supply when local and imported surface waters are limited. To avoid undesirable results, each KGA Member Agency has committed to the following actions:

1. Manage groundwater levels in their respective management areas at or above the MO set for their Regional Monitoring Wells (RMW).
2. Manage to a water budget that will collectively eliminate the KGA Member Agencies deficit of 239,346 AFY by 2040 (see Section 2.4),
3. Implement projects and management actions identified in Section 4.0 of the KGA Umbrella GSP and further described in each MAP.

As described above and demonstrated in Figure 1, in the Kern Subbasin, Sustainable Management Criteria are more robust than the SGMA prescribed Undesirable Results, MO and MT. Sustainable management begins with early identification of potential minimum threshold exceedances and coordinated actions to address those early exceedances.

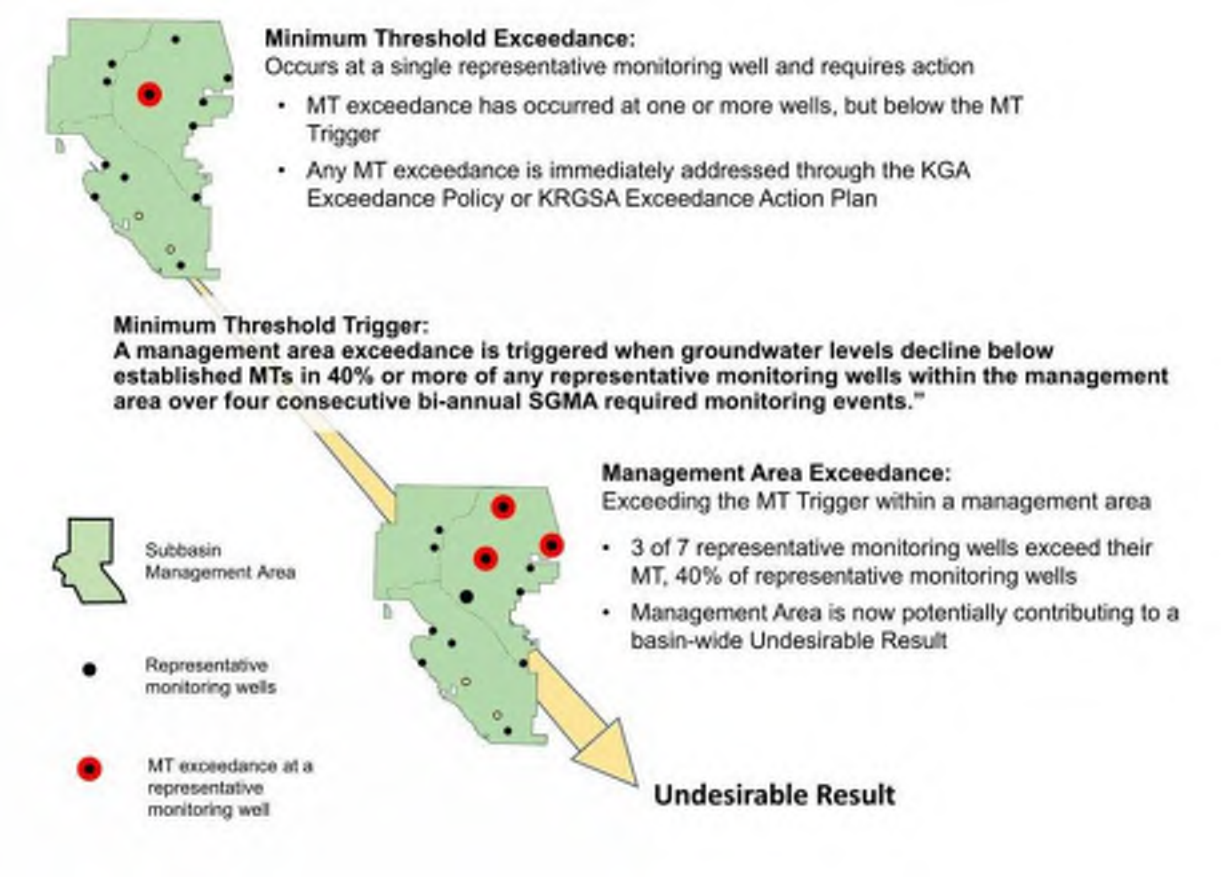


Figure 1. Process of Minimum Threshold Trigger to Undesirable Result

An undesirable result is a condition that occurs throughout the Subbasin, demonstrating that the Subbasin is not sustainably managing groundwater conditions in the aggregate and that impacts to beneficial users are occurring on a scale (spatially and temporally) that is significant and unreasonable to beneficial users and groundwater managers alike. However, the KGA recognizes that as groundwater approaches an undesirable result condition, exceedances of minimum thresholds will likely progressively occur in the absence of intervention, beginning with isolated exceedances which could impact beneficial users. Table 1 lists the KGA management areas and data used to calculate a management area exceedance and undesirable result which accounts for approximately 55% of the basin and does not include the management areas of the other GSAs; however, Figures 2 and 3 include all the management areas including the other GSAs.

Table 1. Number of Monitoring Wells that Trigger A Management Area Exceedance

KGA Management Area	# of Representative Wells	# of Well Exceedances to Trigger Management Area Exceedance Criteria	Acres in Management Area	Percentage of Subbasin
Cawelo GSA	7	3	62,616	3.5
Eastside Water Management Agency	6	2	38,222	2.1
Kern-Tulare Water District (in Kern)	6	2	11,219	0.6
North Kern WSD				
MA-1 (Old District)	8	4	61,741	3.4
MA-2 (RRID)	2	1	5,802	0.3
KCWA-Pioneer GSA	5	2	2,233	0.1
Kern Water Bank Authority	0	0	20,490	1.1
Rosedale-Rio Bravo WSD	19	8	48,610	2.7
Southern San Joaquin MUD	10	4	65,693	3.7
Shafter-Wasco Irrigation District	7	3	39,980	2.2
7th Standard Annex	3	2	10,045	0.6
Semitropic GSA				
MA-1 (Pond Poso)	6	2	82,638	4.6
MA-2 (Buttonwillow)	5	2	92,633	5.2
MA-3 (Undeveloped)	2	1	49,140	2.7
West Kern GSA				
North Project MA	6	2	521	0.0
South Project MA	17	7	889	0.0
Western Watch Area [1]	n/a	n/a	183,128	10.2
Lake Watch Area [1]	n/a	n/a	653	0.0
LSMV Watch Area [1]	n/a	n/a	1,947	0.1
Westside Districts Water Authority				
Westside District MA	3	1	195,263	10.9
Lost Hills Watch Area [1]	n/a	n/a	33,191	1.9
Southwest Watch Area [1]	n/a	n/a	48,739	2.7
Non-District White Lands Watch Areas [1]	n/a	n/a	210,034	11.7

1. "Watch Areas" are areas with no significant groundwater use and no planned groundwater use as documented by the management area member agency. Water areas will be monitored for land use changes and groundwater conditions which could change its designation to a "management area" with specified SMCs.

Defining the point of a Subbasin level undesirable result begins with a defined level of significant and unreasonable impacts to beneficial users, both spatially and temporally, within each management area of the Subbasin. The accumulation of impacts to beneficial users throughout the Subbasin, and across multiple management areas, representing a persistent and prevalent occurrence of impacts to beneficial users is considered an undesirable result.

For Chronic Lowering of Groundwater Levels, the Kern Subbasin has defined the occurrence of an undesirable result as the level of impacts affecting either:

- 15% of the Subbasin area, measured as the combined acres of three adjacent management areas with Management Area Exceedances, or
- 30% of the Subbasin area, measured as the combined acres of any management area with Management Area Exceedances.

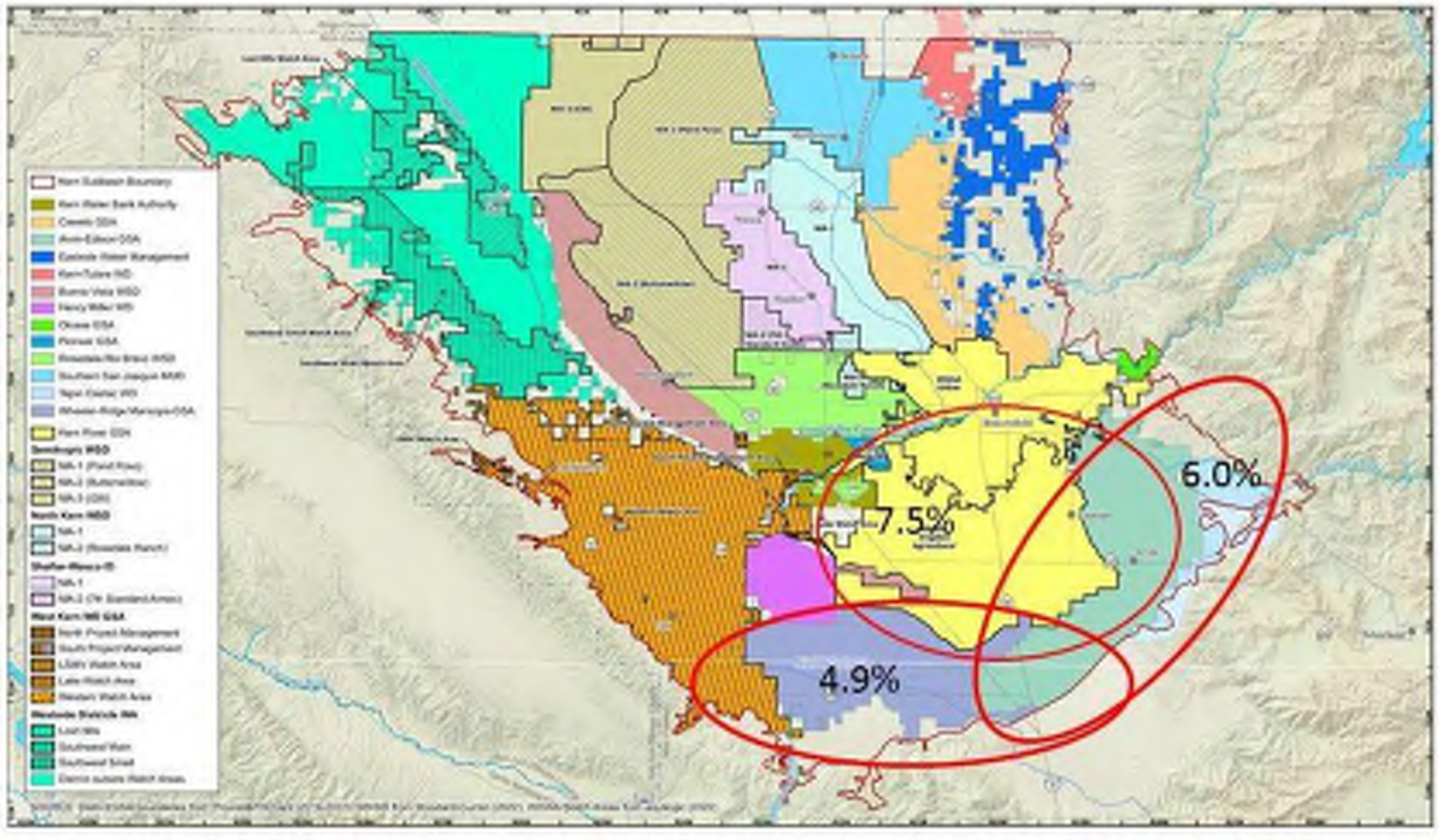
The criterion of three adjacent management areas of at least 15% of the Subbasin was developed to recognize a condition where degrading groundwater conditions from one management area spreads to adjacent management areas. This criterion recognizes that even the lesser percentage of the Subbasin (15%) as a contiguous area is significant with regards to the potential for further degradation of groundwater conditions across the Subbasin. The criterion of 30% of the Subbasin (generally non-contiguous management areas) recognizes a condition of widespread degradation of groundwater conditions across the whole of the Subbasin and across a diverse demographic of beneficial users, operational and geologic landscape.

Figure 2 provides an example of the occurrence of an undesirable result when Management Area Exceedances have occurred in at least three (3) adjacent management areas that represent at least 15% of the Subbasin (as measured by the acreage of each management area). In this example, Management Area Exceedances have occurred in three adjacent areas where the acreage totals more than 15% of the Subbasin total (defined in Section 3.3).

Figure 3 provides an example of the occurrence of the undesirable result criteria when Management Area Exceedances have occurred in greater than 30% of the Subbasin (as measured by the acreage of each management area). In this illustrative example, Management Area Exceedances have occurred in seven (7) separate management areas where the acreage totals more than 30% of the Subbasin total (defined in Section 3.3). This criterion recognizes a widespread occurrence of groundwater conditions across the whole of the Subbasin and across a diverse demographic of beneficial users, operational and geologic landscape.

Management Area	Acres	Percent of Subbasin
Cawelo GSA	62,816	3.5%
Eastside Water Management Area	38,222	2.1%
Kern-Tulare WD (in Kern County)	11,219	0.6%
North Kern WSD		
MA-1	61,741	3.4%
MA-2 (Rosedale Ranch)	5,802	0.3%
KCWA - Pioneer GSA	2,233	0.1%
Kern Water Bank Authority	20,490	1.1%
Rosedale-Rio Bravo WSD	48,810	2.7%
Southern San Joaquin MUD	65,893	3.7%
Shafter-Wasco ID		
MA-1	39,980	2.2%
MA-2 (7th Standard Annex)	10,045	0.6%
Semitropic GSA		
MA-1 (Pond Poso)	82,838	4.6%
MA-2 (Buttonwillow)	92,853	5.2%
MA-3 (Undeveloped)	48,140	2.7%
West Kern WD GSA		
North Project Management Area	521	0.0%
South Project Management Area	889	0.0%
Western Watch Area	183,128	10.2%
Lake Watch Area	653	0.0%
LSMV Watch Area	1,947	0.1%
Westside District WA		
Westside District WA	195,263	10.9%
Lost Hills Watch Area	33,191	1.9%
Southwest Watch Area	48,739	2.7%
Non-District White Lands Watch Areas	210,034	11.7%
South of Kern River Districts		
Arvin Edison WSD GSA	107,728	6.0%
Tejon Castac WD GSA	19,880	1.1%
Wheeler Ridge-Maricopa WSD GSA	87,391	4.9%
Kern River GSA		
KRGSA - AG	134,104	7.5%
KRGSA - Banking	5,845	0.3%
KRGSA - Urban	93,350	5.2%
Buena Vista GSA	50,414	2.8%
Henry Miller GSA	26,855	1.5%
Olcese GSA	3,206	0.2%
TOTALS:	1,792,808	100.00%

"..least three (3) adjacent management areas that represent at least 15% of the Subbasin ..."

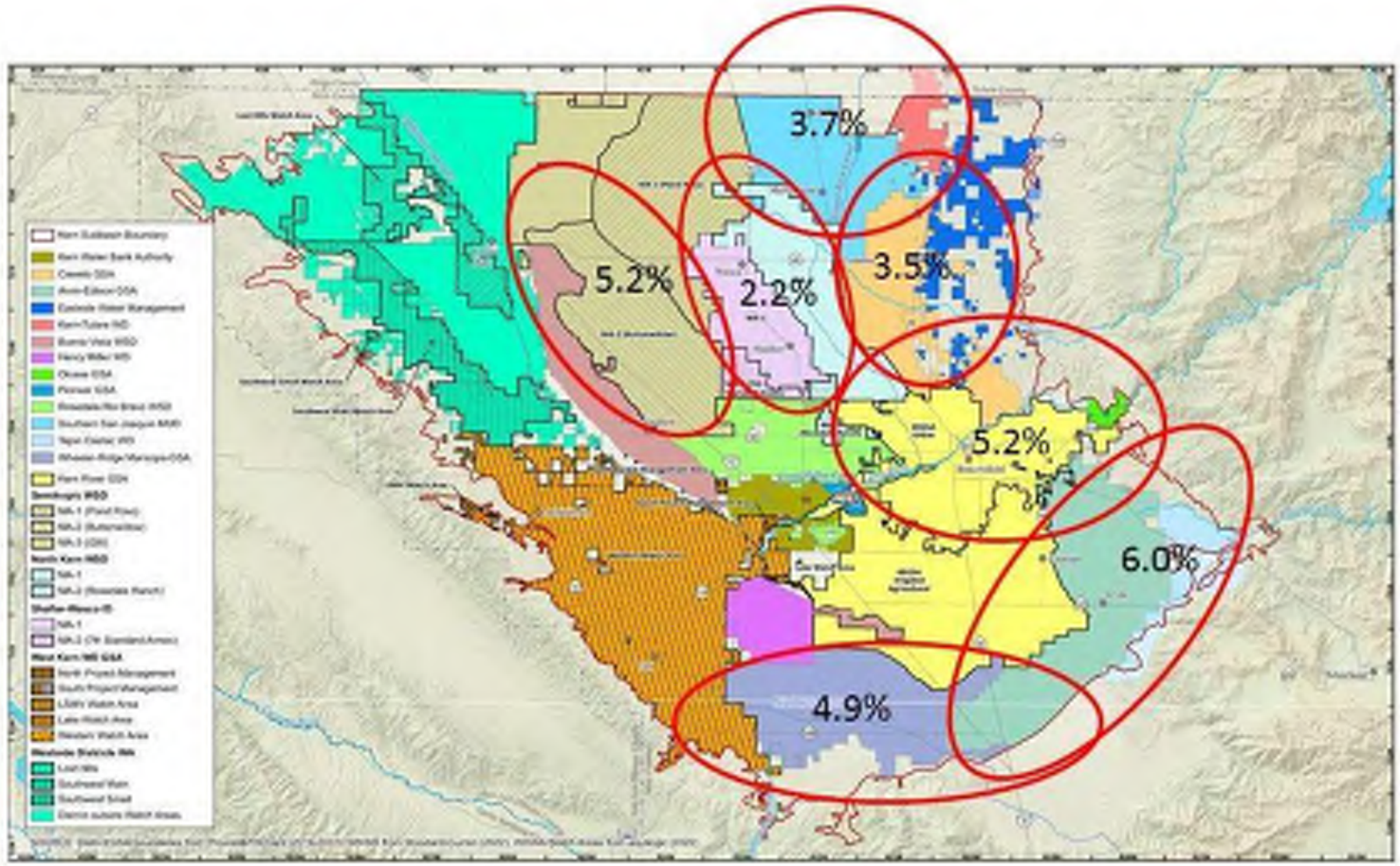


18.4 % of the Subbasin

Figure 2. Example of Undesirable Results Criteria for 15% of Adjacent Management Areas

Management Area	Acres	Percent of Subbasin
Cawelo GSA	62,676	3.5%
Eastside Water Management Area	38,222	2.1%
Kern-Tulare WD (in Kern County)	11,219	0.6%
North Kern WSD		
MA-1	61,741	3.4%
MA-2 (Rosedale Ranch)	5,662	0.3%
KCWA - Pioneer GSA	2,233	0.1%
Kern Water Bank Authority	20,490	1.1%
Rosedale-Rio Bravo WSD	48,610	2.7%
Southern San Joaquin MUD	65,662	3.7%
Shafter-Wasco ID		
MA-1	39,980	2.2%
MA-2 (7th Standard Annex)	10,040	0.6%
Semitropic GSA		
MA-1 (Pond Poso)	82,638	4.6%
MA-2 (Buttonwillow)	92,633	5.2%
MA-3 (Undeveloped)	49,140	2.7%
West Kern WD GSA		
North Project Management Area	521	0.0%
South Project Management Area	889	0.0%
Western Watch Area	183,126	10.2%
Lake Watch Area	653	0.0%
LSMV Watch Area	1,947	0.1%
Westside District WA		
Westside District WA	195,262	10.9%
Lost Hills Watch Area	33,191	1.9%
Southwest Watch Area	48,739	2.7%
Non-District White Lands Watch Areas	210,034	11.7%
South of Kern River Districts		
Arvin Edison WSD GSA	107,726	6.0%
Tejon Castac WD GSA	19,280	1.1%
Wheeler Ridge-Maricopa WSD GSA	87,391	4.9%
Kern River GSA		
KRGGA - AG	134,104	7.5%
KRGGA - Banking	5,040	0.3%
KRGGA - Urban	93,350	5.2%
Buena Vista GSA	50,414	2.8%
Henry Miller GSA	26,055	1.5%
Olcese GSA	3,206	0.2%
TOTALS:	1,792,080	100.0%

"... greater than 30% of the Subbasin (as measured by each management area)."



30.7 % of the Subbasin

Figure 3. Example of Undesirable Results Criteria for 30% of Subbasin

Deficiency 2 – The Plan does not set minimum thresholds for chronic lowering of groundwater levels in a manner consistent with the requirements of SGMA and the GSP regulations

DWR staff's review of the Plan indicated that the approaches used and the level of analysis to support those approaches, is disparate across the various management area plans. Thus, DWR staff developed Table 2.

a) For deficiency 2, DWR staff provided Table 2 that provided individual and helpful specific concerns and suggestive corrective actions for the GSAs and their management areas to address.

The Kern Subbasin GSAs held the weekly meetings to coordinate responses to the deficiencies identified in Table 2. During one of the consultation meetings, a matrix which generally describes each entities response to the specific deficiencies identified was presented, DWR staff indicated that the Kern Subbasin was moving in the right direction however needed to explore impacts to all beneficial users and uses as well as addressing what was being avoided by the actions. Please see the table presented below but note that the information in the table below is only a summary of the discussion and response to the DWR Table 2 and to understand more specific information, the management area plans provide greater details.

The KGA moved forward in exploring the impacts to their beneficial users and uses as well as considering the impacts to those adjacent GSAs. The KGA also explored what was being avoided by their actions of managing to the measurable objectives. The members of the KGA all agreed that they were and are working to avoid the impacts or unmitigated dewatering of municipal and domestic wells while balancing the impact to the agricultural beneficial users in their respective management areas since most, if not all, of the KGA members have more agricultural users than municipal and domestic users. They continued by analyzing water wells depths which was the original justification for the setting of their SMCs. See table 3 for the breakdown of beneficial users and uses in each KGA management area as well as how or if any impacts will occur with the current SMCs set. If there is an impact, see the note about how each KGA member will or has developed a mitigation plan/strategy for impacts.

The KGA members also have agreed that they are managing to their measurable objectives and are managing to their water budgets (checkbook). They have also agreed that if there is more than a 5% of dewatering of wells in their management area, a mitigation plan will or is already developed. This is also explained in great detail in their individual management area plans.

This Page Left Blank Intentionally

Table 2a. KGA Management Area Responses to Deficiency 2, Table 2

KGA Management Area	Summary of DWR Plan Interpretation	DWR Suggested Corrective Action	Proposed Response	Coordination with Neighboring Districts
Areas Outside of Management Areas	The KGA GSP provides little information on the characteristics of non-management-area portions of its GSP area and does not appear to set any sustainable management criteria for these areas. The table of page 297 of the Coordination Agreement indicates that non-districted lands account for 18,013 acre-feet per year of total demand, which Department Staff note is a larger volume than occurs in many of the areas covered by the management area plans.	Provide a comprehensive discussion of areas covered by the KGA GSP, but that are not contained within the various management area plans. Among other items, provide maps of these areas, describe the uses and users or groundwater in these areas, and either set sustainable management criteria for these areas or include robust discussions justifying why sustainable management area are not required.	The KGA Umbrella already has a description of the non-districted lands in the Umbrella with maps of those areas however at the time of the GSP submittal, the KGA Board's approach was to remove those lands from the GSA if the landowner was not or had not signed on with a management area (KGA member). Now the direction provided by the KGA Board is to retain all lands and continue to monitor (watch) those lands. Since the very first submittal of the annual reports, the non-districted lands have been included and that will continue. Most of the non-districted lands have oil and grazing activities and those irrigated acres have been reduced with the annexation of the 7th Standard area into the Shafter-Wasco Irrigation District, the establishment of the Eastside Water Management Area and landowners signing agreements with KGA members to be covered by their MAP. The Umbrella will be updated to reflect the direction of the KGA Board, updating of the map reflecting the only those non-districted lands left as well as a map reflecting the lack of water wells in the area of activities of oil and grazing. The Umbrella will also have a "robust" discussion as to the justification of having the non-districted area as a "watch area" which will be also with maps reflecting oil field locations and water quality not conducive to irrigation of crops.	KGA members that are adjacent to those non-districted lands where there exists beneficial uses and users, which are very limited areas, considered them as they were setting their SMC and continue to consider as they manage under SGMA.
Cawelo GSA	The KGA GSP Cawelo management area established minimum thresholds for chronic lowering of groundwater levels based on the conditions experienced over the past 10 years. The minimum threshold is set 80 feet below the historic low between 2007 and 2016. Cawelo states that most wells have been drilled deeper and undesirable results associated with drought are unlikely. While it appears during a meeting held in 2019, Cawelo received a presentation on impacts to wells given various minimum thresholds, a discussion of impacts to beneficial uses and users of the adopted minimum thresholds is not provided.	The KGA GSP must describe how the minimum thresholds in the Cawelo management area may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	The Cawelo MAP is attempting to avoid significant and unreasonable impacts to a significant number of private, agricultural, industrial, domestic and/or small water system wells due to the management and use of groundwater under SGMA that would cause these wells to either be unable to continue to supply water for their intended beneficial use or incur significant economic impacts to continue operation of the well. The Cawelo MAP identified 76 small water system or private groundwater wells and 197 agricultural and industrial water supply wells. Five community and 12 non-community small water systems were identified that provide water for residential or institutional use. The largest of these is the Kern County Sheriff's Lerdo Detention Facility which houses up to 2,300 inmates and up to 500 employees. A well completion analysis was conducted that compared the MT from the nearest RMW to the well screen interval and saturated thickness for 290 water supply wells. The analysis indicates that most wells in the Cawelo MAP are constructed sufficiently deep to accommodate the MTs in all but 3 (3%) of the domestic and small water system wells and 1 (<1%) of the agricultural and industrial wells being potentially vulnerable. The four community water systems were considered to be completed sufficiently deep so as to accommodate the MTs in their areas. Furthermore, to address DWR's comment "cc" in Table 2 of the Final Determination Letter, the Cawelo MAP will develop a summary table identifying for each sustainability indicator, the respective beneficial users / uses considered, potential effects to beneficial users / uses, summary of undesirable result causes, local undesirable result criteria / definition, justification for the local undesirable result criteria / definition, minimum threshold(s) definition, justification for the minimum threshold(s), and measurable object definition. The minimum threshold(s) definition will include a summary of how the conditions will avoid undesirable results for the other sustainability indicators.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). Cawelo GSA coordinated the Cawelo MAP RMW MTs with neighboring MAP RMW MTs. During the coordination no recommended MT adjustments were identified. Cawelo GSA will continue to coordinate with neighboring GSAs / MAPs to identify potential future issues. Other Cawelo MAP revisions that demonstrate coordination will include: • Addition of the KGA Exceedance Policy as the first Management Action in the MAP, to be implemented immediately. • Documenting the well impact analysis was used to identify potential impacts to beneficial users / uses consistent with KGA MAPs. Addition of a Domestic Well Mitigation Program to be considered by the Cawelo GSA Board, if deemed necessary and appropriate, to assist in offsetting costs for domestic well issues related to dewatering of pumps and/or well screens to the point of significant reduction in production.

Eastside Water Management Area	While it appears that Eastside is protective of dewatering wells, all the minimum thresholds are below historical lows and the impacts of the established minimum thresholds for chronic lowering of groundwater levels on beneficial uses and users are not discussed. Eastside is aware that there are domestic wells within the management area; however, "the full extent and distribution of active domestic wells within the Management Area is currently unknown".	The KGA GSP must describe how the minimum thresholds in the Eastside management area may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	The EWMA will perform a well impact analysis to describe potential impacts to beneficial users. The analysis will artificially drop water levels to the minimum thresholds for RMWs and review potential impacts to ag and domestic wells in an area of influence at each RMW. The EWMA's beneficial users consist primarily of ag/production wells, a number of domestic wells and one municipal well. The EWMA will ensure well information in the analysis includes all current, publicly available data.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s).
Kern Water Bank Management Area	The KGA GSP Kern Water Bank management area can only recover groundwater that has previously been stored minus losses that have been applied. The Kern Water Bank states that "[a]n extensive Mitigation Monitoring Reporting Program (MMRP) has been developed by DWR for the KWB Storage Project that reduces impacts from operations to less-than significant, and undesirable results are not present or are not likely to occur." It is acknowledged that pumping operations can cause lowering of groundwater levels in adjacent areas and threshold water levels have been established in the Joint Operation Plan. The threshold water levels in the Joint Operation Plan are based on DWR KWB Model and a model developed by Rosedale-Rio Bravo Water Storage District. "When the With-Project conditions are fifteen (15) or forty-five (45) feet deeper than the Without-Project conditions at any operative domestic or agricultural well, respectively, and mechanical failure or other operational problems have occurred or are reasonably likely to occur due to declining water levels, mitigation will be provided …" The 15-foot threshold is essentially the point when the projects have had a discernable influence on Domestic/Small Community users. The 45-foot threshold for Agricultural users recognizes the significant economic benefits resulting from higher groundwater elevations provided by the projects through time, and that agricultural wells in the area are completed to greater depths.	While the Department understands the unique circumstances with the Kern Water Bank, compliance with SGMA and the GSP Regulations is still a requirement and while the thresholds established in the Joint Operation Plan are being utilized to meet these requirements, all parts of the GSP Regulations related to the sustainable management criteria must be addressed. The KGS GSP must provide an explanation of how the Join Operation Plan meets the requirements of SGMA and the GSP Regulations. It is also noted that the Joint Operation Plan expired on January 31, 2019. Provide an updated explanation if these thresholds have changes and the latest Joint Operation Plan if applicable.7th	The Joint Operations Plan protects beneficial users impacted by lowered water levels resulting from KWB operations with the 15- and 45-foot triggers. The Plan has been renewed through 2023 and thresholds have not changed. If the Joint Plan is not renewed at some point in the future, the KWB Long-term Plan will take precedence. The KWB can only recover water stored previously, so KWB operations cannot cause a reduction of native groundwater supplies. Therefore, the "threshold" for a reduction of native groundwater supplies for the KWBA is when stored water accounts (less prescribed losses) are zero. The objective of the water quality measures in the KWB MOU is to export more salt than is imported by storage operations and the threshold is to maintain a positive salt balance. The objective of the mitigation measures in the DWR MMRP is to identify and mitigate as necessary potential threats to water quality that may be discovered on KWB lands such that potential impacts will be less-than-significant. The objective of the Pump-in Policy and Improvement District 4 standards is to minimize impacts to water quality in the Cross Valley Canal and Aqueduct and the threshold is to meet these requirements through modifications to recovery pumping if necessary. InSAR and extensometer data indicates inelastic subsidence has not occurred during 27 years of operations. KWBA will continue to monitor both InSAR data and extensometer data and develop thresholds and management actions should inelastic subsidence develop in the Kern Fan area.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). In addition, the Kern Water Bank MOU, which has been negotiated with adjoining groundwater stakeholders, prescribes groundwater quality thresholds.

Kern-Tulare Water District	The management area plan states that chronic lowering of groundwater levels is the major cause of undesirable results for reduction in groundwater storage and land subsidence. Kern-Tulare management area plan utilized historical groundwater level data from 2006 to 2018 for wells perforated at the Santa Margarita Formation and projected out the trendline to 2040. These values ranged from -120 to -190 feet mean sea level. The district then selected -150 feet msl as the minimum threshold for each of the well sites. The lowest groundwater level the management area has experienced is -51.8 feet. The Kern-Tulare management area plan states that "water users within the District are the predominant users of the Santa Margarita Formation" and that minimum thresholds may impact groundwater users within the management area by requiring an overall reduction in groundwater pumping to ensure the minimum threshold is met; however, no discussion is provided describing the impacts to beneficial uses and users.	The KGA GSP must provide an explanation of how minimum thresholds within the Kern-Tulare management area at the monitoring sites are consistent with the requirement to be based on a groundwater elevation indicating a significant and unreasonable depletion of supply at a given location. If the minimum thresholds were not set consistent with levels indicating an undesirable depletion of supply, the thresholds should be revised accordingly. Provide a discussion identifying how the minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	In order to develop the minimum threshold, the District initially started with the lowest water surface elevation experienced historically in the Santa Margarita Formation (SMF) which occurred during the peak of the drought in August 2015 at -52 ft msl. Landowners did not have any significant or unreasonable impacts occur at this level. Next, the District discussed SMCs with the Eastside Water Management Area (EWMA) who are adjacent to and upslope of the District and also rely upon the SMF. EWMA wells are shallower and will go dry before wells in the District. EWMA established minimum thresholds at each individual well site based on the allowance of drawdown to 20% of the saturated water column height above the bottom of the well and was increased on a well-by-well basis to take into account the amount of head above the existing pump intake. EWMA had determined that the minimum threshold required in a representative monitoring well on the eastern border of the District (Well 04) that extracts groundwater out of the SMF should be set at -133 ft msl. Based on landowner feedback and coordination with EWMA, the minimum threshold for groundwater elevation in wells perforated to the SMF was set at -150 ft msl which ranges as a depth to water from about 600 to 830 ft. At this elevation, no agricultural wells perforated to the SMF will go dry. Agricultural users are the only beneficial users of the SMF. The minimum threshold prevents continued lowering of groundwater elevations which may impact agricultural users that do not have access to water supplies other than groundwater. All domestic wells within the District are drilled to depths of less than 700 ft and do not reach the SMF (1800-2400 ft bgs). As shown in Figure 2-17 of the KTWD MAP Basin Setting, groundwater levels in the upper aquifer that supplies the domestic wells are either stable or rising.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s).
North Kern WSD/ Shafter-Wasco ID	The KGA GSP North Kern/Shafter-Wasco management area plan identifies three management areas, two managed by North Kern WSD and the third managed by Shafter-Wasco ID. In looking at Figure 3-2, management area NKWSD-MA-2 does not have minimum thresholds established. A well impact analysis of the equivalent minimum threshold average values (represented as depth to groundwater) for each HZ was used to determine that a portion of the existing wells are impacted to varying extents. Based on results of the well impact analysis, the management area plan states that is can be assumed many wells will remain operational and that water levels can drop without causing undesirable results which cannot be mitigated. Agricultural wells would be mitigated by landowners. While the management area plan states that mitigation to domestic wells would be necessary, there is no mention of who would implement the mitigation effort.	The KGA GSP must establish sustainable management criteria for management area NKWSD-MA-2. The KGA GSP must be revised to explain how minimum thresholds within the North Kern Water Storage District/Shafter-Wasco Irrigation District management area at the monitoring sites are consistent with the requirement to be based on a groundwater elevation indicating a significant and unreasonable depletion of supply at a given location. If the minimum thresholds were not set consistent with levels indicating an undesirable depletion of supply, the thresholds should be revised accordingly. Verify how the subset of wells used in the well impact analysis is representative of wells in the management area. Provide an explanation of the mitigation plan for domestic wells.	North Kern Water Storage District has identified two representative monitoring wells for MA-2 (Rosedale Ranch). A well impact analysis was conducted, MOs and MT were established with consideration for potential impacts to beneficial users and coordination with surrounding RMWs. A description will be provided to explain how the quantity above fresh water is so substantial that depletion of supply is not a significant issue in the Kern County Subbasin and that groundwater levels at the MT are protective of groundwater in storage. In each management area, the quantity of water that exists between March 2020 water levels and MT's will also be calculated, to show the correlation between the water budget and the MT depths. An updated Well Impact Analysis was conducted using DWRs Well Completion Report database. The MAP will be updated with the current analysis that is consistent with assumptions and methodology used by neighboring districts and demonstrate how wells are representative. The Well Impact Analysis was used to determine MOs and MTs for RMWs avoiding significant and unreasonable impacts to municipal wells and mitigated domestic wells. MOs and MTs could be further to reduce the number of other beneficial users impacted and/or better coordinate with surrounding RMWs.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). In addition to using the well impact analysis, setting SMCs for the two new RMWs in RRID included interpolating a coordinated level based on RMW's along a north-south and east-west line. This method included wells from KRGSA, RRB, SWID, and CWD. A coordinated MO and MT was selected. MTs for wells in the southern portion of NKWSD and SWID were raised 50 ft to reduce impacts to beneficial users and to coordinate with neighboring districts. Corresponding MOs were also raised. Through coordination meetings, it was recommended that KRGSA lower the MT by 30 ft. at their nearby wells. Other changes that demonstrate coordination will include: – Adding KGA Exceedance Action Plan as a Management Action – Documenting the methodology used for the Well Impact Analysis is consistent with KGA Member Agencies – Implementing a Domestic Well Mitigation Program as a Management Action

Kern County Water Agency Pioneer GSA Management Area	The Pioneer management area minimum thresholds are "calculated for each representative well by using the difference between the historical maximum and minimum values, calculating 20 percent of that range and subtracting the 20 percent value from the historical minimum value." However, the management area provides no further information or description (e.g., details of the well and pump information) for beneficial uses and users. Based on Table 7-1, it appears the minimum threshold represents a substantial reduction in groundwater levels relative to recent (i.e., 2011-2019) levels, which, at their lowest point, appear to be just over 250 feet below ground surface. Without any further description provided in the management area plan, Department Staff cannot assess whether the minimum thresholds are reasonable and substantially comply with GSP Regulations.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the Pioneer management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels.	1. The Pioneer GSA has calculated and set thresholds to provide operational flexibility and maintain long-term sustainability for the beneficial uses and users of groundwater within its MAP Area. As the sole beneficial user of groundwater in the MAP, the Pioneer Participants were consulted during the GSP development process to ensure thresholds and undesirable results criteria accurately represented the quantitative and qualitative conditions as directed by SGMA regulations. The Pioneer Participants have determined that groundwater level and groundwater storage conditions that would be expected at a MT Trigger would represent undesirable conditions for their normal and sustainable banking operations. These conditions include increased operation costs due to increased energy requirements for pumping deeper water, lowering pumps, and additional operational maintenance requirements. 2. MTs were set in the Pioneer Management Area to allow for an appropriate margin of operational flexibility for the sustainable operation of the Pioneer Project (the sole beneficial use). Through coordination efforts, neighboring GSAs' MTs and MOs were also taken into consideration to ensure protection of nearby beneficial uses and users outside of the Pioneer Management Area (as discussed further in Section 1.5, Existing Water Management Programs). In addition, a spatial analysis of MTs and water level trends was performed to ensure relative consistency between the MTs of the Pioneer Management Area and those set in adjacent management areas, and no conflicts or issues between Pioneer and its neighbors were identified. 3. An analysis of historical groundwater quality and groundwater level data was performed to estimate groundwater quality if groundwater level minimum thresholds were to be reached. Results of the analysis show that no groundwater quality thresholds are expected to be exceeded at the minimum thresholds. This analysis demonstrates that the minimum thresholds will not negatively impact groundwater quality in the Pioneer MAP Area and will not negatively impact Pioneer Project operations (the sole beneficial use). The Pioneer GSA will continue to monitor groundwater levels and groundwater quality to ensure the historically observed trend does not change under future conditions. MTs were set to mitigate the potential for land subsidence by relying on the Pioneer Project's current and historical sustainable management of groundwater levels, noting that no undesirable results with respect to land subsidence have been identified historically and that subsidence elastically responds to groundwater banking operations in the Pioneer Project GSA Area.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). The Pioneer GSA has coordinated with neighboring GSAs (Rosedale-Rio Bravo Water Storage District and the Kern Water Bank Authority) regarding the thresholds; no conflicts or issues were identified. Ongoing coordination with both agencies will continue through the Joint Operating Plan and the Kern Fan Monitoring Committee MOUs (as described in Section 1.5, Existing Water Management Programs). The Pioneer GSA has coordinated with Kern River GSA (KRGSA) regarding the thresholds; no conflict or issues were identified. Ongoing coordination with the KRGSA will continue as described in Section 1.5, Existing Water Management Programs.

Rosedale-Rio Bravo Management Area	Rosedale Rio Bravo conducted an analysis of the economic impacts of continued groundwater lowering, examining the costs for each 25-foot increment of lowering, and concluded that any "additional reinvestment in groundwater facilities [beyond those already experienced] …would be deemed an undesirable result." Therefore, groundwater level thresholds are set at the low point of the last drought. The management area plan states that they would consider an undesirable result to occur if two of either the North, Central, or South of the River Zones exceed their thresholds, or if the threshold was exceeded in any of the South or East Zones. Why thresholds are allowed to be exceeded in one of the North, Central, or South of the River zones without agency considering that to trigger an undesirable result was not adequately explained. Adequate explanation is also lacking regarding whether the triggering of an undesirable result in any of these zones trigger the entire Rosedale Rio Bravo management area to become an undesirable result watch area, or if only the area of the triggering monitoring zone(s) would contribute to the Subbasin-wide tracking of undesirable results.	The KGA GSP must provide clarification regarding why minimum threshold exceedances are allowed to occur in one of the North, Central, or South of the River zones for this management area (i.e., why it takes two of those zones to exceed their threshold before the management area plan considers an undesirable result to have occurred). Describe any projects or management actions that may be implemented if the minimum threshold is exceeded in one of those areas and users are impacted but an undesirable result is not triggered.	RRBMA will include all the monitoring areas into one singular Management Area. While the monitoring areas will remain the **KGA coordinated triggers will be applied to the whole of the RRBMA (MA)**. The monitoring areas are strictly geographical areas that will be utilized to provide the RRBMA with data and information pertaining to each sustainability criteria and the corresponding to unique beneficial uses within each monitoring area. RRBMA conducted additional well impact analysis analyzing the number, percentage, age, and type of wells that would be impacted at a revised MT of 50' and 75' below the low point of the last drought. The MT was revised to approximately 50' below the historical low point considering the number of domestic wells that may require replacement (less than 3). These wells would be mitigated by existing mitigation requirements with the RRBMA or by proposed adaptive management actions (see section 7.5).	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and that maintain groundwater elevations at or above the measurable objectives in each member agency's Management Area. To provide clarity and to better coordinate with neighboring MA's, RRBMA prepared multiple groundwater level and MT cross-sections in the general direction of groundwater flow and crossing multiple MA's. MT's and MO's were compared and adjusted to the projected water levels for consistency across the coordinating MA's. RRBMA coordinated groundwater level MO's and MT's with the following GSA's and MA's: 1. Buena Vista WSD GSA 2. Kern Groundwater Authority GSA a. North Kern Water Storage District b. Shafter Wasco Irrigation District c. 7th Standard Annex d. West Kern Water District e. Pioneer Project 3. Kern River GSA a. Improvement District No. 4
Semitropic GSA	The KGA GSP Semitropic Water Storage District management are plan further divides the management area into three management areas. In comparing the map of the monitoring well sites (Figure 3-1) and Table 3-1 which summarizes the minimum thresholds, Department staff were not able to correlate the two. The management area plan states that there are thresholds for the upper zone wells in Appendix B-3; however, Department staff could not locate this appendix and it is not clear how these thresholds were established, and the location of the monitoring sites assigned these minimum thresholds. A well impact analysis of the equivalent minimum threshold average values (represented as depth to water values) for each HZ was used to determine that a portion of the existing wells are impacted to varying degrees. Based on results of the well impact analysis, the management area plan states that is can be assumed many wells will remain operational and that water levels can drop without causing undesirable results which cannot be mitigated. Agricultural wells would be mitigated by landowners. While the management area plan states that mitigation to domestic wells would be necessary, there is no mention of who would implement the mitigation effort.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the Semitropic Water Storage District management area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly. Reconcile Figure 3-1 and Table 3-1 to utilize the same well naming convention so that Department staff and other interested parties may correlate the two. Verify how the subset of wells used in the well impact analysis is representative of wells in the management area. Provide an explanation of the mitigation plan for domestic wells.	The SWSD MAP utilized a well impact analysis for determination of impacts to beneficial users present in its three management areas for the lowering of groundwater levels. This analysis included the level of impacts at various levels of performance above the MT, including the MO. Additional description and analysis will be presented in the MAP to clearly show levels of impacts to beneficial users from current water levels down through the MO and MT levels. While the SWSD MAP included a thorough analysis of water quality, additional descriptions will be included to show the relationship between water quality and groundwater levels. While the linkage is not as well defined for subsidence, the SWSD MAP will include an expanded discussion, which will also be consistent with the Subbasin wide approach to subsidence. Figure 3-1 and Table 3-1 will be updated as appropriate. Additional descriptions of the well impact analysis will be included to describe the wells used for the well impact analysis and their representation of the wells within the three SWSD GSA management areas. The SWSD GSA is developing a mitigation program, and a complimentary funding program, for the appropriate mitigation of impacts to domestic wells. These will be described in the SWSD MAP.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). RRB: Incorporated comments from RRB as noted: - Edits to Management Action 2 to more closely align with RRB's water budget and charges program - Added additional RMW's to management area adjacent to RRB - Added KGA Exceedance Policy as Management Action - Added Domestic Well Mitigation as Management Action SWID/NK: Discussions regarding beneficial users and well impact analysis BV, Westside, Wheeler, Henry Miller: Coordination regarding development of SMC for subsidence relative to California Aqueduct

SWID 7th Standard Annex	The KGA GSP Shafter-Wasco Irrigation District management area calculates the minimum thresholds for chronic lowering of groundwater levels by "projecting a theoretical future water groundwater elevation based on the assumption that the conditions experienced over the ten-year period 2006-2016 (Spring measurements) continue through 2016 to 2040" at each of the three well sites. The management area plan claims this is done to be consistent with what is being used by surrounding management areas. The management area plan examined the impacts of the minimum thresholds and measurable objectives on wells within the area and determined that there they would potentially experience "excessive dewatering, [but] the impacts would not be unreasonable and would be mitigated through an Impacted Well Mitigation Program." It's unclear if all the wells in the management area were included in this impact analysis.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the Shafter-Wasco Irrigation District Management Area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly.	SWID 7th Standard Annex Management Area will raise the MTs for Chronic Lowering of Groundwater Levels by 50 feet based on coordination with adjacent Management Areas to maintain the MT gradient to be similar to the current groundwater elevation gradient and to reduce risk of creating Undesirable results. The SMC section of the SWID 7th Standard Annex Map ("the MAP") will be reorganized to make it more consistent with the DWR BMPs and Determination Letter. More explicit section headers will be added, including Relationship with Other Sustainability Indicators, Impact to Adjacent Management Areas and Basins, Impact to Beneficial Users, State/Federal/Local Standards, and Measurement of MTs. Some sections will be expanded to better address DWR's comments on the MAP in its Determination Letter. Refinements will be made to standardize language and triggers to match Basin-wide definitions. The MAP will clarify that MTs for Chronic Lowering of Groundwater Levels were set at levels that would avoid depletion of supply that would lead to Undesirable Results. Local Undesirable Results criteria justification will be updated with a well age analysis and an expanded well impact analysis by beneficial user category. The MAP will clarify that the well impact analysis includes all wells within the Management Area, including wells compiled from the stakeholder survey and domestic well information from the DWR database. The Impacted Well Mitigation Program that was considered by SWID landowners and funded in the Proposition 218 in 2019 will be explained to include more details.	The SWID 7th Standard Annex MAP (Section 4.5.2 Public Meetings Summary) documents the direct outreach and coordination efforts with neighboring districts that addressed identified potential conflicts of MT and MT development processes. The MTs within the SWID 7th Standard Annex MAP have been developed in consideration of and in coordination with the MTs established in neighboring water agencies within the Kern Subbasin. The methodology used to develop the MTs is generally consistent with the approach taken in several surrounding Management Areas (i.e., Shafter-Wasco Irrigation District Management Area, Rosedale-Rio Brave Water Storage District, and North Kern Water Storage District Management Area), in that all of the approaches consider historical water level trends, well construction information, and projected groundwater levels. The SWID 7th Standard Annex Management Area raised the MTs and MOs for Chronic Lowering of Groundwater Levels by 50 feet to reduce impacts to beneficial users and to coordinate with adjacent management areas.
Southern San Joaquin MUD	The KGA GSP Southern San Joaquin Municipal Utility District management area, in establishing minimum thresholds for chronic lowering of groundwater levels, the management area was dived into hydrogeologic zones (HZ). A well impact analysis of the equivalent minimum threshold average values (represented as depth to groundwater) for each HZ was used to determine that a portion of the existing wells are impacted to varying extents. Based on results of the well impact analysis, the management area plan states that is can be assumed many wells will remain operational and that water levels can drop without causing undesirable results which cannot be mitigated. Agricultural wells would be mitigated by landowners. While the management area plan states that mitigation to domestic wells would be necessary, there is no mention of who would implement the mitigation effort.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the Southern San Joaquin Municipal Utility District management area, including how they represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating a depletion of supply, the minimum thresholds should be revised accordingly. Verify how the subset of wells used in the well impact analysis is representative of the wells in the management area. Provide an explanation of the mitigation plan for domestic wells.	A description will be provided to explain how MTs represent site-specific levels of depletion that could cause undesirable results and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence will be described. The total number of wells in each Management Area will be estimated using DWRs Well Completion Report database, then compared against the dataset used for the Well Impact Analysis. A statement will be added to explain that the subset of wells in the Well Impact Analysis only included wells with a complete record for construction details. The total number of known well details will be compared against the total well counts in DWR's database. A mitigation plan will be developed prior to submittal to DWR. A new Well Impact Analysis was conducted using DWRs Well Completion Report database, then compared against the dataset used for the original Analysis and Gailey model. There was significant discrepancy between each dataset due to assumptions made to filter data. The MAP will be updated with the current analysis that is consistent with assumptions and methodology used by neighboring districts.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). To better coordinate with neighboring districts, the Southern San Joaquin Municipal Utility District evaluated their MTs with those of neighboring districts to ensure values were consistent. Coordination with neighboring districts determined no recommended MT adjustments. Other changes that demonstrate coordination will include: – Adding KGA Exceedance Policy as a Management Action – Documenting the methodology used for the Well Impact Analysis is consistent with KGA Member Agencies – Implementing a Domestic Well Mitigation Program as a Management Action. While previously listed in their 2020 plan, additional information will be added to provide an explanation of the mitigation plan for domestic wells.

West-Kern Water District	The KGA GSP West Kern Water District management area plan describes it being divided into four management areas (Lake, North Project, South Project, and Western). Department staff note that Figure 1-2 shows an additional management area (Little Santa Maria Valley), and Appendix H consists of a draft GSP for this additional management area. No sustainable management criteria were determined for the Lake management area because the District was unable to procure the groundwater level data for the production wells in the area. No sustainable management criteria were established for the western management area because there is no groundwater usage in the area; however, earlier parts of the management area plan describe groundwater usage in this area as de minimis without further explanation of the type of de minimis users in the area. Due to the draft nature of the material provided for Little Santa Maria Valley, Department staff is unable to review the sustainable management criteria for that portion of the KGA GSP.	The KGA GSP must provide sustainable management criteria for all identified management areas. The minimum thresholds must include a description of the selection of groundwater level minimum thresholds, including how they represent site-specific levels of significant and unreasonable depletion of supply that could cause undesirable results, how they may affect beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels.	1. WKWD has revised categorization of areas within the MAP to match the Subbasin definitions. The WKWD MAP will contain two management areas and three watch areas as follows: – North Project Management Area – South Project Management Area – Lake Watch Area – Western Watch Area – Little Santa Maria Valley Watch Area SMC were already provided for the two management areas. Watch areas have no significant current or planned groundwater use and, therefore, SMC will not be developed for the three watch areas. 2. a. WKWD has determined that groundwater level conditions that would be expected at a MT Trigger would represent undesirable conditions for their normal and sustainable operations. These conditions may include increased operation costs due to increased energy requirements for pumping deeper water, costs to lower pumps, costs to install treatment systems or seek alternate water supplies due to degraded water quality, costs to remedy land subsidence, and/or additional operational maintenance requirements and costs. b. WKWD is the primary beneficial user in the WKWD GSA area. WKWD is the only groundwater user to pump, treat, and distribute water from the WKWD MAP Management Areas. WKWD calculated and set sustainable management criteria to provide operational flexibility and maintain long-term sustainability for the beneficial uses and users of groundwater within its MAP Area. As the primary beneficial user of groundwater in the MAP, WKWD was consulted during the GSP development process to ensure the thresholds and undesirable results criteria accurately represented the quantitative and qualitative conditions as directed by SGMA regulations. Through coordination efforts, neighboring GSAs' MTs and MOs were also taken into consideration to ensure protection of nearby beneficial uses and users outside of the WKWD Management Area. In addition, a spatial analysis of MTs and water level trends was performed to ensure relative consistency between the MTs of the WKWD Management Area and those set in adjacent management areas. c. An analysis of historical groundwater quality and groundwater level data was performed to estimate groundwater quality if groundwater level minimum thresholds were to be reached. This analysis demonstrates that the minimum thresholds will not negatively impact groundwater quality in the WKWD MAP Area and will not negatively impact WKWD operations (the primary beneficial use). The WKWD GSA will continue to monitor groundwater levels and groundwater quality to ensure the historically observed trend does not change under future conditions. Furthermore, groundwater delivered by WKWD for domestic and industrial uses must meet Title 22 drinking water standards. Any groundwater in exceedance of drinking water standards is required to be treated and disinfected to meet such standards. Any degradation of groundwater quality will be identified during required routine water quality monitoring by WKWD would be considered an undesirable result by nature, regardless of groundwater levels.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s). The WKWD GSA has coordinated with neighboring GSAs regarding the thresholds; no conflicts or issues were identified. Ongoing coordination with the other agencies will continue as described in Section 1.5, Existing Water Management Programs.

			MTs in the WKWD MAP Area were set to mitigate the potential for land subsidence, noting that no undesirable results with respect to land subsidence have been identified historically and that subsidence elastically responds to groundwater banking operations in the Kern Fan aquifer. No infrastructure damage relating to land subsidence has been documented in the WKWD MAP area and the potential for future damage to critical infrastructure appears unlikely due to the elastic response of subsidence to groundwater banking operations. No long-term historical subsidence has been documented in the WKWD MAP area and ground surface elevation has risen approximately 0.8 feet over time.	
Westside Districts Water Authority	The KGA GSP Westside District Water Authority (WDWA) management area states that total groundwater demand is 3,000 acre-feet per year due to water quality; therefore, the potential for significant lowering of groundwater levels due to pumping is believed to be minimal. In establishing minimum thresholds, the management area first divided into two sentry coordination zones. There is one minimum threshold established for Sentry Zone #1 and three for Sentry Zone #2. These minimum thresholds are not explained or justified. The established minimum thresholds do not apply for the majority of the management area and the rest of the management area is not being monitoring for water levels. The management area plan states that minimal pumping takes place within the management area due to water quality; however, based on Figure 28a and Figure 28b, subsidence appears to be occurring within the middle of the management area. For this reason, sustainable management criteria must be applied to the entirety of the management area, including the establishment of thresholds and monitoring.	The KGA GSP must explain the selection of groundwater level minimum thresholds for the WDWA management area, including how they represent site-specific levels of depletion that could cause undesirable results, how they may affect the interests of beneficial uses and users of groundwater, and the relationship between this sustainability indicator and other sustainability indicators such as the degradation of groundwater quality and subsidence, both of which can be exacerbated by lowering groundwater levels. If minimum thresholds were not set consistent with levels indicating depletion of supply, the minimum thresholds should be revised accordingly. The larger portion of the management area must establish sustainable management criteria, including the establishment of minimum thresholds and monitoring; otherwise, further evaluation and justification is needed to negate management criteria in this portion of the management area.	Due to naturally occurring poor groundwater quality, groundwater demand is largely limited to use for blending with surface water from the Aqueduct. Further, much of the WDWA is undeveloped range land or is used for oil and gas production with no significant current or planned SGMA related groundwater uses. Based on CV2Sim modeling the most significant change in groundwater levels/storage is attributed to natural under flow from the WDWA towards the axis of the Valley. The WDWA does not control this natural phenomenon. The WDWA has revised categorization of areas within the MAP to coordinate with adjacent Management Areas and match the Subbasin definitions. The revised WDWA MAP will contain a single management area and two Watch Areas as follows: – Lost Hills Watch Area – Southwest Watch Area An Additional Watch Area comprised of KGA Undistricted Lands, that are interspersed within the two aforementioned Watch Areas, will also be included in the revised MAP. Once approved by the KGA Board, the revised SMC will initially include up to three additional monitoring wells (total of six) in the WDWA Management Area. Watch Areas have no significant current or planned SGMA related groundwater use at this time and, therefore, SMC will not be developed for the three Watch Areas (two WDWA, and one Undistricted Lands) unless conditions change. In addition, the MO/MT for RMW 7106-03 which was originally set using only CV2Sim modeling simulations due to a lack of actual groundwater level data. The MO/MT adjusted to reflect recently acquired actual groundwater level data. Prior to making this change the WDWA coordinated with the adjacent water district, Buena Vista Water Storage District and the KGA Board. Two of the new RMWs are the Lerdo Well 7 (35.528925,-119.629831) and the Starrh Well 3-8 (35.419371,-119.633266). This brings the number of RMWs in the WDWA to a total of 5, with a projected sixth RMW under review for inclusion. Potential impacts to beneficial users were assessed through the use of historical WDWA pumping volumes, land use, CASGEM well construction and groundwater level data, the WDWA estimated water budget, and modeling using the CV2Sim hydrogeologic model. Taken together this information indicates that under current and projected conditions impacts to the principal beneficial user should be within planned MOs/MTs and therefore impacts to other users would be de minimis as expected groundwater levels would not constitute an undesirable result. Subsidence was assessed by the WDWA, and the findings were presented to the DWR (CASP) staff on three occasions (January & April 2020 and June 2022). These studies concluded that causes other than agricultural withdrawals, such as oil field activities, are a substantive contributor to subsidence in the WDWA.	KGA Member Agencies have committed to managing groundwater condition using water budgets that avoid groundwater overdraft, where present, and maintains groundwater elevation at or above the measurable objectives in each member agencies management area(s).

Table 2b. KGA Management Area Responses to Deficiency 2, Comment CC to all GSPs

KGA Management Area	Response to Table 2 "cc" groundwater level relationship to each sustainability threshold
DWR Corrective Action (cc): All the GSPs must demonstrate the relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the GSA has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	
Cawelo GSA	• The chronic lowering of groundwater levels MTs are used as a proxy for groundwater storage for the respective RMW. • Based on available data, there is no direct correlation between water levels and trends in water quality within the Cawelo MAP. Therefore, water quality is used as a MT for the degraded water quality SMC to protect beneficial users and uses. • Groundwater level MTs for land subsidence were determined to be lower than the MT for chronic lowering of groundwater level. Therefore, the chronic lowering of groundwater level MTs are protective for land subsidence. • Interconnected surface water and seawater intrusion are not applicable to the Cawelo MAP.
Eastside Water Management Area	• **Groundwater Storage:** The EWMA is using groundwater levels as a proxy for reduction in groundwater storage. Due to data gaps of the deeper aquifers not modeled in the original model and production wells perforated in multiple zones, levels are being used until the basin-wide hydrologic study is completed and will be evaluated for the 2025 GSP update. • **Groundwater Quality:** TDS was selected as a constituent of concern due to the potential to be affected by groundwater pumping increases or decreases in the EWMA. The Santa Margarita Formation and the Olcese Sand contain higher-TDS groundwater at more western locations and at greater depths. Continued pumping potentially could move the "fresh/saline" groundwater interface if not monitored and managed, as necessary. Therefore, the MT was set at 750 mg/L and the MO at 500 mg/L. • **Land Subsidence**: Minimum thresholds for Regional Critical Infrastructure have been established at the subbasin level. No regional critical infrastructure is located within the EWMA, therefore, no Undesirable Results are defined. The EWMA has not proposed any local minimum threshold for management area critical infrastructure. The only critical infrastructure within EMWA are roads, pipelines, and wells and the EWMA is unaware of any costs incurred to replace or repair infrastructure due to subsidence within the EWMA.
Kern Water Bank Management Area	Groundwater levels are not used as a proxy for sustainability thresholds.
Kern-Tulare Water District	• **Groundwater Storage:** The District is using groundwater levels as a proxy for reduction in groundwater storage. The groundwater level minimum thresholds were selected to avoid dewatering the SMF and the District's management actions are focused on pumping at or less than the sustainable yield. The minimum threshold selected ensures the District balances average annual inflows and outflows of groundwater so that a negative change in storage that results in lower groundwater levels does not occur. • **Groundwater Quality:** The District's main groundwater quality concern is that immediately west of the District the SMF becomes saline. Recharge has fed fresh water from the east at a sufficient elevation to exert a westward hydraulic gradient in the SMF maintaining the fresh-saltwater interface along the western border of the District. Over pumping of groundwater beneath the District has the potential to reverse the gradient so that saline water begins to move eastward. Since the groundwater level minimum threshold has been placed below what has historically been experienced and the District knows changes in groundwater elevation differences has the capability to change the groundwater gradient, the District has selected to establish a separate minimum threshold for groundwater quality as TDS < 750 mg/L. The District's management actions aim to balance average annual inflows and outflows of water which reduces the potential for changing the groundwater gradient. • **Land Subsidence**: Minimum thresholds for Regional Critical Infrastructure have been established at the subbasin level. The District has not proposed any local minimum threshold for management area critical infrastructure. The only critical infrastructure on the land surface within the District are roads, pipelines, and wells. Within the District, groundwater elevations have declined historically without creating a loss of functionality due to subsidence. The District is unaware of any costs incurred to replace or repair infrastructure due to subsidence within the District. Even though significant impacts to infrastructure is not anticipated, the District's management actions aim to balance average annual inflows and outflows of water which reduces the potential for additional subsidence related to groundwater production.
North Kern WSD/ Shafter-Wasco ID	Groundwater levels are used as a proxy for groundwater in storage and water quality. Regional Interim SMCs are used land subsidence. • **Groundwater storage** is determined at the Subbasin level. NK-SWID demonstrated that their MTs are set at a depth that is protective of groundwater storage by presenting a summary of average 2020 water levels, median well depth, MO, MT, and base of fresh water. This data is also graphically displayed with the well impact study results. • **Quality** constituents of concern for the Subbasin were evaluated. Effects of water levels declining to the MT were evaluated based on historical data. Trend analysis indicates: o Arsenic is released from pyrites bound in the E-clay, which is prevalent in SWID MA. Highest observed concentrations were 20 ppb between 2010-11, which represents hydrologically wet years and higher water levels. When water levels declined to historic low (2018-19), arsenic levels declined. This is likely because less of the pumped water is in direct contact with the E-clay. o Nitrate in shallow wells increased when water levels reach historic low. While there is a direct correlation, no projects or management actions are proposed through SGMA. The districts intend to coordinate with the Nitrate Management Zone mitigation programs. o TCP is prevalent throughout both Management Areas. There is no relevant correction between water level and contaminant concentration. No SGMA-associated projects are proposed. o Salinity is found to be increasing in most areas. Where recharge basin is present, groundwater downgradient of the basins generally has lower salinity levels than wells that are upgradient. The high-quality source of recharge available to NKWSD and SWID appear to be freshening groundwater. o Throughout the SGMA implementation period, evaluation of groundwater levels and water quality trends will be routinely monitored. If a correlation develops indicating that declining water levels are causing unmitigated impacts to beneficial users, stakeholders will be consulted, and appropriate corrective actions or mitigation will be considered. • **Subsidence** is expected to occur if water levels decline to the MT, estimates indicate that an additional -0.9 to -1.1 feet of subsidence could occur. This estimate is well within the extent value of -3.6 feet during the SGMA implementation period (2040).

Table 2b. KGA Management Area Responses to Deficiency 2, Comment CC to all GSPs

KGA Management Area	Response to Table 2 "cc" groundwater level relationship to each sustainability threshold
DWR Corrective Action (cc): All the GSPs must demonstrate the relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the GSA has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	
Kern County Water Agency Pioneer GSA Management Area	An analysis of historical groundwater quality and groundwater level data was performed to estimate groundwater quality if groundwater level minimum thresholds were to be reached. Results of the analysis show that no groundwater quality thresholds are expected to be exceeded at the minimum thresholds. This analysis demonstrates that the minimum thresholds will not negatively impact groundwater quality in the Pioneer MAP Area and will not negatively impact Pioneer Project operations (the sole beneficial use). The Pioneer GSA will continue to monitor groundwater levels and groundwater quality to ensure the historically observed trend does not change under future conditions. MTs were set to mitigate the potential for land subsidence by relying on the Pioneer Project's current and historical sustainable management of groundwater levels, noting that no undesirable results with respect to land subsidence have been identified historically and that subsidence elastically responds to groundwater banking operations in the Pioneer Project GSA Area.
Rosedale-Rio Bravo Management Area	**Chronic Lowering of Groundwater Levels.** Minimum Thresholds set for monitoring of groundwater levels within the RRBMA are based on historical groundwater conditions less 50 feet as expressed by hydrographs at representative monitoring wells, which levels are coordinated with most of the neighboring Management Areas. The RRBMA seeks to avoid unmitigated impacts that require the replacement of wells caused by chronic lowering of groundwater levels. A detailed well impact analysis was performed to confirm that undesirable results will be avoided. All wells in the RRBMA were evaluated in terms of well depths, screened intervals, age, and drawdown requirements, etc. Should impacts occur, an adaptive management action was developed to repair or replace impacted domestic wells and emergency water supplies will be provided. **Reduction in Groundwater Storage.** The KGA has opted to use water level Minimum Thresholds and Measurable Objectives as a "proxies" for reduction in groundwater storage. The RRBMA Minimum Thresholds set for monitoring of groundwater levels are based on historical groundwater conditions less 50 feet as expressed by hydrographs at representative monitoring wells. The RRBMA seeks to avoid an imbalanced water supply. The RRBMA will coordinate with the water level method until such time as a basin study can be completed and volumetric methodologies adopted. However, RRBMA will also calculate annually the amount of groundwater in storage above the Minimum Threshold using its groundwater model for planning purposes. The RRBMA will calculate annual numerical model generated volumes in storage within the groundwater basin and a check-book balance, and will seek to keep both above 0 acre-feet in storage. **Degraded Water Quality**. Minimum Thresholds for degradation of water quality are based on water quality MCL's for KGA identified Constituents of Concern (COC's) for beneficial user groups. The Minimum Thresholds were set at greater than the current MCL, or an observed increase of 10% over the 2015-2020 value. The RRBMA seeks to avoid operations that cause KGA identified COC's to rise above the MCL thus limiting beneficial use or requiring well head treatment by domestic, municipal, and banking wells. COC's such as Nitrate and Arsenic appear to be somewhat connected to water levels, therefore water levels do somewhat provide a secondary proxy for degraded water quality. The RRBMA chose not to rely solely on water levels as the primary evaluation metric and opted to assign actual Minimum Thresholds for each COC at several representative monitoring wells. This method will help the RRBMA to ensure that groundwater level MTs are appropriate for degraded water quality. **Land Subsidence**. A Subbasin-wide approach is now being developed to set Minimum Thresholds for regional land subsidence. This approach is intended to be protective of regional critical infrastructure throughout the Subbasin, which the Subbasin has determined to be the California Aqueduct and the Friant-Kern Canal in areas outside of the RRBMA. The RRBMA seeks to avoid groundwater recovery created subsidence that will impact Management Area critical infrastructure requiring unscheduled retrofitting or replacement within and adjacent to the RBMA. The interim Minimum Threshold set for RRBMA subsidence, is 0.1 ft/year over a five-year rolling average. This was based on historical trends that did not result in impacts to critical infrastructure within the RRBMA, as expressed at several locations in proximity to groundwater pumping and other identified critical infrastructure within the RRBMA. Recent rates of subsidence within the RRBMA (2015-2021) were unaffected by large variations in depths to groundwater during that time. The RRBMA chose specific Minimum Thresholds for land subsidence in order to monitor subsidence independent of groundwater levels in order to help ensure that groundwater level MTs are appropriate measurements for subsidence.
Semitropic GSA	The primary minimum threshold for the SWSD GSA, based upon the well impact analysis and consultation with SWSD GSA Beneficial Users, is Chronic Lowering of Groundwater Levels. In accordance with §354.28 (d), the SWSD GSA minimum thresholds for chronic lowering of groundwater levels are used as a proxy for reduction of groundwater storage, and degraded groundwater water quality. **Relationship of Groundwater Levels and Reduction of Groundwater Storage:** Although groundwater storage and capacity in the Subbasin is plentiful, it becomes uneconomical to obtain groundwater at certain depths. Therefore, the SWSD GSA has elected to maintain approximately 10-years of groundwater storage (by volume) above the minimum threshold for groundwater elevation to manage a 10-year operational drought, similar to the 2006-2016 historical period. **Relationship of Groundwater Levels and Degraded Water Quality:** With respect to water quality, changes in groundwater levels can cause changes in water quality. However, as discussed in Section 2.3.5 water quality within the SWSD GSA is not significantly affected by changes in groundwater levels above the minimum thresholds for chronic lower of groundwater levels. And since there are no anticipated changes in water quality from fluctuations of groundwater levels above the minimum threshold values, groundwater elevation minimum thresholds serve as the appropriate proxy for water quality.
SWID 7th Standard Annex	MTs for Chronic Lowering of Groundwater Levels are set at levels that would avoid a depletion of supply that may lead to URs. MTs consider historical groundwater level trends based on the assumption that the conditions experienced over the ten-year period 2006-2016 continue from 2016 through 2040. A well impact analysis of all wells within the Management Area was conducted that showed that the proposed MTs could potentially cause bottom of well screen dewatered in 26% of wells within the Management Area (including 12% of agricultural and industrial wells, 56% of domestic wells, and 0% of municipal wells). A Well Dewatering Mitigation Program (Section 17.1.6 of the MAP) addresses wells impacted by Chronic Lowering of Groundwater Levels before water levels reach MO or MT, including agricultural and domestic supply wells. Groundwater levels will be measured in each of the three RMWs semiannually and will be analyzed for trends. Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage are directly, if not linearly, related. To demonstrate that the Minimum Thresholds for Chronic Lowering of Groundwater Levels are sufficiently protective, a calculation was performed to determine the fraction of total usable groundwater storage that would be removed from the Principal Aquifer if groundwater levels were to decline from current (Spring 2016) levels to their respective Minimum Thresholds for Chronic Lowering of Groundwater Level. This volume is then compared to the volume of usable storage, and it is shown that the usable storage is substantially greater, and therefore the Minimum Thresholds for Chronic Lowering of Groundwater Levels are protective for the Reduction of Groundwater Storage Sustainability Indicator. Because hydrogeologic storage properties and the MA Plan area are constant when looking at the change in storage (Change in Storage = MA Plan Area * Storage Coefficient * Change in Saturated Thickness), the following analysis is presented in terms of saturated thickness, which is mathematically equivalent to storage volume. The change in saturated thickness from current (Spring 2016) groundwater elevations (13.7 ft msl) to the Chronic Lowering of Groundwater Levels MTs (-87 ft msl) is approximately 101 ft. The total usable groundwater storage is calculated to be 624 ft of saturated thickness within the Management Area based on current groundwater elevations and the deepest groundwater extractions from well construction information (-710 ft msl) within the MA Plan Area plus 100 ft reserve for well pumping operations. Therefore, the reduction in usable storage volume if groundwater levels were to decline to the MTs amounts to 16%. As described in detail in Section 13.2, because volume of usable groundwater storage can be represented by changes in groundwater elevations and the amount of recoverable storage is substantially greater than the volume associated with a reduction in groundwater levels to the MTs for Chronic Lowering of Groundwater Levels, those MTs are considered protective for the Reduction of Groundwater Storage Sustainability Indicator.

Table 2b. KGA Management Area Responses to Deficiency 2, Comment CC to all GSPs

KGA Management Area	Response to Table 2 "cc" groundwater level relationship to each sustainability threshold
DWR Corrective Action (cc): All the GSPs must demonstrate the relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the GSA has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.	
	There is no apparent correlation between groundwater elevations and water quality measurements based on the historical data, with the exception of a suspected correlation between groundwater levels and arsenic concentration and at the base of fresh water defined by Page (1973). The base of fresh water is well below the MT for Chronic Lowering of Groundwater Levels. The storage associated with the MT is approximately 4.5% of the storage associated with the base of fresh water. Therefore, the MT for Chronic Lowering of Groundwater Levels is conservative and protective to water quality within the Management Area, and the MTs are not expected to exacerbate water quality issues. No direct correlation can be discerned between water levels and Land Subsidence measurements within the Management Area at this time as little to no subsidence has occurred within the Management Area based on available data and the lack of Corcoran clay suggests that the risk continues to be small. It should be noted that there is no Regional Critical Infrastructure within the 7th Standard Annex Management Area. Both Seawater Intrusion and Interconnected Surface Water are not applicable to the Management Area.
Southern San Joaquin MUD	Groundwater levels are used as a proxy for groundwater in storage, water quality, and subsidence. • **Groundwater storage** is determined at the Subbasin level. SSJMUD demonstrated that their MTs are set at a depth that is protective of groundwater storage by presenting a summary of average 2020 water levels, median well depth, MO, MT, and base of fresh water. This data is also graphically displayed with the well impact study results. • **Quality** constituents of concern for the Subbasin were evaluated. Effects of water levels declining to the MT were evaluated based on historical data. Trend analysis indicates: o Arsenic is released from pyrites bound in the E-clay, which is prevalent in the SSJMUD management area. Prevalence is largely correlated to well construction. When wells are constructed in an area without E-clay, results show moderate, stable arsenic concentrations and are not impacted by fluctuating water level. o Nitrate in shallow wells increased when water levels reach historic low. While there is a direct correlation, no projects or management actions are proposed through SGMA. The districts intend to coordinate with the Nitrate Management Zone mitigation programs. o TCP is prevalent throughout the SSJMUD Management Area. There is no relevant correlation between water level and contaminant concentration. o Salinity is found to be increasing in most areas. Although there are no spreading grounds currently in SSJMUD Management Areas, evaluation of sodium levels in other parts of the Subbasin have shown wells located downstream of spreading show lower sodium levels and decreasing trends. This indicates spreading grounds are diluting salinity in portions of the basin with higher sodium levels. SSJMUD is actively construction recharge basin, which are expected to be fully implemented in early 2023. Salinity management will be further addressed through the Salt Control Program, which began collecting fees in 2021 to support the Prioritization and Optimization Study that began in 2022. o Throughout the SGMA implementation period, evaluation of groundwater levels and water quality trends will be routinely monitored. If a correlation develops indicating that declining water levels are causing unmitigated impacts to beneficial users, stakeholders will be consulted, and appropriate corrective actions or mitigation will be considered. • **Subsidence** is expected to occur if water levels decline to the MT. Work is still in-progress to estimate the inches of inelastic subsidence that could be caused by water levels intermittently declining to the MT.
West-Kern Water District	An analysis of historical groundwater quality and groundwater level data was performed to estimate groundwater quality if groundwater level minimum thresholds were to be reached. Results of the analysis show that no groundwater quality thresholds are expected to be exceeded at the minimum thresholds. This analysis demonstrates that the minimum thresholds will not negatively impact groundwater quality in the WKWD MAP Area and will not negatively impact WKWD operations (the sole beneficial use). The WKWD GSA will continue to monitor groundwater levels and groundwater quality to ensure the historically observed trend does not change under future conditions. MTs were set to mitigate the potential for land subsidence by relying on the WKWD's current and historical sustainable management of groundwater levels, noting that no undesirable results with respect to land subsidence have been identified historically and that subsidence elastically responds to groundwater banking operations in the WKWD GSA Area in areas where groundwater production occur.
Westside Districts Water Authority	**Chronic Lowering of Groundwater Levels.** Due to naturally occurring poor groundwater quality, groundwater demand (i.e., 3,000-5,000 AFY) is largely limited to use for blending with surface water from the aqueduct. Further, much of the WDWA is undeveloped rangeland, or is used for oil and gas production with no significant current or planned groundwater uses. The WDWA has no control over oil and gas activities. The WDWA has revised categorization of areas within its management area to coordinate with adjacent management areas and match subbasin definitions. The revised WDWA will contain a single management area and two watch areas as follows. Lost Hills Watch Area (approximately 33,191 acres) and Southwest Watch Area (approximately 48,739 acres). The watch areas include non-cultivated lands, areas adjacent to former or active oilfields and open rangeland. **Reduction in Groundwater Storage.** Due to naturally occurring poor groundwater quality, groundwater demand (i.e., 3,000-5,000 AFY) is largely limited to use for blending with surface water from the aqueduct. SGMA-related groundwater extraction de minimis when compared to natural underflow. Based on CV2Sim modeling, the principal factor (approximately 111,000 AFY) affecting change in groundwater storage is natural underflow toward the axis of the valley. To further monitor for changes in groundwater storage, the WDWA will utilize data from representative monitoring wells and the planned update to the CV2Sim model. Representative monitoring well Minimum Thresholds are set above historic low groundwater levels. **Degraded Water Quality.** An analysis of historical groundwater quality has determined that groundwater quality within the WDWA is naturally degraded due to the presence of marine sediments and saline connate water. The WDWA therefore relies on surface water as its primary water source. As a result, the WDWA typically utilizes groundwater (i.e., 3,000-5,000 AFY) for the purpose of blending when surface water deliveries are low. **Subsidence.** Two recent studies conducted by the WDWA and KGA indicate that current rates of subsidence within the WDWA and adjacent to Regional Critical Infrastructure are attributable to oilfield activities. The WDWA has no control over oil and gas activities.

This Page Left Blank Intentionally

To identify beneficial users, all KGA Management Areas used a Well Impact Study to identify beneficial uses and users within each management area that reflects the types of users that actively rely on local groundwater resources and those that can be directly affected by groundwater management, impacts of operating at proposed Measurable Objectives (MO), and impacts of exceeding Minimum Thresholds (MT). Each MAP provides the details of the data and methodology applied to the Well Impact Study specific to that management area and identifies an estimate of potential impacts to beneficial users (in terms of dewatered wells) if groundwater elevations reach the MO and MT in the management area. Table 3a provides a tabular summary and Figure 4a shows a graphic summary of the number of wells for each beneficial use category (M-municipal, D-domestic, A-agricultural) and the potential impact to each category as a percent of wells that could be dewatered at the measurable objective. Table 3b shows a tabular summary of Figure 4b shows a graphic summary of the percent of wells that could be dewatered at the minimum threshold.

Table 3a. Tabular Summary of Wells Potentially Dewatered at the Measurable Objective

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	0	0	0%
EWMA	2	11	41	24%	0	0	0	0%
NK	1	22	161	13%	0	0	2	0%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	0	0	0%
SWID	16	68	118	42%	0	8	7	10%
SSJMUD	19	67	243	26%	0	13	11	15%
SWSD	4	138	763	16%	0	10	4	7%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	2	0	18%
Total	81	577	1827	26%	0	33	24	5%

0 Municipal wells going dry at the MT's

Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M= Municipal, D= Domestic, and A=Agricultural

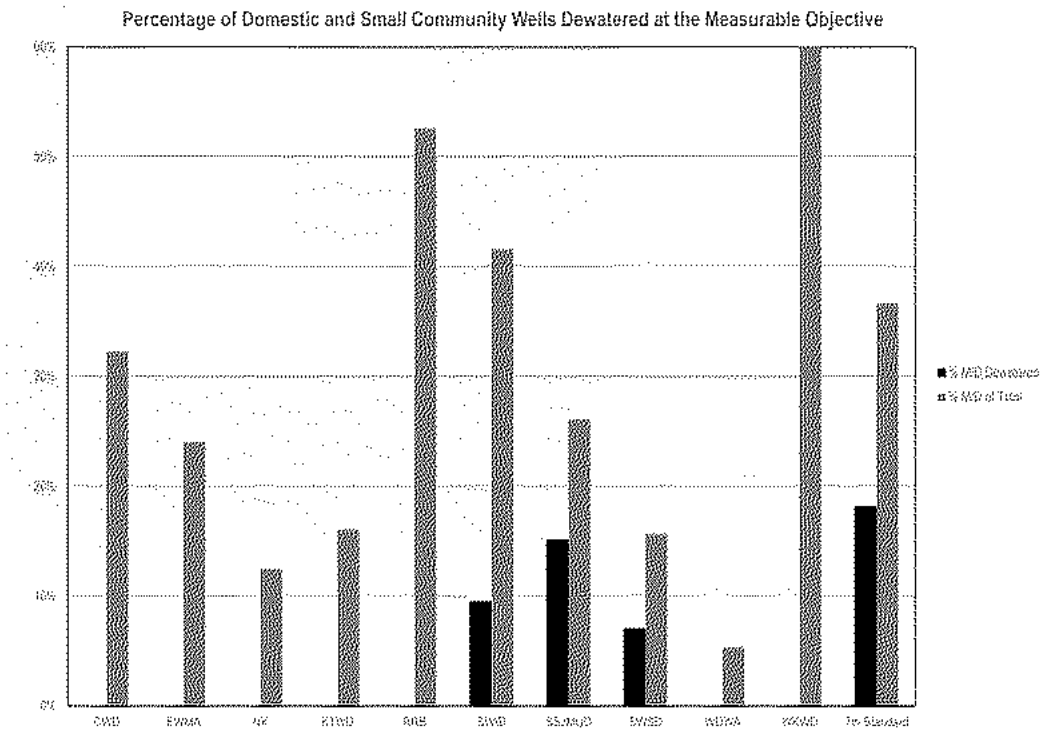


Figure 4a. Graphic Summary of Wells Potentially Dewatered at the Measurable Objective

Table 3b. Tabular Summary of Wells Potentially Dewatered at the Minimum Threshold

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	3	1	3%
EWMA	2	11	41	24%	0	3	0	23%
NK	1	22	161	13%	0	2	5	9%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	21	0	12%
SWID	16	68	118	42%	0	22	13	26%
SSJMUD	19	67	243	26%	0	29	25	34%
SWSD	4	138	763	16%	0	41	52	29%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	5	2	45%
Total	81	577	1827	26%	0	126	98	19%

0 Municipal wells going dry at the MT's

Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M= Municipal, D= Domestic, and A=Agricultural

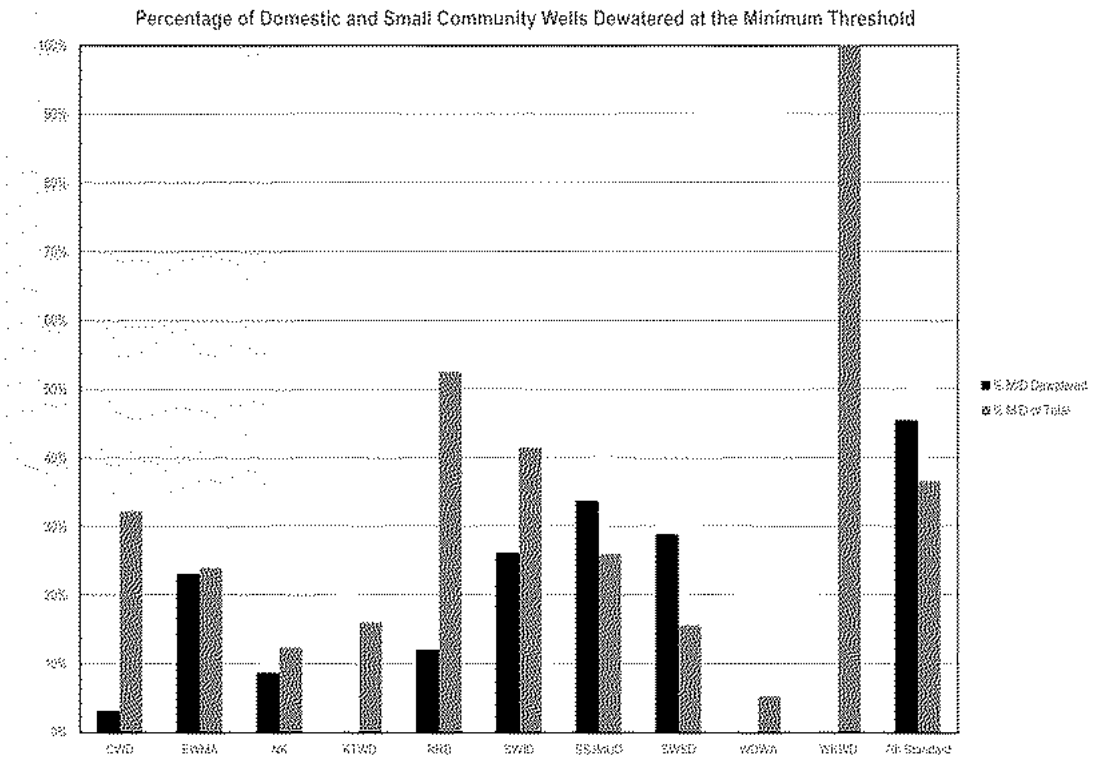


Figure 4b. Graphic Summary of Wells Potentially Dewatered at the Minimum Threshold

Interests of Beneficial Uses and Users

Effects caused by groundwater management are defined in Section 3.4, Undesirable Results. The Subbasin is trying to avoid widespread occurrence of groundwater levels declining below the minimum thresholds, which indicates the Subbasin is not sustainably managing groundwater conditions in the aggregate and that beneficial users could be affected on a spatial and temporal scale that it too substantial to mitigate. If groundwater levels approach the minimum threshold, isolated exceedances will likely occur and is expected to progressively occur in multiple wells if there is no intervention. To avoid a widespread occurrence of MT exceedances, the KGA established an *Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater*, which is a proactive approach to identifying and working with management areas to address a single, isolated exceedance. If intervention at a single MT exceedance is unsuccessful, a Management Area Exceedance may be triggered, which could trigger a Subbasin-wide undesirable result.

The minimum thresholds established for Chronic Lowering of Groundwater Levels are used by many management areas as a proxy for Reduction in Groundwater Storage and Degraded Water Quality (where applicable), and in a few instances Land Subsidence. Table 4 shows the measurable objective and minimum threshold for each KGA regional monitoring wells, indicates whether the groundwater elevation is used as a proxy for other sustainability indicators, and defines the trigger for a management area exceedance for each sustainability indicator. This table also shows the

management area trigger reported in the 2020 GSP submittal and the changes that have been made to better coordinate and make consistent management area triggers. Note that the table below is a summary of the management area triggers and detailed information about the analysis to set those triggers are located in the management area plans.

Table 4. Summary of KGA RMWs with SMCs and Trigger to a Management Area Exceedance

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Cawelo GSA		Well 12H	RMW-167	25	ft msl	103	ft msl	X		X	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA fall below the MT during three (3) successive spring measurements.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA fall below the MT during three (3) successive spring measurements.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA have TDS concentrations going above the MT for two continuous years.~~ A management area exceedance is considered to occur when more than 40% of representative monitoring wells used to monitor TDS concentrations exceed their minimum thresholds for two consecutive annual monitoring periods.	Since groundwater elevations below historical lows may lead to localized land subsidence undesirable results, the exceedance of the land subsidence MT at a single representative monitoring well will be considered a management area exceedance.
		Well 24R	RMW-170	-43	ft msl	35	ft msl	X		X				
		Well 11M	RMW-171	-81	ft msl	3	ft msl	X		X				
		Well 6C	RMW-172	-85	ft msl	-1	ft msl	X		X				
		Well 33C	RMW-173	-64	ft msl	20	ft msl	X		X				
		Well 28L	RMW-169	26	ft msl	110	ft msl	X		X				
		Well 4R	RMW-168	-24	ft msl	60	ft msl	X		X				
Eastside Water Management Authority		EWMA #04 *(added July 2020)*	RMW-283	-133.21	ft msl	87.79	ft msl	X			~~Measurement of water levels below minimum thresholds, in four (4) consecutive semiannual monitoring periods, in no less than 50% of the Representative monitoring network wells, rounded down to the nearest whole number, i.e., four (4) wells. (Sec 12.1.2)~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Same as GW levels criteria (Sec 12.2.2)~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Chronic lowering of groundwater levels or changes in storage may potentially draw saline water into the area of groundwater production in these units in the EWMA, thus monitoring for TDS will be necessary to foresee and avoid Undesirable Results related to degradation of groundwater quality. (Sec 12.4).	There have been no known occurrences of significant (i.e., magnitude more than one foot) land subsidence within the EWMA (Figure GWC-4) and no observed negative effects. Since no "critical infrastructure" are located within the EWMA, no Undesirable Results are defined within the EWMA.. (Sec 12.5.3)
		EWMA #21	RMW-185	-110	ft msl	136	ft msl	X						
		EWMA #23	RMW-278	-71	ft msl	132	ft msl	X						
		EWMA #30	RMW-187	-228	ft msl	-71	ft msl	X						
		EWMA #10 *(added July 2020)*	RMW-280	-43	ft msl	175.8	ft msl	X						
		EWMA #41	RMW-189	-41	ft msl	230	ft msl	X						
		EWMA #49 *(added April 2022)*	RMW-	312.0	ft msl	381.9	ft msl	X						
Kern-Tulare Water District		Well 4P1	RMW-175	-150	ft msl	20	ft msl	X			~~An Undesirable Result for the KTWD would be lowering the groundwater levels to the extent that the minimum threshold for groundwater levels are exceeded in 30% of the monitoring wells located within the District. The 30% criteria was chosen to be consistent with criteria used throughout the Kern Subbasin.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Undesirable Result and Minimum Threshold for reduction of groundwater storage shall be the same threshold associated with chronic lowering of groundwater levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	A management area exceedance is triggered when the MT for groundwater quality is exceeded in 40% or more of any representative monitoring wells within the management area. KTWD believes that the main constituent of concern associated with the chronic lowering of groundwater levels is TDS. Immediately west of the District, the Santa Margarita Formation becomes saline. The District has established a minimum threshold for TDS as 750 mg/L.	KTWD has not established any management area critical infrastructure. The District is unaware of any loss of functionality or incurred costs to replace or repair infrastructure due to subsidence within the District.
		Well 20C1	RMW-176	-150	ft msl	20	ft msl	X						
		Well 15P1	RMW-177	-150	ft msl	20	ft msl	X						
		Well 24Q1	RMW-178	-150	ft msl	20	ft msl	X						
		Well 32M1	RMW-179	-150	ft msl	20	ft msl	X						
		Well 8L1	RMW-180	-150	ft msl	20	ft msl	X						

Table 4. Summary of KGA RMWs with SMCs and Trigger to a Management Area Exceedance

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Minimum Threshold		Measurable Objective		Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
				Value	Unit	Value	Unit							
Rosedale-Rio Bravo Management Area		1 Bushnell	RMW-050	-33.1	ft msl	48	ft msl	X			~~The RBMA will seek to maintain at least two water level monitoring points for each monitoring zone. To the extent that average water levels in of designated monitoring points has exceeded the minimum threshold of the monitoring zone, it will be considered an undesirable result. To the extent that two of the North, Central, and South of River zones exceed this criterion, the RBMA will consider it an undesirable result. To the extent that either the South or East zones exceed this criterion, the RBMA will consider it an undesirable result.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Minimum Threshold for the RRB MA groundwater storage as calculated by its cumulative balance (Appendix D) will be 0 AF and its Measurable Objective is 663,000 AF. The storage level with respect to the calculated water surface calculations will assume the level Minimum Threshold to be 0.~~ The RRBMA will coordinate with the other KGA MAP's and utilize groundwater levels as a proxy until such time as a basin study can be completed and volumetric methodologies are adopted. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Measurable Objective will be any applicable beneficial use COC value that is less than the MCL and a value increase less than 10 percent of the 2015-2020 value. An undesirable result will exist if any applicable beneficial use COC value that is greater that the current MCL and value increase of greater than 10 percent from the 2015-2020 value.~~ A Management Area exceedance is triggered when groundwater quality rises above the established minimum threshold in 40% or more of any representative monitoring wells within the respective Management Area over two-consecutive annual SGMA required monitoring events.	~~Until a regional program is developed, a threshold of 2 feet will be assigned given that there is not a history of subsidence in the RBMA. A measurable objective of less than 1 foot will be assigned and a 2030 milestone of less than 1.5 feet will be assigned.~~ A Management Area exceedance is triggered when the average measured subsidence rate at the representative monitoring sites exceeds the established minimum threshold over a six-year rolling average.
		3 L.R. Stout	RMW-052	-2.7	ft msl	78	ft msl	X						
		5 RBG School	RMW-053	3.5	ft msl	85	ft msl	X						
		18 Cauzza	RMW-057	8.3	ft msl	82	ft msl	X						
		6 P. Enns Domestic	RMW-054	41.9	ft msl	116	ft msl	X						
		16 Section 18	RMW-055	16.0	ft msl	90	ft msl	X						
		17 Blacco HQ	RMW-056	9.0	ft msl	83	ft msl	X						
		19 Parsons	RMW-058	28.3	ft msl	127	ft msl	X						
		20 West I-5	RMW-059	44.0	ft msl	143	ft msl	X						
		22 Virgil Bussell	RMW-060	49.0	ft msl	148	ft msl	X						
		27N_Mayer	RMW-061a	55.0	ft msl	154	ft msl	X						
		30 Enos	RMW-062a	69.0	ft msl	168	ft msl	X						
		9 Chet Reed	RMW-063	101.0	ft msl	209	ft msl	X						
		13 Home Place	RMW-064	86.4	ft msl	196	ft msl	X						
		32 Greeley	RMW-065a	84.0	ft msl	192	ft msl	X						
		36 Harvest Ranch	RMW-066	91.0	ft msl	199	ft msl	X						
		37 RRBWSD Shop	RMW-067a	107.0	ft msl	215	ft msl	X						
		28J Triple	RMW-068b	129.0	ft msl	196	ft msl	X						
		32N Triple	RMW-068a	127.0	ft msl	189	ft msl	X						
		Frito Lay	RMW-?						X					
		Brock South	RMW-?						X					
		Nord Road Water	RMW-?						X					
		I-5 and Stockdale Hwy	RMP-?					X		X				
		Stockdale Hwy and Hwy 43	RMP-?					X		X				
		Allen Road and Hwy 58	RMP-?					X		X				
		Hwy 58 and Hwy 43	RMP-?					X		X				
		Hwy 43 and 7th Standard Rd	RMP-?					X		X				

Table 4. Summary of KGA RMWs with SMCs and Trigger to a Management Area Exceedance

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Semitropic WSD GSA	MA-2 Buttonwillow	S-02	RMW-119	-200	ft msl	-127	ft msl	X	X		~~Within the Semitropic GSA, a management area will be considered an undesirable result watch area when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Within the Semitropic GSA, a management area will be considered an undesirable result watch area for reduction in groundwater storage when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since water elevations serve as a proxy for reduction of groundwater storage.~~ Groundwater levels are used as a proxy for storage. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Within the Semitropic GSA, a management area will be considered an undesirable result watch area for degraded water quality when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since groundwater levels serve as a proxy for degraded water quality.~~ Groundwater levels are used as a proxy for water quality. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Semitropic has identified land subsidence as a data gap. The SWSD GSA has not historically experienced impacts to local infrastructure from the levels of subsidence historically experienced. As such no minimum thresholds for local infrastructure are established for land subsidence at this time.
		S-04	RMW-121	-144	ft msl	-76	ft msl	X	X					
		S-05	RMW-122	-242	ft msl	-161	ft msl	X	X					
		S-1 (added February 2020)	RMW-277	-165	ft msl	-80	ft msl	X	X					
		948L02 Cluster 1 of 2	RMW-139	-180	ft msl	-101	ft msl	X	X					
	MA-3 Undeveloped	S-11	RMW-130	-258	ft msl	-195	ft msl	X	X					
		S-12	RMW-131	-264	ft msl	-194	ft msl	X	X					
	MA-1 Pond-Poso	S-06	RMW-123	-306	ft msl	-209	ft msl	X	X					
		S-09A Cluster 1 of 2	RMW-128	-227	ft msl	-146	ft msl	X	X					
		S-13A Cluster 1 of 2	RMW-132	-371	ft msl	-269	ft msl	X	X					
		S-14B Cluster 2 of 2	RMW-135	-335	ft msl	-233	ft msl	X	X					
		26S-23E-15A1	RMW-137	-345	ft msl	-244	ft msl	X	X					
		S-8A Cluster 1 of 2	RMW-126	-331	ft msl	-229	ft msl	X	X					
Westside Districts Water Authority		S#14 (added November 2020)	RMW-279	150	ft msl	200	ft msl	X			~~There has been little historical pumping for irrigation in the interior areas of the WDWA due to naturally degrade ground water. The WDWA maintains two sentry coordination zones with adjacent groundwater management areas to the east and will expand its network of monitor wells as part of PMA #1. An undesirable result is identified if a sentry zone records a measured GW level falls below its MT over three consecutive monitor events.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~See response to Lowering of GW Levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Water quality in the WDWA is known to be naturally degraded due to local geology. As a result over 95% of water used in the WDWA is surface water.	Land subsidence is an identified data gap, as such interim MOs/ MTs have been identified for regional critical infrastructure and associated management area infrastructure pursuant to the Basin-wide coordinated GSP subsidence plan. The interim MOs/MTs are valid until 2025 at which time they may be updated based on additional data. Areas of InSAR identified subsidence in the WDWA include the Lost Hills and Belridge oilfields. Recent subsidence studies by the WDWA to assess impacts to the Aqueduct (MP 195-215) have identified sources other than agricultural pumping as the likely primary cause. This material was shared with the subsidence experts within the DWR in early 2020 subsequent to GSP submittal. The WDWA is coordinating with adjacent water districts to assess interim MOs/MTs pending acquiring additional subsidence data as described in the KGA GSP Subsidence Management Plan.
		7108-66 (added March 2020)	RMW-275	-115	ft msl	-62	ft msl	X						
		7106-63	RMW-203	59	ft msl	101	ft msl	X						

Deficiency 3 The Plan's Land Subsidence Sustainable Management Criteria do not Satisfy the Requirements of SGMA and the GSP Regulations

In the review of the Plan, DWR staff indicated as deficiency #3 that the Subbasin does not have a "basin wide coordinated GSP subsidence monitoring plan" nor any coordinated Subbasin wide subsidence sustainable management criteria or assessment of critical infrastructure that would be susceptible to substantial interference from future subsidence. The DWR staff is correct that when the original Plan was developed the Subbasin realized that the data gaps to establish and set a monitoring plan for subsidence would not have been based on scientific and defensible data and submitted the Plan indicating just that. Since then, the Subbasin has been very active in having studies completed to assist in having the scientific and defensible data in preparation for the 2025 update but since DWR now has indicated subsidence as a deficiency, the Subbasin has been engaged to achieve the setting of interim sustainable management criteria.

DWR staff recommended the following corrective actions:

1. *The Subbasin's GSAs should coordinate and collectively satisfy the requirements of SGMA and the GSP Regulations to develop the sustainable management criteria for land subsidence.*
2. *The Plan should identify the rate and extent of subsidence corresponding with substantial interference that will serve as the minimum threshold or should thoroughly demonstrate that another metric can serve as a proxy for that rate and extent.*
3. *If land subsidence is not applicable to parts of the Subbasin, the GSP must provide supported justification of such. The supporting information must be sufficiently detailed and the analyses sufficiently thorough and reasonable and must be supported by the best available information and best available science.*

In the 2020 GSPs submittals, the Kern Subbasin coordinated definition for a basin-wide undesirable result for land subsidence is:

> *The point at which significant and unreasonable impacts, as determined by a subsidence rate and extent in the basin, that affects the surface land uses or critical infrastructure.*
>
> *This is determined when subsidence results in significant and unreasonable impacts to critical infrastructure as indicated by monitoring points established by a basin wide coordinated GSP subsidence monitoring plan.*

From the weekly GSA/KGA meetings, the Kern Subbasin worked collaboratively to respond to the DWR deficiency as it relates to subsidence but maintaining the definition of the basin-wide undesirable results due to the diverse and complexity of the subbasin. However, the Kern Subbasin did further identify the occurrence of a single minimum threshold exceedance along either the Aqueduct or the Friant-Kern Canal as an undesirable result with a call-to action for the GSAs/KGA to investigate the exceedance and to address the causation of the exceedance.

Due to the size, diverse and complexity of the subbasin, the Kern Subbasin coordinated and collectively defined infrastructure as:

Regional Critical Infrastructure is defined as infrastructure located within the Subbasin that serves multiple areas of the Subbasin and whose loss of significant functionality due to inelastic subsidence, if caused by SGMA related Subbasin groundwater extractions, would have significant impacts to beneficial users. The Subbasin has collectively determined that the only infrastructure that meets the definition for Regional Critical Infrastructure are the California Aqueduct and the Friant-Kern Canal, refer to Figure 5.

Management Area Critical Infrastructure is defined as infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by SGMA related Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area. Each Subbasin Management Area has identified their respective Management Area Critical Infrastructure in their Management Area Plan or individual GSP.

Relying on the studies that were completed after the submittal of the Plan on January 31, 2020, but before the deadline per the DWR determination letter of July 27, 2022, the Subbasin was able to work with the California Aqueduct Subsidence Project team (CASP) and presented those results of those studies as well as having an opportunity to present to the DWR SGMA staff. From both of those meetings, the Subbasin developed and finalized two white papers, one for the California Aqueduct and one for the Friant-Kern Canal. Both white papers provided methodology used to set interim sustainable management criteria for the two Regional Critical infrastructure that will be revised in the 2025 update of the Plan. The Subbasin is committed to continue to explore scientific and defensible data to achieve a comprehensive understanding of the root causation of subsidence in the Subbasin.

In the meeting with DWR SGMA staff, they understood the data that was provided by the Kern Subbasin and appreciated the challenge of setting sustainable management criteria in the face of the existing data gaps. However, DWR stated that substantial compliance with the requirements of SGMA requires the development of sustainable management criteria however DWR staff stated that the setting of the sustainable management criteria can include caveats while the Kern Subbasin continues to move forward on studies that will provide scientific and defensible data to include in the 2025 update. Those caveats suggested were:

- The sustainable management criteria can be interim, will only be valid until 2025, and will be updated in the 2025 Plan update
- Due to the complexity of the Kern Subbasin, setting an interim SMC for subsidence, does not require GSAs take responsibility, manage, regulate or otherwise be liable for impacts resulting from actions outside the authority of the GSA or outside the GSA’s ability to manage sustainability under SGMA: and
- That the Kern Subbasin GSAs are not responsible for addressing subsidence caused by activities outside of the jurisdiction of SGMA i.e., extractions from exempt aquifers, or

caused by activities other than extraction of water on behalf of the beneficial users under the purview of SGMA

From the meeting with DWR SGMA staff the Kern Subbasin GSAs collaborated on a "white paper" for the California aqueduct. The "white paper" on the CA aqueduct was developed with basin-wide agreed upon methodology and data. The data that was used, was the little amount of data obtained from the KGA study of 2021 and the Westside study that provided additional information about other activities adjacent to the Ca aqueduct. Upon completion of the draft "white paper", the Kern Subbasin worked to set-up two meeting with the CASP team, however the paragraph below provides more details into those two meetings and the history of the previous meetings. In the last meeting with the CASP team, they indicated their commitment to continue to work collaboratively on establishing a monitoring system (CASP is looking to add one more monitoring well in the Kern subbasin) as well as to develop data-based management objectives and future sustainable management criteria.

Prior to COVID, the Kern subbasin had been meeting with the DWR CASP team to share KGA findings related to non-SGMA related sources of subsidence (e.g., oil field, geotechnical etc.) on the Aqueduct. These studies had been shared with DWR SGMA on a separate occasion. Knowing that DWR SGMA and DWR CASP do not directly communicate on a staff level, the Subbasin recently held two additional meetings (July 8th and June 3rd) to bring new DWR CASP staff up to speed on the findings of KGA subsidence work conducted between 2020 and 2022. At the July 8th meeting, the CASP team expressed that they are still analyzing data for their 2022 Precise Survey Report on the California Aqueduct and as such, they were unable to provide any concrete findings or direction on potential subsidence rates for comparison to the KGA studies. The Kern Subbasin presented an Aqueduct "white paper" to the CASP that details the proposed methodology for evaluating future subsidence rates, and the need to set interim (i.e., through 2025) MO/MTs per the direction of DWR SGMA staff. The Subbasin and DWR CASP also explored mutually beneficial studies that could be implemented between 2022 and 2025 that would address identified data gaps for both the Subbasin and DWR CASP. The CASP team indicated that they understood the white paper approach and were also evaluating non-SGMA related sources of subsidence. As an initial step, DWR CASP had held a meeting with CA Department of Conservation – Geologic Energy Management Division (CAL GEM)to discuss how to account for those activities in their evaluations. The CASP team stated that they believe themselves to be similar to the GSAs as an infrastructure owner, and thus a participant of SGMA not a regulator.

After reviewing the draft white paper, the CASP team followed up with a letter dated 7-10-2022. In their letter the CASP team identified topics where more study and discussion are necessary. For example, methodology on averaging pool subsidence and monitoring corridor details as well as sharing studies that provide information on soluble soils and natural differential compaction. The Kern Subbasin has already completed a preliminary assessment of native soils in parts of the westside of the Subbasin and has plans to expand those studies as part of the assessment of subsidence for the 2025 SGMA update. Further, the Kern Subbasin will also assess the subsidence rates by Aqueduct pool as requested by the CASP. These topics and others will be discussed during a series of monthly technical coordination meetings with CASP. The first monthly technical meeting has been proposed for August 2022.

As the Kern subbasin moves forward, we believe significant data gaps pertaining to the various causes and rates of subsidence in the KCS still exist and, that if addressed, will lead to better defined management objectives for the Aqueduct and help focus planned and future monitoring resources where they will be most effective. We also believe that working jointly and in close consultation with the DWR-California Aqueduct Subsidence Project (CASP) team would multiply the respective expertise and resources of both parties to the benefit of all those dependent on the Aqueduct. The process and methods for establishing interim sustainable management criteria is provided in Section 3.5.3.1, California Aqueduct.

As for the Friant-Kern Canal, the Kern Subbasin is working towards the same relationship as with the CASP team. However, the Friant-Kern Canal does have a more complicated situation to it, with the activities north of the Kern Subbasin and the current subsidence in the northern area. The KGA has engaged Lawrence Berkeley Livermore Lab to assist in both critical infrastructure subsidence assessments to assist in understanding the causation of subsidence in the subbasin and one area will be to understand how the activities to the north impact the Kern Subbasin's ability to become sustainable under the subsidence component. The KGA and its members recognize InSAR is a valuable tool, in conjunction with ground-based geodetic technology, for assessing subsidence in relation to KGA identified critical infrastructure. To ensure the best suite of technologies and methodology are brought to bear on subsidence affecting Subbasin critical infrastructure, the KGA will reassess both the methodology for determining the current interim MOs/MTs and the infrastructure specific MO/MT levels in 2025.The process and methods for establishing interim sustainable management criteria is provided in Section 3.5.3, Friant-Kern Canal.

Pertaining to the management area critical infrastructure, each individual management area plan has addressed and analyzed subsidence as it relates to critical infrastructure in their management areas.

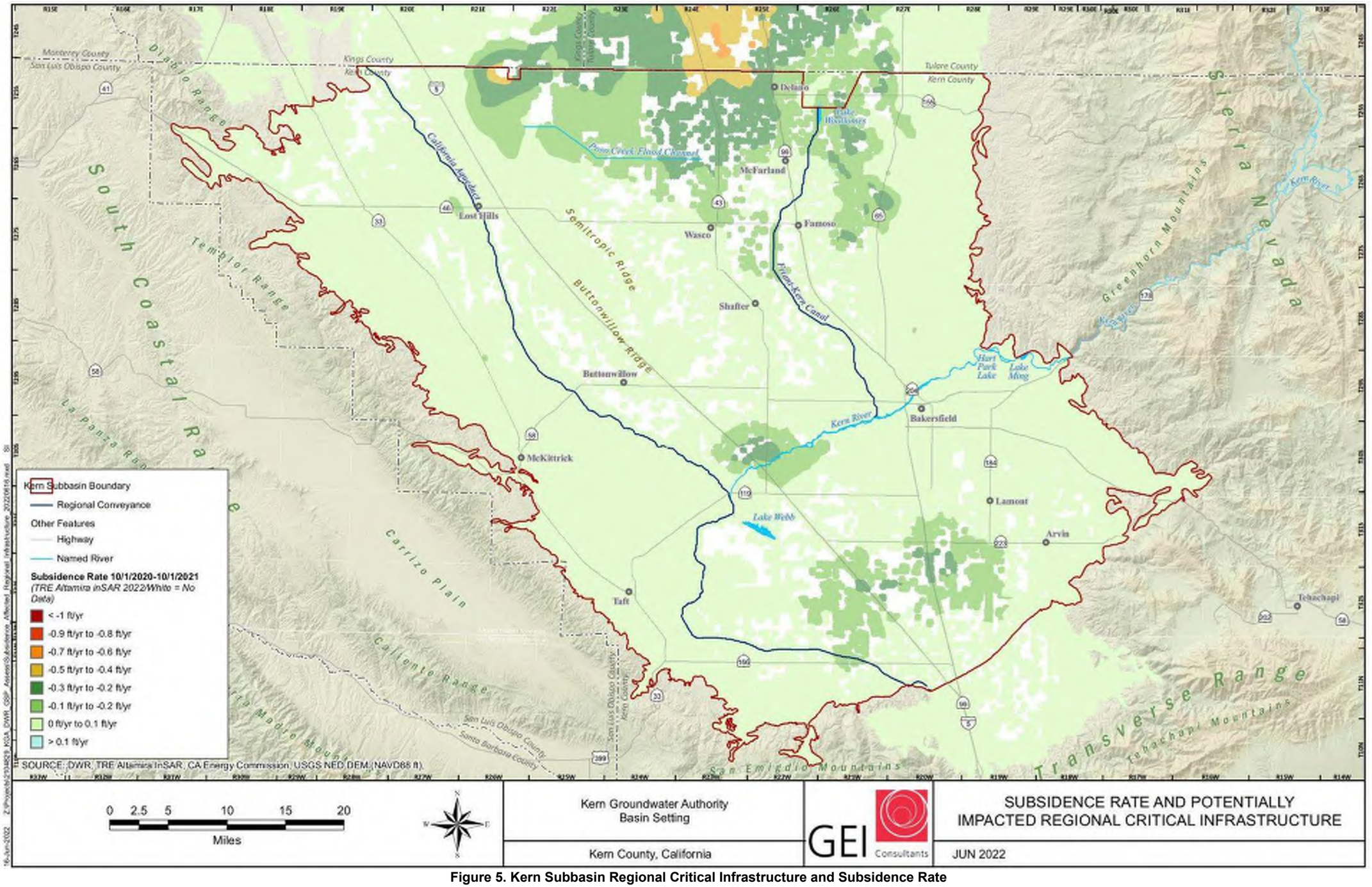


Figure 5. Kern Subbasin Regional Critical Infrastructure and Subsidence Rate

This Page is Intentionally Blank

Kern Groundwater Authority

Groundwater Sustainability Plan

Kern County, CA

Amended July 2022

This Page is Intentionally Blank

Table of Contents

Executive Summary 1

1 Introduction 1

1.1 Sustainable Groundwater Management Act 2
1.2 Purpose of the Groundwater Sustainability Plan 3
1.3 Sustainability Goal 9
1.4 Agency Information 12
1.4.1 Organization and Management Structure of the KGA GSA 12
1.4.2 SOKR GSA Formation 13
1.4.3 Non-Districted Lands 14
1.4.4 Legal Authority of the GSA 26
1.4.5 GSP Implementation Costs & Funding 27
1.5 GSP Organization 27

2 Plan Area and Basin Setting 29

2.1 Description of Plan Area 29
2.1.1 Summary of Jurisdictional Areas and other Features 29
2.1.2 Plan Area Setting 29
2.1.3 Existing Plans in the Plan Area 35
2.1.4 Existing and Ongoing Water Resource Programs 41
2.1.4.1 Management Plans 41
2.1.4.2 Conjunctive Use Programs 46
2.1.4.3 Well Permitting Process 47
2.1.4.4 Plan Elements from CWC Section 10727.4 49
2.1.5 Notice and Communication 51
2.1.5.1 Description of Beneficial Uses and Users in the Subbasin 51
2.1.5.2 Communication 52
2.1.5.3 Informing the Public about GSP Development Progress 59
2.1.5.4 Public Comments 59
2.2 Basin Setting 59
2.2.1 Hydrogeologic Conceptual Model 60
2.2.1.1 Kern County and Lateral Boundaries 60
2.2.1.2 Regional Geologic and Structural Setting 60
2.2.1.3 Geologic Features that Significantly Affect Groundwater Flow 72
2.2.1.4 Kern County Subbasin Boundaries 76
2.2.1.5 Bottom of Subbasin 76
2.2.1.6 Principal Aquifers and Aquitards 82
2.2.1.7 Data Gaps and Uncertainty 91
2.2.1.8 Cross Sections 91
2.2.1.9 Mapped Physical Characteristics 101
2.3 Groundwater Conditions 114
2.3.1 Groundwater Trends 114
2.3.1.1 Elevation and Flow Directions 115
2.3.1.2 Hydrographs and Vertical Gradients 122

2.3.2 Seawater Intrusion 122
2.3.3 Groundwater Quality 122
2.3.3.1 Arsenic 123
2.3.3.2 Nitrate 125
2.3.3.3 Boron 130
2.3.3.4 Hexavalent Chromium 130
2.3.3.5 Synthetic Organic Chemicals 131
2.3.3.6 Total Dissolved Solids (TDS), Sodium and Chloride 132
2.3.3.7 Groundwater Contaminant Sites 136
2.3.4 Land Subsidence 144
2.3.4.1 Processes Leading to Land Subsidence 145
2.3.4.2 Lawrence Berkeley National Laboratory Subsidence Study 146
2.3.4.3 Regional Critical Infrastructure 150
2.3.4.4 Fault Movement 156
2.3.4.5 Impacts to Well Casing 156
2.3.4.6 Degraded Water Quality 156
2.3.4.7 Land Subsidence Monitoring 156
2.3.4.8 Remote Sensing 157
2.3.4.9 Historical Subsidence Results 157
2.3.4.10 Recent Subsidence Results 158
2.3.4.11 Annual Rate of Subsidence 159
2.3.4.12 Map of Subsidence Locations 159
2.3.4.13 Data Gaps in Subsidence Understanding 160
2.3.5 Interconnected Surface Water Systems 162
2.3.5.1 Groundwater Elevation and the Kern River 172
2.3.5.2 Hydrographs 172
2.3.5.3 Stream Gaging 172
2.3.5.4 Data Gaps 173
2.3.6 Groundwater Dependent Ecosystems 176
2.3.6.1 NCCAG Mapped Data 177
2.3.6.2 Evaluation of NCCAG Results 177
2.4 Water Budget Information 182
2.4.1 Model Development 183
2.4.2 Data Compilation 183
2.4.3 Historical and Current Water Budget 183
2.4.3.1 Sustainable Yield 185
2.4.3.2 Native Yield 185
2.4.4 Projected Future Water Budgets without SGMA Implementation 193
2.4.4.1 Future Baseline Water Budget 193
2.4.4.2 2030 Climate Change Water Budget 193
2.4.4.3 2070 Climate Change Water Budget 194
2.5 Management Areas 194

3 Sustainable Management Criteria 197
3.1 Sustainability Goal 203
3.2 Minimum Threshold Exceedances 203
3.3 Management Area Exceedance 204

3.4 Undesirable Results 205
3.4.1 Criteria Used to Define Undesirable Results 207
3.4.2 Undesirable Result for Chronic Lowering of Groundwater Levels 211
3.4.2.1 Potential Cause of Chronic Lowering of Groundwater Levels 212
3.4.2.2 Potential Effects of Chronic Lowering of Groundwater Levels 212
3.4.3 Undesirable Result for Reduction of Groundwater Storage 212
3.4.3.1 Potential Cause of Reduction of Groundwater Storage 214
3.4.3.2 Potential Effects of Reduction of Groundwater Storage 214
3.4.4 Undesirable Result for Degraded Water Quality 214
3.4.4.1 Potential Cause of Degraded Water Quality 215
3.4.4.2 Potential Effects of Degraded Water Quality 215
3.4.5 Undesirable Result for Land Subsidence 215
3.4.5.1 Potential Cause of Land Subsidence 216
3.4.6 Seawater Intrusion 217
3.4.7 Interconnected Surface Water 217
3.5 Minimum Thresholds and Measurable Objectives 218
3.5.1 Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage 235
3.5.2 Degraded Water Quality 235
3.5.3 Land Subsidence 236
3.5.3.1 Interim Measurable Objectives and Interim Minimum Thresholds 239
3.5.3.2 California Aqueduct 240
3.5.4 Seawater Intrusion 242
3.5.5 Depletions of Interconnected Surface Water 243
3.6 Monitoring Network 243
3.6.1 Monitoring Network Description 243
3.6.2 Monitoring Network Objectives 244
3.6.3 Monitoring Data Quality Objectives 244
3.6.4 Monitoring Progress Toward Measurable Objectives 244
3.6.5 Coverage of Sustainability Indicators 245
3.6.6 Scientific Rational for Site Selection 245
3.6.7 Monitoring Protocols for Data Collection and Monitoring 246
3.6.7.1 Groundwater Level Monitoring Network Protocol and Standards 246
3.6.7.2 Water Quality Monitoring Network Protocol and Standards 249
3.6.8 Reduction of Groundwater Storage 252
3.6.9 Land Subsidence Monitoring Network 252
3.6.9.1 CA Aqueduct Monitoring Plan 253
3.6.9.2 Monitoring Corridor 253
3.6.9.3 Areas of Interest (AOIs) 253
3.6.9.4 Watch Areas (WAs) 254
3.6.9.5 Friant-Kern Canal Monitoring Plan 254
3.6.9.6 Monitoring Corridor 256
3.6.9.7 Areas of Interest (AOIs) 256
3.6.9.8 Monitoring Protocols 257
3.6.10 Assessment and Improvement of Monitoring Network 266
3.6.10.1 Groundwater Elevation and Storage 266
3.6.10.2 Groundwater Quality 267

3.6.10.3 Land Subsidence 267
3.6.11 Monitoring Summary 267

4 Projects and Management Actions 268
4.1 Proposed Projects and Management Actions 268
4.2 Projected Future Water Budgets with SGMA Implementation 270
4.2.1 Future Baseline Water Budget with SGMA Implementation 270
4.2.2 2030 Climate Change Water Budget with SGMA Implementation 271
4.2.3 2070 Climate Change Water Budget with SGMA Implementation 271

5 References 292

List of Tables

Table 1-1	San Joaquin Valley Contribution to California's Agricultural Economy (2018)
Table 1-2	Summary of Communications and Stakeholder Engagement in response to DWR's Determination Letter
Table 1-3	Expected Well Impacts at the Measurable Objective
Table 1-4	Expected Well Impacts at the Minimum Threshold
Table 1-5	Groundwater Sustainability Agencies in Kern County Subbasin
Table 1-6	Kern Groundwater Authority Member Agencies
Table 1-7	GSAs preparing GSPs within the Kern County Subbasin
Table 1-8	Estimated Costs for GSP Implementation
Table 2-1	Summary of KGA Water Resources Programs
Table 2-2	Generalized Hydrostratigraphy of Kern County Subbasin
Table 2-3	Primary Aquifer System of Kern County Subbasin
Table 2-4	Aquifer Parameters for Kern County Subbasin
Table 2-5	GeoTracker EnviroStor Sites with Potential Groundwater Media
Table 2-6	Summary of Results of the LBL Study for the Period 2015 to 2021
Table 2-7	Land Subsidence Data
Table 2-8	Kern Subbasin GSA-Level Water Budgets
Table 2-9	Management Areas under the Kern Groundwater Authority
Table 3-1	Kern Subbasin Management Area Exceedances Information
Table 3-2	Tabular Summary of Wells Potentially Dewatered at the MO
Table 3-3	Tabular Summary of Wells Potentially Dewatered at the MT
Table 3-4	Summary of Minimum Thresholds and Measurable Objectives
Table 3-5	Management Area Proposed Changes to the Regional Monitoring Network
Table 3-6	Subsidence (INTERIM) MO and (INTERIM) MT for Aqueduct Pools in Kern
Table 3-7	FKC Lower Reach Interim MO and MT and Extents
Table 3-8	Monitoring Impacts to Beneficial Uses and Users
Table 3-9	Standards and Requirement Monitoring Well Information
Table 3-10a	CA Aqueduct Pools in Kern Subbasin and Associated Management Areas
Table 3-10b	CA Aqueduct Pools in Kern Subbasin and Monitoring Classification Extent
Table 4-1	KGA Projects and Management Actions
Table 4-2	KGA Member Entities List of Projects and Management Actions

List of Figures

Figure 1-1 Percentage of Domestic and Small Community Wells Dewatered at the MO
Figure 1-2 Percentage of Domestic and Small Community Wells Dewatered at the MT
Figure 1-3 Groundwater Sustainability Agencies within Kern County Subbasin
Figure 1-4 Member Agencies of the Kern Groundwater Authority
Figure 1-5 2019 Kern County Subbasin Non-Districted Lands
Figure 1-5a 2022 Kern County Subbasin Non-Districted Lands
Figure 1-5b 2021 Kern County Subbasin Annual Consumptive Use
Figure 1-6 Kern County Subbasin Wells within Non-Districted Lands
Figure 1-6b Non-Districted Lands and DMS Production Wells
Figure 2-1 Jurisdictional Area of Kern Groundwater Authority
Figure 2-2 Land Use within Kern County Subbasin
Figure 2-3 Agricultural Land Water Source within Kern County Subbasin
Figure 2-4 Density of Wells per Square Mile (Production)
Figure 2-5 Density of Wells per Square Mile (Domestic)
Figure 2-6 Density of Wells per Square Mile (Public)
Figure 2-7 Groundwater Dependent Communities
Figure 2-8 Kern County Public Health Services – Overdrafted Basin Supplemental Well Application
Figure 2-9 Kern Groundwater Authority's Communication & Engagement Timeline Phase 1: GSA Formation and Coordination
Figure 2-10 Kern Groundwater Authority's Communication & Engagement Timeline Phase 2: GSP Preparation and Submission, and Phase 3: GSP Review and Evaluation
Figure 2-11 Kern Groundwater Authority's Communication & Engagement Timeline Phase 3: GSP Review and Evaluation
Figure 2-12 Kern County Subbasin and Vicinity
Figure 2-13 Geologic Map (Bartow, 1991)
Figure 2-14 Approximate Thickness and Extent of E-Modified Corcoran Clay
Figure 2-15 Conceptual Block Diagram Looking North from Kern River
Figure 2-16 Generalized Quaternary Depositional Facies
Figure 2-17 Geologic Map (Page, 1986)
Figure 2-18 Geologic Map Index (CGS, 2010)
Figure 2-19 Base of Fresh Water by Page (1973) with Non-USDWs
Figure 2-20 Elevation Contours of 10,000 MG/L TDS with Non-USDWs
Figure 2-21 Groundwater Subbasin Conceptual Profile
Figure 2-22 General Distribution of Groundwater Aquifer Supply Production in Kern County Subbasin
Figure 2-23 Hydraulic Conductivity Values

Figure 2-24a Cross Section A-A' North of River
Figure 2-24b Cross Section B-B' North of River
Figure 2-24c Geologic Cross-Section A-A', Arvin-Edison Water Storage District
Figure 2-24d Geologic Cross-Section B-B', Arvin-Edison Water Storage District
Figure 2-24e Geologic Cross-Section C-C', Arvin-Edison Water Storage District
Figure 2-24f Geologic Cross-Section A-A', Wheeler Ridge-Maricopa Water Storage District
Figure 2-24g Geologic Cross-Section G-G', Wheeler Ridge-Maricopa Water Storage District
Figure 2-25 Topographic Features
Figure 2-26 Soils of Kern County Subbasin
Figure 2-27 Hydrologic Soil Groups
Figure 2-28 Areas of Direct Recharge
Figure 2-29 Surface Water Features from National Hydrography Dataset
Figure 2-30 Generalized Diagram of Groundwater Flow in Kern County Subbasin
Figure 2-31 Spring 2015 Regional Groundwater Elevations
Figure 2-32 Spring 2015 Upper Zone Groundwater Elevations
Figure 2-33 Fall 2015 Regional Groundwater Elevations
Figure 2-34 Summer 2011 Upper Zone Groundwater Elevations
Figure 2-35 Nitrate Concentrations and Septic Systems
Figure 2-36 Max TCP Concentrations from Public Supply Wells from Jan. 2018 to Apr. 2019
Figure 2-37 Permitted Discharge Locations
Figure 2-38 Clean-up Sites Listed in Envirostor and GeoTracker Databases
Figure 2-39 Oil and Gas Wells in the Underground Injection Control Program
Figure 2-40 Kern Subbasin Subsidence Assessment Areas
Figure 2-41 Potentially Impacted Regional Critical Infrastructure
Figure 2-42 Potentially Impacted Regional Critical Infrastructure with Subsidence Rate
Figure 2-43 Identified Regional Critical Infrastructure with Subsidence Rate
Figure 2-44 Historical Subsidence
Figure 2-45 Subsidence 2007-2010
Figure 2-46 Subsidence 2015-2016
Figure 2-47 Rate of Subsidence 2007-2010
Figure 2-48 Rate of Subsidence 2015-2016
Figure 2-49 Rate of Subsidence 2015-2016 from DWR California's Groundwater Live (2022)
Figure 2-50 Rate of Subsidence 2020-2021 from DWR California's Groundwater Live (2022)
Figure 2-51 Supply Well Hydrographs
Figure 2-52 State and Federal Lands in the Kern County Subbasin

Figure 2-53a NCCAG Wetlands
Figure 2-53b NCCAG Vegetation
Figure 2-54 Historical Groundwater Budget for WY1995 to WY2014
Figure 2-55 Average Annual Groundwater Budget for WY1995 to WY2014
Figure 2-56 Annual and Cumulative Change in Groundwater Storage for WY1995 to WY2014
Figure 2-57 Groundwater Recharge by Source for WY1995 to WY2014
Figure 2-58 Groundwater Pumping by Type for WY1995 to WY2014
Figure 2-59 Surface Water Deliveries by Type for WY1995 to WY2014
Figure 2-54 Management Areas within Kern County Subbasin
Figure 3-1 Representation of KGA Minimum Threshold Exceedance Management Policy
Figure 3-2 Example of Undesirable Results Criteria for 15% of Subbasin
Figure 3-3 Example of Undesirable Results Criteria for 30% of Subbasin
Figure 3-4 Graphic Summary of Wells Potentially Dewatered at the MO
Figure 3-5 Graphic Summary of Wells Potentially Dewatered at the MT
Figure 3-6R Regional Groundwater Level Monitoring Network (REVISED)
Figure 3-7R Regional Minimum Threshold Contours for Groundwater Levels (REVISED)
Figure 3-8R Regional Measurable Objective Contours for Groundwater Levels (REVISED)
Figure 3-9 Kern Subbasin Subsidence Sub-Regions
Figure 3-10 Subsidence Monitoring Design Approach
Figure 3-11 Regional Subsidence Monitoring Network
Figure 4-1 Baseline Projected Future Average Annual Groundwater Budget for WY2041-2070
Figure 4-2 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070
Figure 4-3 Projected Future Change in Groundwater Storage for all Conditions
Figure 4-4 Projected Future Change in Groundwater Storage for all Conditions

List of Attachments

Attachment A	Joint Powers Agreement
Attachment B	Amended Coordination Agreement
Attachment C	Communication and Engagement Plan
Attachment D	Public Comments
Attachment E1	Earth Consultants International, Subsidence Report
Attachment E2	Lawrence-Berkely National Laboratory Subsidence Study
Attachment E3	California Aqueduct White Paper
Attachment E4	Friant-Kern Canal White Paper
Attachment F	Interconnected Surface Water Systems
Attachment G	Groundwater Dependent Ecosystems
Attachment H	Historical and Projected Future Water Budget Development with C2VSim FG-Kern
Attachment I	Management Area Plan Attachments
	Cawelo Water District GSA Management Area Plan
	Eastside Water Management Area Management Area Plan
	Kern County Water Agency – Pioneer Project GSA Management Area Plan
	Kern-Tulare Water District Management Area Plan
	Kern Water Bank Management Area Plan
	North Kern Water Storage District & Shafter-Wasco Irrigation District Management Are Plan
	Rosedale-Rio Bravo Water Storage District Management Area Plan
	Semitropic Water Storage District GSA Management Area Plan
	Shafter-Wasco Irrigation District 7th Standard Annexation Management Area Plan
	Southern San Joaquin Municipal Utility District Management Area Plan
	West Kern Water District GSA Management Area Plan
	Westside District Water Authority Management Area Plan

List of Abbreviations

µmhos/cm	micromhos per centimeter
µS/cm	microsiemens per centimeter
AB	Assembly Bill
AF	Acre-Feet
Al/Fe-	Aluminum- and Iron-Bearing
AOI	Area of Interest
BGS	Below Ground Surface
BMP	Best Management Practices
BMSL	Below Mean Sea Level
BVARA	Buena Vista Aquatic Recreation Area
C&E	Communications and Engagement Plan
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CDFW	California Department of Fish and Wildlife
CGPS	Continuous Global Positioning System
CIWQS	California Integrated Water Quality System
Cr3	Trivalent Chromium
Cr6+	Hexavalent Chromium
CUP	Conditional Use Permit
CVP	Central Valley Project
CVPIA	Central Valley Improvement Act of 1992
CVRWQCB	Central Valley Regional Water Quality Control Board
CWC	California Water Code
DBCP	Dibromochloropropane
DDW	Division of Drinking Water
DOGGR	Division of Oil, Gas, and Geothermal Resources
DTSC	Department of Toxic Substances
DTW	Depth to Water
DWR	California Department of Water Resources
ESA	European Space Agency
GAMA	Groundwater Ambient Monitoring and Assessment Program
GDE	Groundwater Dependent Ecosystems
GPM	Gallons per Minute
GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
HCM	Hydrogeologic Conceptual Model

HMWD	Henry Miller Water District
HR2W	Human Right to Water
ID4	Improvement District 4
ILRP	Irrigated Lands Regulatory Program
InSAR	Inferometric Synthetic-Aperture Radar
IRWM	Integrated Regional Water Management Plan
JPA	Joint Powers Agreement
JPL	Jet Propulsion Laboratory
KCWA	Kern County Water Agency
KDWD	Kern Delta Water District
Kern Fan	Kern Alluvial Fan
KGA	Kern Groundwater Authority
KGET	Kern Golden Empire Television
KRGSA	Kern River Groundwater Sustainability Agency
KRWCA	Kern River Watershed Coalition Authority
LANDSAT	Land Remote-Sensing Satellite
LSCE	Luhdorff & Scalmanini Consulting Engineers
LUST	Leaking Underground Storage Tank
MA	Management Area
Mc	Fanglomerate
MCL	Maximum Contaminant Level
mg/l	Milligrams Per Liter
MGSA	McFarland Groundwater Sustainability Agency
MIT	Mechanical Integrity Test
msl	Mean Sea Level
NASA	National Aeronautics and Space Administration
NCCAG	Natural Communities Commonly Associated with Groundwater
NHD	National Hydrography Dataset
NHI	Nitrate Hazard Index
NKWSD	North Kern Water Storage District
PALSAR	Phased Array type L-band Synthetic Aperture Radar
PPB	Parts per Billion
PPT	Parts per Trillion
RPE	Reference Point Elevation
RWQCB	Regional Water Quality Control Board
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SDWIS	State Drinking Water Information System
SGMA	Sustainable Groundwater Management Act

SMCL	Secondary Maximum Contaminant Level
SOPAC	Scripps Orbit and Permanent Array Center
SpC	Specific Conductance
SSJMUD	Southern San Joaquin Municipal Utility District
SSURGO	Soil Survey Geographical Database
Subbasin	Kern County Subbasin
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCP	1,2,3-trichloropropane
TDS	Total Dissolved Solids
TNC	The Nature Conservancy
UAVSAR	Unmanned Aerial Vehicle Synthetic Aperture Radar
UIC	Underground Injection Control
UNAVCO	Unmanned Aerial Vehicle Synthetic Aperture Radar
USDA	United States Department of Agriculture
USDW	Underground Source of Drinking Water
USGS	United States Geological Survey
UST	Underground Storage Tank
WDR	Waste Discharge Requirements

List of Kern Subbasin Definitions

Management Area	Areas that will be considered against the determination of an undesirable result at the basin level.
Watch Area	Areas with no significant groundwater use and no planned groundwater use as documented in the MAP. Watch areas will be monitored for land use changes and groundwater conditions that could change its designation to a "management area" with specified Sustainable Management Criteria.
Monitoring Area	Areas that have significance within a Management Area for monitoring groundwater conditions or impacts to certain beneficial users but are not considered towards the determination of an Undesirable Result.
MT Exceedance	A single representative monitoring well exceeds its minimum threshold.
MT Trigger	A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events (Definition for Chronic Lowering of Groundwater).
Management Area Exceedance	Exceeding the MT Trigger (i.e., 40% of wells) with a management area is a “Management Area Exceedance,” not an Undesirable Result which is defined at the basin level.
Undesirable Result	The basin-wide definition of unreasonable impacts to beneficial uses and users of groundwater. Should only be referred to as a basin-wide conditions and not a management area condition. The equivalent designation at the management area is a “Management Area Exceedance.”
Urban Management Area Exceedance	A management area exceedance is triggered when groundwater levels decline below established Minimum Thresholds (MT) in any Regional Monitoring Well (RMW) for more than three conservative months.

This Page is Intentionally Blank

Executive Summary

The Kern Groundwater Authority (KGA) Groundwater Sustainability Agency (GSA) covers approximately 1.2 million acres of the Kern County Subbasin's (Subbasin) approximate 1.8 million acres, as defined by the California Department of Water Resources (DWR) Bulletin 118 (see Figure E-1). DWR has identified the Kern Subbasin as a "critically overdrafted basin." The Kern Groundwater Authority includes 12 member entities made up of water districts/agencies, groundwater banking projects, and organized nondistricted lands. The 12 member entities also constitute the KGA Board, with one representative from each member entity. Its boundary stretches along the northwest, northeast, and southern parts of the Subbasin. The KGA was formed for the purpose of:

- Coordinating groundwater management programs and activities;
- Identifying and addressing issues pertaining to sustainable groundwater management;
- Establishing a framework for local groundwater management; and
- Coordinating with other GSAs in the Subbasin.

The KGA provides, through a Joint Powers Agreement, each member the sole right and responsibility to implement SGMA within its respective boundaries and/or management areas, in a manner determined by the member. However, the implementation actions can not interfere with the surrounding members or GSAs in their ability to comply with SGMA. The KGA, as such, provides the critical mechanism for coordination of SGMA related activities between its members as well as with the other GSAs in the Subbasin.

The Subbasin includes 14 organized GSAs. Of these, five GSAs have elected to be included in the Groundwater Sustainability Plan (GSP) of the KGA and two are included in the Kern River Groundwater Sustainability Agency GSP, and three are included in the South of Kern River GSP. Three additional specific GSPs have been prepared in the Subbasin by Buena Vista Water Storage District GSA, Henry Miller Water District GSA, and Olcese Groundwater Sustainability Agency. The six GSAs submitting GSPs have coordinated throughout the development of the GSPs in the Subbasin as indicated in the executed Coordination Agreement and will continue through the implementation of the GSPs.

Kern County produces a wide variety of crops on approximately 900,000 acres, making it a major contributor to California's agricultural economy. One important honor that Kern County is known for is its agricultural industry ranking. Kern County is currently ranked the #1 agricultural producing county in the United States and has been for the last three years with gross value of all agricultural commodities produced in 2017 estimated at $7.25 billion. The top five commodities are grapes, almonds, citrus, milk, and pistachios, which make up more than $4.5 billion (63 percent) of the total value. With this, Kern County agriculture is the largest employer in the region with 1 in every 5 jobs related to agriculture. The communities, economy, and local governments are and have been reliant on Kern County agriculture and are dedicated to preserving the viability of agriculture into the future.

As stated, all the GSAs in the Subbasin have coordinated and collaborated on the development of water modeling budgets (historical, baseline and projected) in the Subbasin. Considerable effort and resources were expended to update the C2VSim model with local data to better represent Subbasin conditions, as described in this GSP. Subbasin-wide water budget results from the numerical model-based water budget show the Subbasin, as a whole, has an overdraft of 324,326 acre-feet per year over the baseline conditions of which the KGA is approximately 239,346 of the deficit.

In response to this level of overdraft the KGA members, in coordination with the other GSAs in the Subbasin, have developed Subbasin-wide Sustainable Management Criteria. This includes required Measurable Objectives and Minimum Thresholds for the Sustainability Indicators relevant to the specific management areas of the Subbasin to protect against the occurrence of Undesirable Results that would cause unreasonable impacts the beneficial users and uses of groundwater in the Subbasin.

The KGA Members have sources of water supplies such as local streams (Caliente, Poso Creek), Kern River, State Water Project and Central Valley Project sources. Each member addresses their own individual water supply sources in greater detail in their individual management area plans along with how the beneficial users in their jurisdiction will participate in achieving sustainability.

The KGA Members have also identified more than 150 projects and management actions ranging from expansion of local and regional conveyance and recharge facilities to take advantage of surplus supplies; new conveyance and recharge projects; and participation in the California WaterFix or other thru-Delta improvement projects. Management actions range from implementing district level fee structures to incentive reduced groundwater pumping; participation in local, regional, and state-wide water markets; and setting allocation for groundwater use by landowner, based on the sustainable yield of management areas.

The coordinated modeling effort shows that implementation and completion of the identified projects and management actions during the implementation period of 2020 to 2040, as stated in the individual management area plans and GSPs from the other GSAs in the Subbasin, would result in an average surplus of 85,578 acre-feet per year over the projected baseline condition simulation.

1 Introduction

The Kern County Subbasin is located at the southern end of the San Joaquin Valley and is known for its rich soil and Mediterranean-like climate, which has made Kern County one of the top producing agriculture regions in the nation. The Kern County Subbasin (Subbasin) is bounded by the Kern County Line and the Tule Groundwater Subbasin on the north; the granitic bedrock of the Sierra Nevada foothills on the east; the Tehachapi mountains on the southeast; and by the marine sediments of the San Emigdio Mountains and Coast Ranges on the southwest and west (DWR, 2006).

California is the nation's largest agricultural producer and is the nation's sole exporter of many agricultural commodities, supplying nearly 99 percent of the almonds, artichokes, and garlic. Recent study by the University of California (November 2019) highlighted the contribution of agriculture to California's economy. Agricultural production, agricultural support, agricultural distribution, and agricultural processing employ nearly 1.2 million people and generated approximately $264 billion in sales in 2018. The San Joaquin Valley is the major contributor to California agricultural economy as can be shown in Table 1-1.

Table 1-1: San Joaquin Valley Contribution to California's Agricultural Economy (2018)

	Agricultural Production	Agricultural Support	Agricultural Distribution	Agricultural Processing
San Joaquin Valley				
Jobs	131,700	116,900	33,700	62,900
Earnings ($ billion)	$6.5	$4.2	$1.9	$4.0
Sales ($ billion)	$24.0	$7.7	$6.4	$31.7
California				
Jobs	325,200	320,000	304,00	245,000
Earnings ($ billion)	$16.2	$18.0	$17.8	$16.0
Sales ($ billion)	$61.0	$32.0	$57.4	$113.0

Sources: California's Working Landscapes, University of California, November 2019

In Kern County a wide variety of crops are produced on approximately 900,000 acres, making it a major contributor to California's agricultural economy. One important honor that Kern County is known for is its agricultural industry ranking. Kern County currently is ranked the #1 agricultural producing county in the United States and has been for the last three years with gross value of all agricultural commodities produced in 2017 estimated at $7.25 billion (Kern County Department of Agriculture and Measurement Standards, 2018). The top five commodities are grapes, almonds, citrus, milk, and pistachios, which make up more than $4.5 billion (63 percent) of the total value. With this, Kern County agriculture is the largest employer in the region with 1 in every 5 jobs related to agriculture. The communities, economy, and local governments are and have been reliant on Kern County agriculture and are dedicated to preserving the viability of agriculture into the future.

Bulletin 118 published by California Department of Water Resources (DWR) in January 1980 states that "The Kern County Water Agency, which covers the Kern County Basin, presently receives about half of its maximum annual entitlement from the State Water Project. If no new lands were to go into production, and the full entitlement from the State Water Project were delivered today, there would be no overdraft in Kern County as a whole." Harvested acres in Kern County have remained relatively steady at an average of 858,000 acres a year with only a 10 percent annual fluctuation from that average between 1980 and 2017.

Since the operation of the State Water Project (SWP) in 1968 until 2007, SWP contractors received on average 86 percent of their entitlement. However, in May 2007, Federal Judge Oliver Wagner overturned a federal scientific study that aimed to protect Delta Smelt in the Sacramento-San Joaquin Delta (Delta) resulting in curtailing Delta export pumping operations to protect the continued existence of the fish. In addition, the State of California experienced a historic extended drought from 2012 to 2016. As a result, SWP contractors received on an average only 48 percent of their entitlement from 2008 to 2016.

Despite the reduction in SWP deliveries, the groundwater overdraft in the entire Subbasin declined from 600,000 acre-feet per year in 1980 (Bulletin 118-80) to a current estimate of 324,300 acre-feet in 2015 (Todd, 2019). This decrease in amount of overdraft per year was achieved through change in crop patterns; increase in agriculture efficiency; and increase in conjunctive use and banking projects throughout the Subbasin.

The current baseline condition estimates that the Subbasin has an average annual overdraft of 324,326 acre-feet per year (Todd, 2019 projected water model). However, with the proposed projects and management actions slated for development and implementation in the Subbasin, it is forecasted that the Subbasin will achieve sustainability by 2040 with an estimated 42,144 acre-feet of annual surplus (see Attachment H). The projects and management actions are described in this Groundwater Sustainability Plan (GSP) and the individual management area plans, attached to this GSP, and the 4 other GSPs prepared within the Subbasin. Collectively, the projects and management actions currently proposed provide a reasonable approach for sustainable management of the groundwater Subbasin and can be adaptively managed to meet future challenges as necessary.

1.1 Sustainable Groundwater Management Act

During the height of the last drought in 2014, the State Legislature passed the Sustainable Groundwater Management Act (SGMA), which consists of a three-bill package of Assembly Bill (AB) 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley) and SB 1319 (Pavley). SGMA as it is called, provides for the local control of groundwater resources while requiring the sustainable management of that groundwater resource. One of the first requirements under the SGMA law was to form/establish a local governance body called a Groundwater Sustainability Agency (GSA) with the local authority to develop, adopt, and implement a GSP. GSPs must document monitoring conditions and establish management criteria to avoid undesirable results and identify potential actions which either maintain and/or achieve sustainable groundwater management by 2040 or 20 years from the date of the adoption of the GSP. The KGA, through a

Joint Powers Agreement, is a recognized GSA in the Subbasin for the purpose of developing a GSP.

Sustainable management of groundwater is defined under SGMA as the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (California Water Code (CWC) Section 10721(v)). The undesirable results under SGMA include the significant and unreasonable lowering of groundwater levels; loss of groundwater storage and supply; degradation of water quality; land subsidence; surface water depletion; and sea water intrusion.

Further, under the SGMA law, water basins throughout California were determined or classified to be of "high" or "medium" priority by DWR. The Subbasin was determined or classified to be a "high" priority basin, which triggers the requirement of submittal of its GSP by January 31, 2020.

1.2 Purpose of the Groundwater Sustainability Plan

The purpose of this GSP is to comply with SGMA and serve as a comprehensive foundation for groundwater management within areas of the Subbasin covered by the Kern Groundwater Authority (KGA) by providing information on the current groundwater conditions; establishing the sustainability goals to be achieved through the implementation of management actions and projects; and demonstrating how sustainability will be achieved through the 20-year implementation period.

In the Subbasin, there are five other established GSA groups who are submitting GSPs: the Kern River Groundwater Sustainability Agency (KRGSA), Buena Vista Water Storage District (BVGSA), Henry Miller Water District (HMGSA), Olcese Groundwater Sustainability Agency (Olcese GSA), and South of Kern River (SOKR) group.

Throughout the development process for this Amended GSP, the KGA has considered and coordinated with the other five GSA groups in the Subbasin to comply with the requirement of developing and utilizing consistent data and methodologies throughout the Subbasin, especially the development of a basin-wide basin setting, water model, the setting of sustainable management criteria and water budget allocations, to mention a few of the coordinated efforts. To truly coordinate during the development of the Kern Subbasin GSPs, the water district managers met each Friday to discuss, explore concepts, and engage in robust discussions on methodologies before coming to a consensus. Additionally, the GSAs within the Subbasin coordinated the respective elements of their GSPs necessary for achieving the sustainability goals for the Subbasin as well as Management Actions and Projects. In addition to the weekly meetings with all the GSAs, the KGA held weekly meetings to coordinate and collaborate on the responses to the DWR determination letter as well as at the KGA board meetings, held open discussions providing updates to the responses and how the KGA would be amending their submitted GSP seeking inputs from the public, stakeholders and beneficial users. Also, the KGA members held their board meetings with open discussions to their individual beneficial users in seeking input. A summary of KGA member communications and stakeholder engagement efforts are provided in Table 1-2

This Page is Intentionally Blank

Table 1-2. Summary of Communication and Stakeholder Engagement in Response to DWR's Determination Letter

Management Area	Summary of Communications and Stakeholder Engagement in response to DWR's Determination Letter
KGA	• Weekly meetings for KGA Member Agencies and their Consultants from February 1 through July 25, 2022 to coordinate response to DWR comments • Weekly meetings for Kern Subbasin GSAs and their Consultants from February 1 through July 25, 2022 to coordinate response to DWR comments • Monthly: KGA Executive Director provides informational updates on Determination Letter, and work in progress to address the deficiencies at the KGA Board meetings from February 23 to June 28, 2022 • Monthly Presentations at the Kern County Farm Bureau meetings to discuss updates to the response to DWR comments and SGMA • April 27, 2022: KGA Board meeting – Discussion and adoption of the KGA Exceedance Action Plan during Executive Director public meeting items • May 25, 2022: KGA Board meeting – Discussion and approval of Lawrence Berkeley Livermore Lab proposal on subsidence during Executive Director public meeting items • June 3, 2022: Meeting with CA Aqueduct Subsidence Program Team (CASP) to continue the discussions on subsidence as it relates to the CA Aqueduct. New CASP team members • June 20, 2022: Presentation to the Greater Kern Hispanic Chamber of Commerce on SGMA and DWR comments • June 22, 2022: KGA Board meeting – Discussion and adoption of Kern County Subbasin Sustainability Goals during Executive Director public meeting items. • July 8, 2022: DWR/CASP Team meeting to update on Kern Subbasin subsidence studies and consideration for setting interim SMCs for the CA Aqueduct. • July 12, 2022: Presentation to Teachers Ag Seminar on SGMA and DWR comments.
Cawelo GSA	• Weekly meetings for KGA Member Agencies and their Consultants from February 1 through July 25, 2022 • Weekly meetings for Kern Subbasin GSAs and their Consultants from February 1 through July 25, 2022 • Monthly: Cawelo GSA Board Packages included Progress Reports describing work completed and work in progress to address deficiencies in the DWR Determination Letter. • Monthly: Staff provided updates on the Cawelo GSA and KGA activities and Cawelo GSA coordination activities with other Management Areas during each monthly Cawelo GSA Special Board Meeting. • April 2022: Cawelo GSA coordination meetings with Eastside Water Management Area and North Kern Water Storage District • July 14, 2022: Cawelo GSA Special Board Meeting and Public Hearing for Adoption of Cawelo GSA Groundwater Sustainability Plan, as Revised.
Eastside Water Management Area	• Monthly: Meetings with Eastside Water Management Area (EWMA) Directors and Members to address deficiencies in the DWR Determination Letter • Monthly: Direct email communication with EWMA landowners regarding response to deficiencies in the DWR Determination Letter • March 25, 2022: Coordination with Kern Tulare Water District on addressing deficiencies in the DWR Determination Letter • April 14, 2022: Coordination with Kern Tulare Water District on addressing deficiencies in the DWR Determination Letter • April 19, 2022: Coordination with Cawelo Water District on addressing deficiencies in the DWR Determination Letter • July 7, 2022: EWMA Special Board to approve amended Management Area Plan.
Kern County Water Agency – Pioneer GSA	• Monthly meetings with Pioneer Participants • As needed Joint Operations Committee meetings for coordination which included RRBWSD, KWB, and Pioneer • April 22, 2022: Pioneer met with KRGSA to coordinate Measurable Objectives and Minimum Thresholds • May 12, 2022: Electronic communication included Draft GSP for review • June 23, 2022: Kern County Water Agency Board meeting to approve the Pioneer GSA GSP to provide to the KGA for submittal • As a member of the KGA, all coordination included in the KGA section above is also included.
Kern-Tulare Water District	• Monthly: Provided SGMA updates at each monthly KTWD Board Meeting. • January 14, 2022: Sent SGMA Update flyer to all landowners within the District summarizing KTWD's GSP and implementation of management actions.

Management Area	Summary of Communications and Stakeholder Engagement in response to DWR's Determination Letter
	• March 25, 2022: Coordination meeting with Eastside Water Management Area. • April 14, 2022: Coordination meeting with Eastside Water Management Area. • May 12, 2022: Staff Engineer gave a presentation at the KTWD Board Meeting on KGA's approach to address DWR's deficiencies and summarized the SWRCB May Board Meeting regarding SGMA. • June 9, 2022: Draft Amended KTWD GSP was included in June Board Packet and presented at the KTWD Board Meeting. • July 14, 2022: Amended KTWD GSP was discussed and approved with revisions at the KTWD Board Meeting.
Kern Water Bank Authority	• Participation in weekly meetings with adjoining GSA managers. • Participation in KGA workshops and meetings listed above. • February 11, 2022: Meeting and KWB tour with Paul Gossellin, DWR, Ann Hayden, Environmental Defense Fund, and adjoining GSA directors. • March 22, 2022: Presentation and tour with Hancock College. • April 21, 2022: Presentation and tour with the Water Education Foundation. Attendees from, Bureau of Reclamation, Delta Stewardship Council, DWR, CA State Water Board, UC ANR/Cooperative Extension, US Geological Survey, Valley Water. • May 10, 2022: Teleconference with UC Extension, Sustainable Agriculture and Land Conservation Program, regarding conservation of agricultural lands. • May 26, 2022, May 17, 2022, and June 28, 2022: Meeting with Kern Subbasin CA Aqueduct Subsidence Committee, including adjoining GSA's. • June 14, 2022: KWBA Board meeting (open session) to discuss revisions to KGA GSP chapter report. • July 12, 2022: KWBA Board meeting (open session) to approve Revised KGA GSP chapter report and submittal.
North Kern Water Storage District and Shafter-Wasco Irrigation District	• Weekly meetings for KGA Member Agencies and their Consultants from February 1 through July 25, 2022 • Weekly meetings for Kern Subbasin GSAs and their Consultants from February 1 through July 25, 2022 • Monthly: NKWSD Board Packages included Progress Reports describing work in progress to address deficiencies in the DWR Determination Letter. • Monthly: General Manager's provided updates on KGA activities and District coordination with adjacent management areas during each monthly Board Meeting. • March 9, 2022: NKWSD RMW coordination meeting with KRGSA • March 31, 2022: NKWSD RMW coordination meeting with Cawelo WD • April 7, 2022: Management area coordination meeting with Shafter-Wasco, North Kern, Rosedale-Rio Bravo, and 7th Standard Annex. • April 18, 2022: NKWSD RMW coordination meeting with KRGSA • April 27, 2022: Meeting with Cities of Shafter and Wasco Staff to discuss DWR Determination Letter and work in progress to resolve the deficiencies. • May 20, 2022: NKWSD SGMA Landowner Committee meeting, presentation on Determination Letter and work in progress to resolve deficiencies. • July 12, 2022: NKWSD SGMA Landowner Committee meeting, present Amended Management Area Plan. • July 13, 2022: SWID Special Board Meeting to approve the Amended Management Area Plan. • July 15, 2022: NKWSD Special Board Meeting to approve the Amended Management Area Plan. • As a member of the KGA, all coordination included in the KGA section above is also included.
Rosedale-Rio Bravo Water Storage District	• Monthly: RRBWSD Board Packages included Progress Reports describing work in progress to address deficiencies in the DWR Determination Letter. • February 22, 2022: RRBMA Stakeholder Workshop #11 • March 9, 2022: ID4, NKWSD, SWID and 7th Standard Annex, SWSD Coordination Meetings • March 14, 2022: SWSD Coordination Meeting • April 7, 2022: NKWSD, SWID and 7th Standard Annex, SWSD Coordination Meeting

Management Area	Summary of Communications and Stakeholder Engagement in response to DWR's Determination Letter
	• April 12, 2022: RRBMA Stakeholder Workshop #12 • April 13, 2022: NKWSD Coordination Meeting • April 29, 2022: RRBMA Stakeholder Workshop #13 • June 14, 2022: RRBMA Stakeholder Workshop #14 • June 28, 2022: RRBMA Stakeholder Workshop #15 • July 12, 2022: RRBMA Stakeholder 2020 Revised Plan Hearing #2
Semitropic GSA	• February 9, 2022: GSA Board Meeting MA2 update and review of DWR Comments on GSP • February 11, 2022: Workshop with DWR regarding DWR Determination Letter • February 17, 2022: Coordination Meeting (SWID, North Kern WSD, South San Joaquin MUD) • February 28, 2022: Coordination Meeting (RRB) • March 9, 2022: Coordination Meeting (RRB) • March 9, 2022: GSA Board Meeting Review of DWR comments on GSP • March 25, 2022: Coordination Meeting (SWID) • April 5, 2022: Coordination Meeting (Lost Hills Utility District) • April 13,2022: GSA Board Meeting Review of Beneficial Uses and Users, Draft SGMA Mitigation Plan, MA2, Deficiency 1 and 2 items • May 11, 2022: GSA Board Meeting Review approach to responses to DWR comment, Basin coordination and updates • May 25, 2022: Special GSA Board Meeting Review draft revisions to Management Area Plan, Domestic Well Mitigation Program • June 8, 2022: GSA Board Meeting Review draft revisions to Management Area Plan • June 21, 2022: GSA Board Meeting Review draft revisions to Management Area Plan • July 13, 2022: GSA Board Meeting Adopt Revised Management Area Plan
Shafter-Wasco Irrigation District 7th Standard Annexation	• Monthly: SWID MA2 Landowner meetings for discussions to address DWR deficiencies and planning for revisions to MAP. • Monthly: SWID MA2 Manager provided updates on KGA activities and coordination with adjacent management areas during each monthly Board Meeting. • March 9, 2022: SWID coordination meeting with Rosedale-Rio Bravo Water Storage District and other MAs. • April 7, 2022: SWID coordination meeting with Rosedale-Rio Bravo Water Storage District and other MAs. • July 6, 2022: SWID MA2 Landowner Workshop. • July 13, 2022: SWID Board Meeting to consider approval of the MA2 Amended Management Area Plan.
Southern San Joaquin Municipal Utility District	• Monthly: SSJMUD Board Meetings included a review of Progress Reports describing work in progress to address deficiencies in the DWR Determination Letter. • Monthly: SSJMUD Board Meetings included an overview of KGA activities and District coordination. • February 9, 2022: SSJMUD Board Meeting Review of DWR Comments on Management Area Plan • February 11, 2022: Workshop with DWR regarding DWR Determination Letter • March 9, 2022: SSJMUD Board Meetings review of DWR Determination Letter and identified deficiencies • April 12, 2022: SSJMUD Board Meeting Review of Proposed Revisions to Address Deficiency 1 and Deficiency 2; Approval of KGA Exceedance Policy

Management Area	Summary of Communications and Stakeholder Engagement in response to DWR's Determination Letter
	• May 11, 2022: SSJMUD Board Meeting Review of proposed responses to DWR Determination Letter • June 8, 2022: SSJMUD Board Meeting Review of Beneficial Uses and Users, Revised Well Impact Analysis, and Domestic Well Mitigation Program. • June 20, 2022: SSJMUD Special Board Meeting to approve the Amended Management Area Plan • As a member of the KGA, all coordination included in the KGA section above is also included.
West-Kern Water District	• Weekly meetings for KGA Member Agencies and their Consultants from February 1 through July 25, 2022 • Weekly meetings for Kern Subbasin GSAs and their Consultants from February 1 through July 25, 2022 • Monthly: WKWD Board Packages included updates describing work in progress to address deficiencies in the DWR Determination Letter. • Monthly: During regular board meeting, General Manager's report provided updates on KGA activities and any coordination discussions with adjacent management areas. • July 13, 2022, Special Board meeting to approve Revises Management Area Plan
Westside District Water Authority	• Weekly meetings with Board Director, General Manager, and lead consultant to provide updates on work in progress to resolve deficiencies. • April 19, 2022: WDWA Special Board Meeting to approve SMC's and Exceedance Policy. • June 2, 2022: Coordination meeting with neighboring GSA's to update groundwater level SMC's. • July 13, 2022: WDWA Special Board Meeting to approve Amended Management Area Plan.

1.3 Sustainability Goal

Under Section 354.24 of the GSP emergency regulations, each agency shall establish in its GSP a sustainability goal for the basin that culminates in the absence of undesirable results within 20-years of the applicable statutory deadline. This GSP and the GSPs of the other GSAs in the Subbasin have collaborated on the development of the following sustainability goal for the Kern County Subbasin.

The sustainability goal of the Kern County Subbasin is to:

- *Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon.*
- *Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA.*
- *Maintain its groundwater use within the sustainable yield of the basin as demonstrated by monitoring and reporting groundwater conditions.*
- *Operate within the established sustainable management criteria, which are based on the collective technical information presented in the GSPs in the Subbasin.*
- *Protect beneficial users for municipal and domestic drinking water supply wells*

In addition, sustainability within the KGA will focus on maintaining the economic viability of agriculture while also balancing the needs of all beneficial users that rely on groundwater resources. To achieve this, KGA members manage to checkbook water budgets as well as implement projects and management actions within their respective management areas to sustain water levels at or above the measurable objectives to mitigate impacts to beneficial users. Through the coordinated meetings regarding beneficial uses and users, all KGA members have agreed that their groundwater management objective is to avoid dewatering municipal wells and any unmitigated domestic wells. Table 1-3 and Figure 1-1 provides a summary of the number of wells for each beneficial use category and the potential impact to each category as a percent of wells that could be dewatered at the measurable objectives. Table 1-4 and Figure 1-2 provides the summary of potential impact at the minimum thresholds. Wells impacted at the measurable objectives or minimum thresholds are expected to be mitigated through well mitigation programs developed at the management area plan level.

Table 1-3. NEW Expected Well Impacts at the Measurable Objective

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	0	0	0%
EWMA	2	11	41	24%	0	0	0	0%
NK	1	22	161	13%	0	0	2	0%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	0	0	0%
SWID	16	68	118	42%	0	8	7	10%
SSJMUD	19	67	243	26%	0	13	11	15%
SWSD	4	138	763	16%	0	10	4	7%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	2	0	18%
Total	81	577	1827	26%	0	33	24	5%

0 Municipal wells going dry at the MT's

Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M=Municipal, D=Domestic and Small Community, A= Agircultural and Industrial

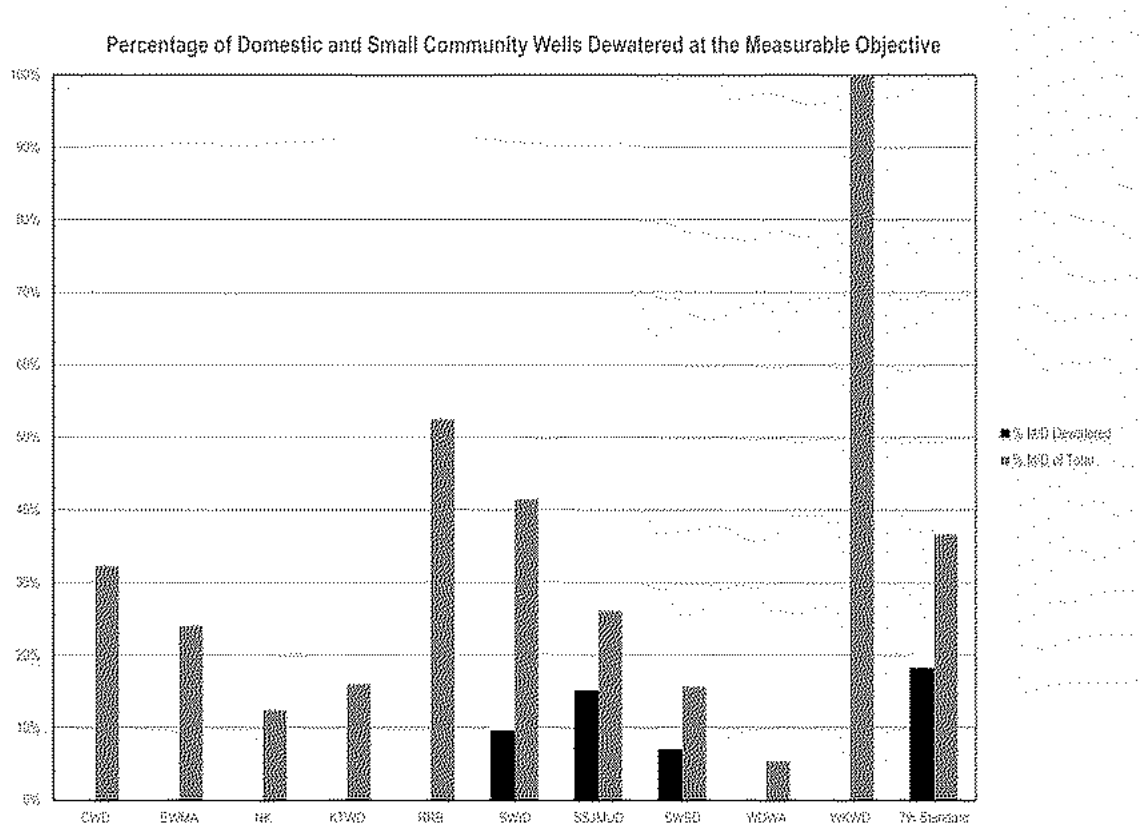


Figure 1-1. NEW Percentage of Domestic and Small Community Wells Dewatered at the Measurable Objective

Table 1-4. NEW Expected Well Impacts at the Minimum Threshold

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	3	1	3%
EWMA	2	11	41	24%	0	3	0	23%
NK	1	22	161	13%	0	2	5	9%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	21	0	12%
SWID	16	68	118	42%	0	22	13	26%
SSJMUD	19	67	243	26%	0	29	25	34%
SWSD	4	138	763	16%	0	41	52	29%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	5	2	45%
Total	81	577	1827	26%	0	126	98	19%

0 Municipal wells going dry at the MT's
Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M=Municipal, D=Domestic and Small Community, A= Agricultural and Industrial

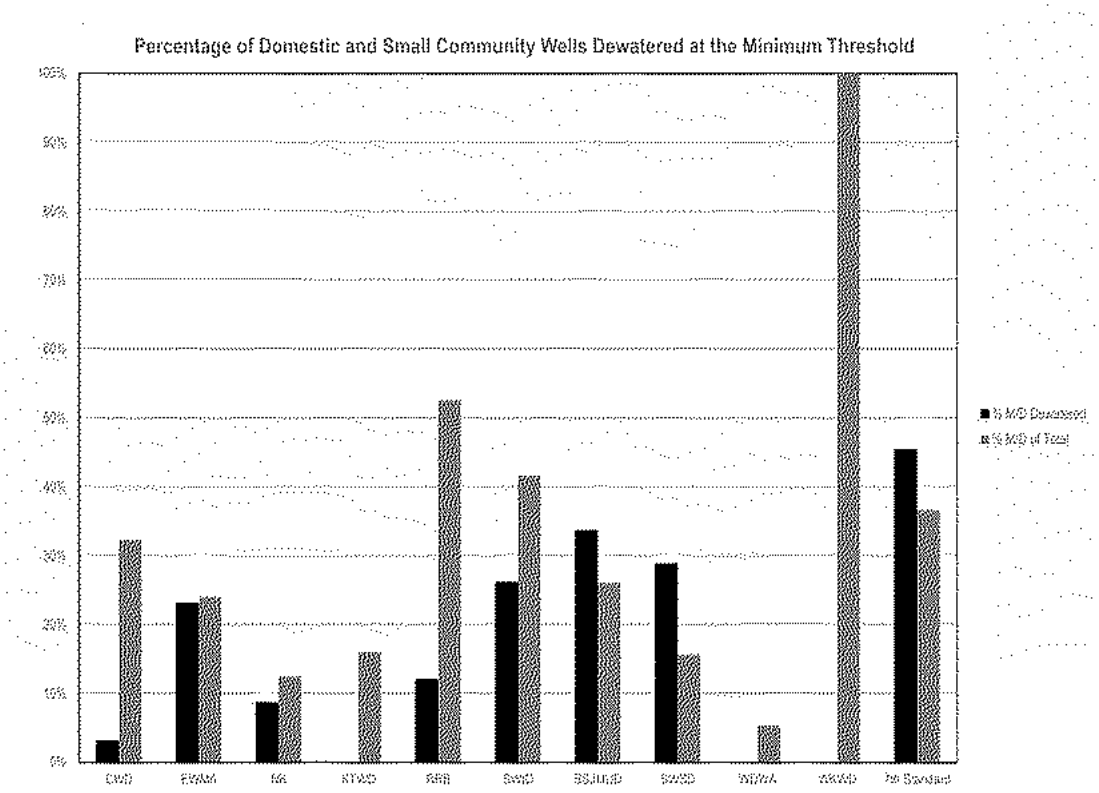


Figure 1-2. NEW Percentage of Domestic and Small Community Wells Dewatered at the Minimum Threshold

1.4 Agency Information

In complying with Section 354.6 of the GSP emergency regulations, the following section provides agency information, legal authority, and estimated cost of plan implementation for the KGA and its members in the Subbasin.

Agency's Name:	Kern Groundwater Authority
Agency's Address:	1800 30th Street, Suite 280
Agency's Phone Number:	(661) 479-7171
Agency's Website:	http://www.kerngwa.com/index.html
Contact Person:	Patty Poire
Contact Person's Title:	Executive Director, KGA

1.4.1 Organization and Management Structure of the KGA GSA

The Subbasin includes 14 organized GSAs, as shown in Figure 1-3. Table 1-5 indicates if the GSA have elected to prepare an independent GSP. In total, 14 GSAs in the Subbasin are developing six GSPs.

Table 1-5: Groundwater Sustainability Agencies in Kern County Subbasin

GSA Name	Independent GSP	GSP Name
Buena Vista Water Storage District GSA	Yes	BVGSA GSP
Henry Miller Water District GSA	Yes	HMWD GSA GSP
Cawelo Water District GSA	No	KGA GSP
Kern Groundwater Authority GSA	Yes	KGA GSP
City of McFarland GSA	No	KGA GSP
Pioneer GSA	No	KGA GSP
Semitropic Water Storage District GSA	No	KGA GSP
West Kern Water District GSA	No	KGA GSP
Greenfield County Water District GSA	No	KRGSA GSP
Kern River GSA	Yes	KRGSA GSP
Olcese Water District GSA	Yes	OGSA GSP
Arvin Groundwater Sustainability Agency	Yes	SOKR GSP
Wheeler Ridge-Maricopa GSA	Yes	SOKR GSP
Tejon-Castac Water District GSA	Yes	SOKR GSP

The KGA, as a Subbasin coordination group, was created prior to the enactment of SGMA with the intent of establishing a framework for the coordinated management of the groundwater basin underlying the San Joaquin Valley portion of Kern County, including the preservation and maintenance of local control over groundwater resources and to provide future certainty for basin users. With the passage of SGMA, the KGA elected to form a GSA under a Joint Powers Agreement (JPA) (Attachment A), thereby assuming responsibility for development of a comprehensive GSP for an area which includes agricultural lands, urban and industrial development as well as oil fields.

The KGA GSA covers approximately 1.3 million acres of the Subbasin's approximate 1.8 million acres and includes 12 member agencies and non-districted lands (Table 1-6 and Figure 1-4). The 12 member agencies also constitute the KGA Board, with one representative from each agency. The KGA also includes a single associate member, the Eastside Water Management Authority, who consistent with SGMA, is a non-voting member of the GSA and represents lands outside of a KGA member agency boundary. The Eastside Water Management Authority was formed by landowners who are non-districted and are working towards becoming a public agency in the future.

Table 1-6: Kern Groundwater Authority Member Agencies

Member Agencies	
Cawelo Water District[1]	Rosedale-Rio Bravo Water Storage District
City of Shafter	Semitropic Water Storage District[1]
Kern County Water Agency - Pioneer Project[1]	Shafter-Wasco Irrigation District
Kern-Tulare Water District	Southern San Joaquin Municipal Utility District
Kern Water Bank Authority	West Kern Water District[1]
North Kern Water Storage District	Westside District Water Authority
Associate Members	
Eastside Water Management Area	

1 – Groundwater Sustainability Agency

1.4.2 SOKR GSA Formation

The KGA submitted the KGA GSP to DWR in January 2020 on behalf of its members. The structure of the 2020 KGA GSP included an overarching or umbrella section and specific management area plan ("MAP") chapters for each of its member districts. After receiving an incomplete assessment from DWR, the KGA immediately began working diligently with its members and Kern Subbasin partners to address the DWR recommendations and deficiencies.

On April 21, 2022, three KGA members – Wheeler Ridge-Maricopa Water Storage District, Tejon-Castac Water District, Arvin-Edison Water Storage District – provided the KGA notice they planned to develop their own GSP as part of the revision in response to the DWR incomplete assessment. These members are geographically similar and plan to revise each of their respective MAPs and submit these sections together as the South of Kern River ("SOKR") GSP. On May 20, 2022, the SOKR members requested the KGA amend its GSP to exclude the SOKR GSAs from the revised KGA GSP. In addition to the removal, this request asked that the SOKR members be allowed to continue KGA membership until they adopted the SOKR GSP, in late July of 2022.

The KGA had significant concerns with the timing of the SOKR withdrawal and the ability of the KGA to both respond to the DWR incomplete assessment and achieve the changes necessary to facilitate the SOKR withdrawal. Despite these concerns, the KGA members have been dedicated to working with the SOKR GSAs to ensure the Kern Subbasin remains compliant with the requirements of SGMA. Specifically, the KGA has worked diligently to ensure the SOKR withdrawal will not disrupt its procedural compliance with SGMA, ensure the Subbasin remains

entirely managed, and develop comprehensive responses to DWR in response to its assessment. The KGA and the SOKR GSAs met with DWR to propose that the KGA submit the revised KGA GSP in response to the DWR assessment in two parts: the revised KGA GSP and the SOKR GSP.

On May 20, 2022, DWR provided a confirmation that, although it would prefer a single GSP for the subbasin, it would not be precluded from accepting the KGA GSP in two parts, from the KGA and SOKR respectively. DWR did not provide this guidance without reservation, but rather, provided the explicit cautions, noting this approach must:

- Ensure that there is no lapse in GSP coverage for the Subbasin; a lapse in coverage would result in an inadequate determination;
- Provide a uniform, basin-wide response to the deficiencies identified in the Incomplete Determination; if the SOKR withdrawal hinders, confuses, or creates additional deficiencies the subbasin would be determined inadequate;
- Amend the Coordination Agreement and ensure all parties sign the amended coordination agreement; if the Coordination Agreement does not include all parties, the revised GSPs cannot be submitted to DWR;
- Ensure the SOKR GSP is complete and contains all the necessary information of an individual GSP; an incomplete SOKR GSP would result in an Inadequate Determination for the entire Kern County Subbasin.

The KGA has been working diligently to achieve the above requirements and protect its members from exposure to an inadequate determination. From a technical perspective, the KGA revised its GSP to remove the SOKR MAPs from its GSP. In addition, all KGA technical materials have been amended to ensure the KGA does not include or otherwise exercise jurisdiction over the SOKR member district areas. On June 22, 2022, the KGA was briefed and understood that the Provision of Jurisdiction Agreements with SOKR districts would expire upon the SOKR districts no longer being members of the KGA. This Provision of Jurisdiction Agreement provided to Wheeler and Arvin with jurisdiction that allowed the districts include out of district lands in their GSAs to ensure the SOKR GSAs are able to obtain valid jurisdiction for management outside of their service area boundaries. The termination of jurisdiction was coordinated to ensure the KGA continued to provide jurisdiction for as long as possible through KGA membership to avoid any lapse in coverage. The KGA amended the Coordination Agreement to include the SOKR agencies, amend all appendices to be consistent with the amendments in the Kern Subbasin GSPs and account for added SOKR GSA membership. The KGA presented the revised Coordination Agreement to the Kern Subbasin Coordination committee in June of 2022 to ensure all the Subbasin Coordination Committee members were able to review, adopt, and execute by the respective Boards by late July 2022. At the June 22, 2022, KGA meeting, the Board approved the revised Coordination Agreement.

1.4.3 Non-Districted Lands

At the inception of the KGA, Kern County was a member of the KGA to represent lands within the Subbasin and outside of the jurisdiction of a local agency participating in a GSA in the

Subbasin – non-districted lands. However, in December 2018, Kern County supervisors elected to withdrawal from the KGA as well as SGMA, and from that action, approximately 440,950 acres of non-districted lands became not covered by a GSA (Figure 1-5A). At the December 19, 2018 KGA Board meeting and after several meetings with staff from both the State Water Board and DWR regarding Kern County's departure, the direction provided by the KGA Board was to reach out to the non-districted landowners and extend coverage; however, those non-districted landowners who are not wanting to participate will be eventually removed from the KGA GSA boundary and will then be required to report directly to the State Water Resources Control Board (State Water Board). The KGA reached out to those landowners via a mass mail-out to advise of the County's decision and extended the opportunity to participate in SGMA through the member agencies of the KGA. The coverage to the non-districted lands was handled by the landowners entering into agreements with the KGA member agencies, including associate members, for SGMA coverage under the KGA members' respective management area plans. Assistance from Kern County Water Agency made this coverage possible by lending its jurisdiction under SGMA to the KGA members' who have agreements with those non-districted landowners. Through the efforts by the member agencies of the KGA, approximately 242,180 acres of the non-districted lands will be covered and will be compliant with SGMA. The remaining 198,770 acres not covered are typically grazing lands or lands associated with oil production where minimal or no groundwater usage exists. The decision to extend SGMA coverage and to revise the KGA GSA boundary to remove non-districted lands not participating with KGA member agencies has been presented and discussed openly at public KGA board meetings since the initial discussion at the December 2018 board meeting. Since the December 2018 Board meeting decision, the KGA has continued to oversee approximately 198,770 acres of non-districted lands that did not have agreements with its members. In 2022 the KGA retained those acres within its GSA boundary. The decision to retain the non-districted lands was made to provide the Kern Subbasin complete coverage in compliance with SGMA and stemmed from follow-up meetings with State Water Board and DWR Staff. Following decision, the KGA stepped up to cover non-irrigated and irrigated lands under their GSP. Other GSAs also extended coverage to landowner lands within or adjacent to their GSA.

For those non-districted lands not covered by a member of the KGA, the six Subbasin GSAs have coordinated to cover all those non-districted lands in the water modeling effort for the historic, baseline, and future projections. Today, the future projection water modeling results demonstrate that the entire Kern Subbasin (including the non-districted lands) will be sustainable with implementation of proposed projects and management actions activities by 2040. Also, the Kern Subbasin GSAs have agreed to continue to coordinate on the monitoring of those non-districted lands going forward and to include the monitoring data in the annual reporting requirements of the Subbasin, thus covering the entire basin in the GSP. Figure 1-5A reflects the data obtained through the development of the Subbasin's annual reports showing little to no consumptive use (measured as evapotranspiration (Et)) over the non-district lands. Figure 1-5B shows 2021 consumptive use in the Subbasin, which generally shows there is little to no consumptive use in the non-district lands. Figure 1-6A reflects water well locations within the non-districted area that supports the annual report data that little to no consumptive use occurs. Additionally, Figure 1-6B shows all representative monitoring wells in the Kern Subbasin in

proximity to the non-districted lands. One important requirement under SGMA is to consider all beneficial users in the setting of sustainable management criteria and to monitor those activities related to groundwater extraction. With almost no water wells in most of the non-districted lands thus no beneficial users to consider, these areas are considered as “management area watch areas”. The low consumptive use values on these non-districted lands demonstrates the lack of groundwater extractions in these areas and justification for consideration as “management area watch areas” Figure 1-5A is the result of satellite imagery for the entire Kern Subbasin generated for use in the annual report and updating the water model (C2VSim) for the entire Kern Subbasin. The lack or even no use of groundwater in these non-districted lands justifies the designation of these areas as “watch areas,” where no significant groundwater use currently exists or is planned consistent with current land use zoning. These watch areas will be monitored for land use changes and groundwater conditions that could change its designation and then at that time, the KGA will develop sustainable management criteria for the area. Prior to the 2025 GSP update, the KGA and the Kern Subbasin will be working on a Basin Study that will ultimately provide the native yield of native groundwater for the Subbasin. This will allow the GSAs to determine native sustainable yield allocations for each acre and process for the allocation of groundwater resources to non-districted lands. This process will provide water extraction limit for those lands that don’t have other water sources such as State Water Project, Friant Water Project, Kern River, or other surface water sources through the remaining implementation horizon and beyond.

Figure 1-5A reflects some irrigated non-districted lands located in the middle of the Kern Subbasin. Those irrigated non-districted lands are lands owned by the City of Los Angeles where they bring in their “sludge” to comply with their wastewater discharge requirements. These lands and the wastewater are used for the production of forage crops. There is one well located within the property to assist in the activities necessary to comply. The City of Los Angeles also has an agreement with the City of Bakersfield to accept their wastewater from their plant #3 (Order No. R5-2009-0087). The City of Bakersfield’s wastewater permit reflects that about 49-acre feet per day of treated effluent is delivered to the City of Los Angeles property. Between the delivery of wastewater sludge, deliveries from the City of Bakersfield and the one well, the City of Los Angeles has been able to comply with their discharge permit. To monitor these activities under SGMA, there are several monitoring wells of the Kern subbasin monitoring network to obtain seasonal water levels. Figure 3-4 in Section 3 provides the location of each monitoring well. The City of Los Angeles has also been very involved in that they attend meetings and understand the SGMA process.

Other small, irrigated lands shown in Figure 1-6 are also monitored through the Kern subbasin monitoring network (Figure 3-4, Section 3). Most of those lands are located adjacent to other GSAs or water districts and the landowners have properties in both the non-districted area and/or the adjacent GSA or water district.

As indicated above, the non-districted lands are monitored through the Kern Subbasin monitoring network or have no beneficial users or uses on the lands. For those lands that are irrigated, they are covered by the sustainable management criteria of the neighboring monitoring

wells as well as the adjacent KGA member. For those lands with no beneficial users or uses which is 98% of the lands, those lands are considered management area watch areas because there are no groundwater extractions due to no existing water wells.

To facilitate the implementation of the KGA GSP, KGA's jurisdictional area is divided into management areas formed by the portion of the Subbasin that underlies the boundaries of each member agency and any associated non-districted lands. Each member agency of KGA has developed its own management area plan to support the development of this KGA Umbrella GSP and collectively are used as reference for details regarding the variances between management areas throughout this report.

KGA includes one disadvantaged community (DAC) that has been a full voting member agency from the beginning of the formation of the exclusive GSA – the City of Shafter. Sustainable management for the City of Shafter is covered in North Kern Water Storage District & Shafter-Wasco Irrigation management area plan. The City of Shafter has been actively engaged with the KGA and its respective management area plan development.

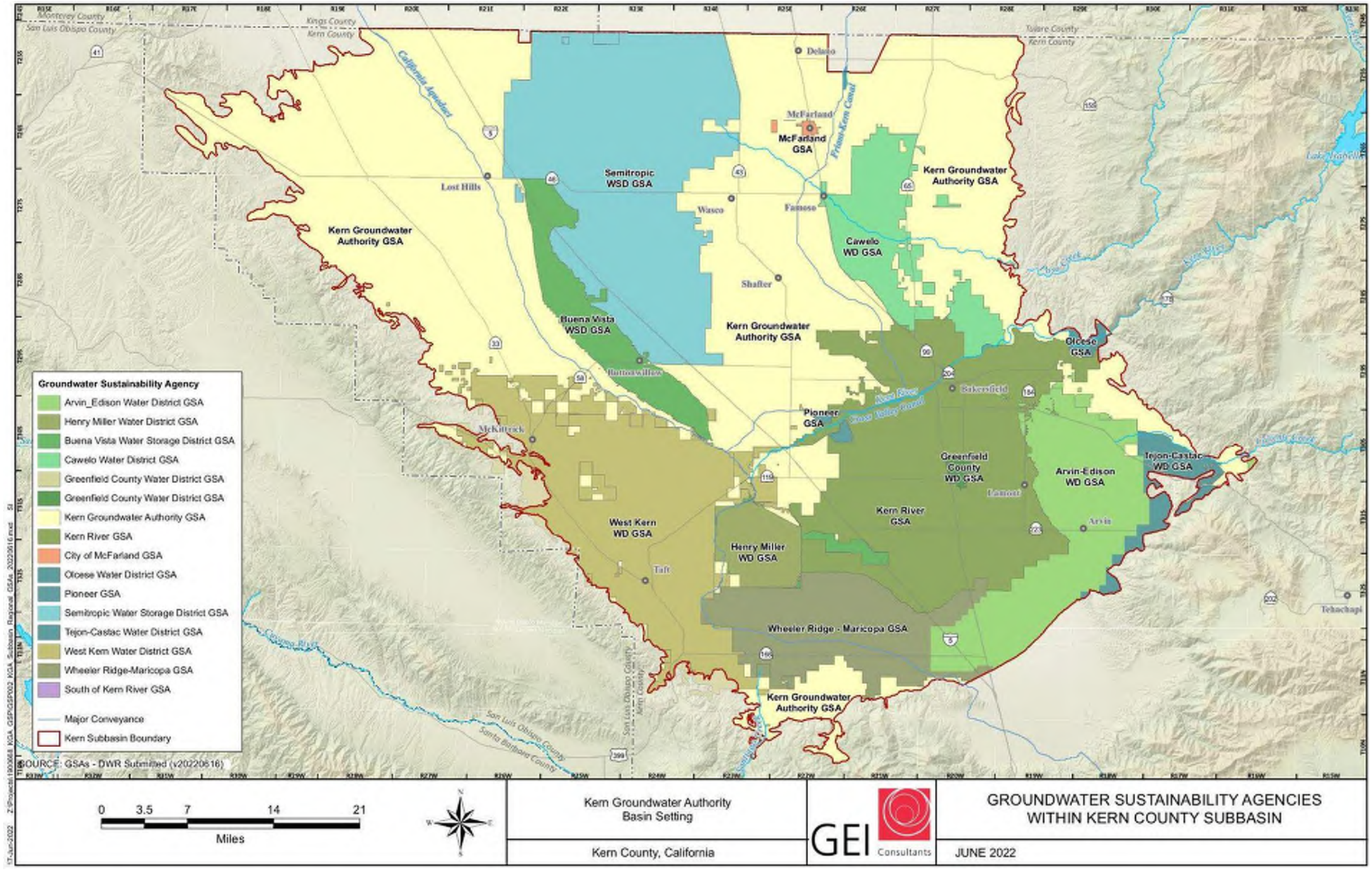


Figure 1-3. Groundwater Sustainability Agencies within Kern County Subbasin

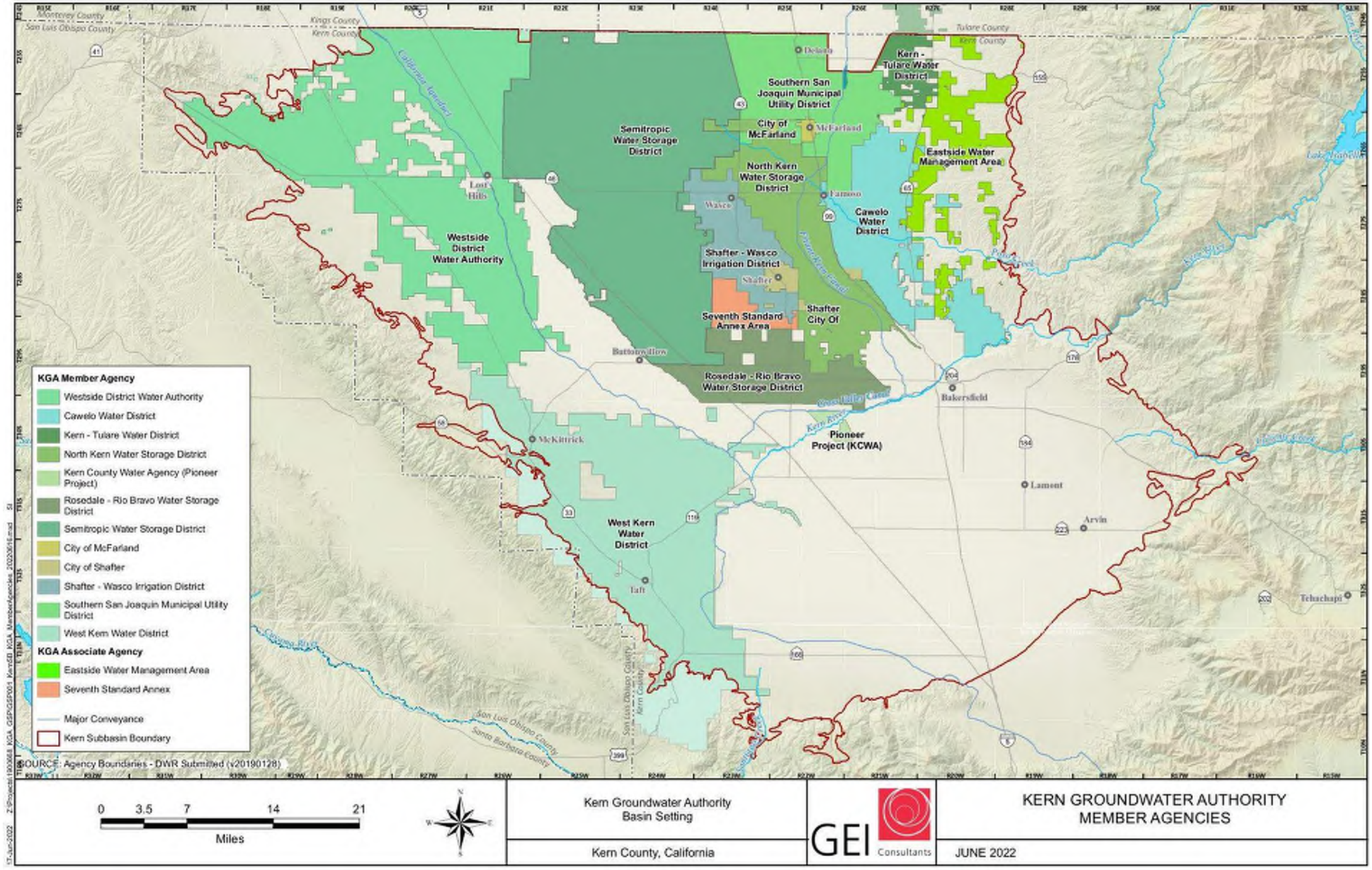


Figure 1-4. Member Agencies of the Kern Groundwater Authority

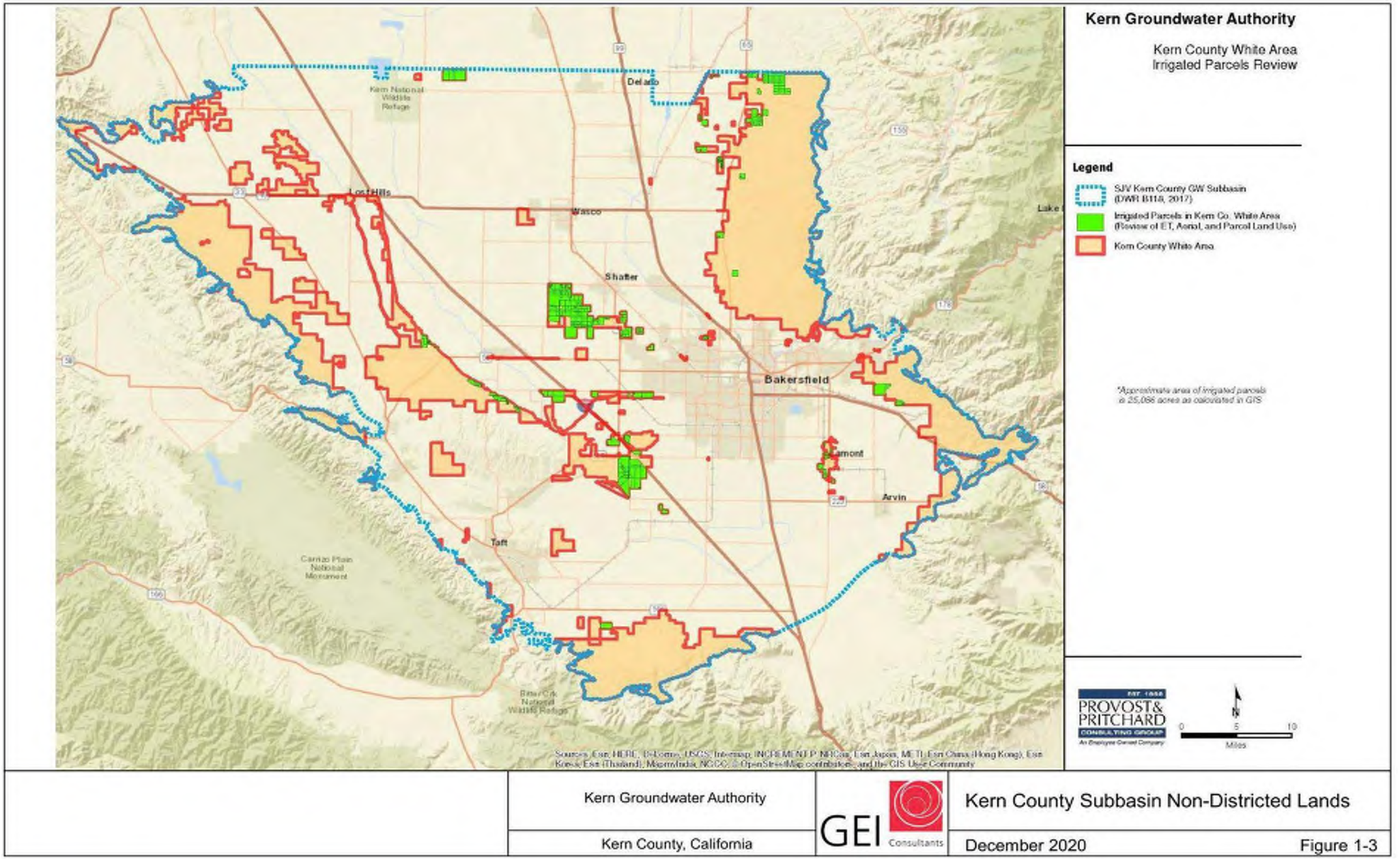


Figure 1-5. 2019 Kern County Subbasin Non-Districted Lands

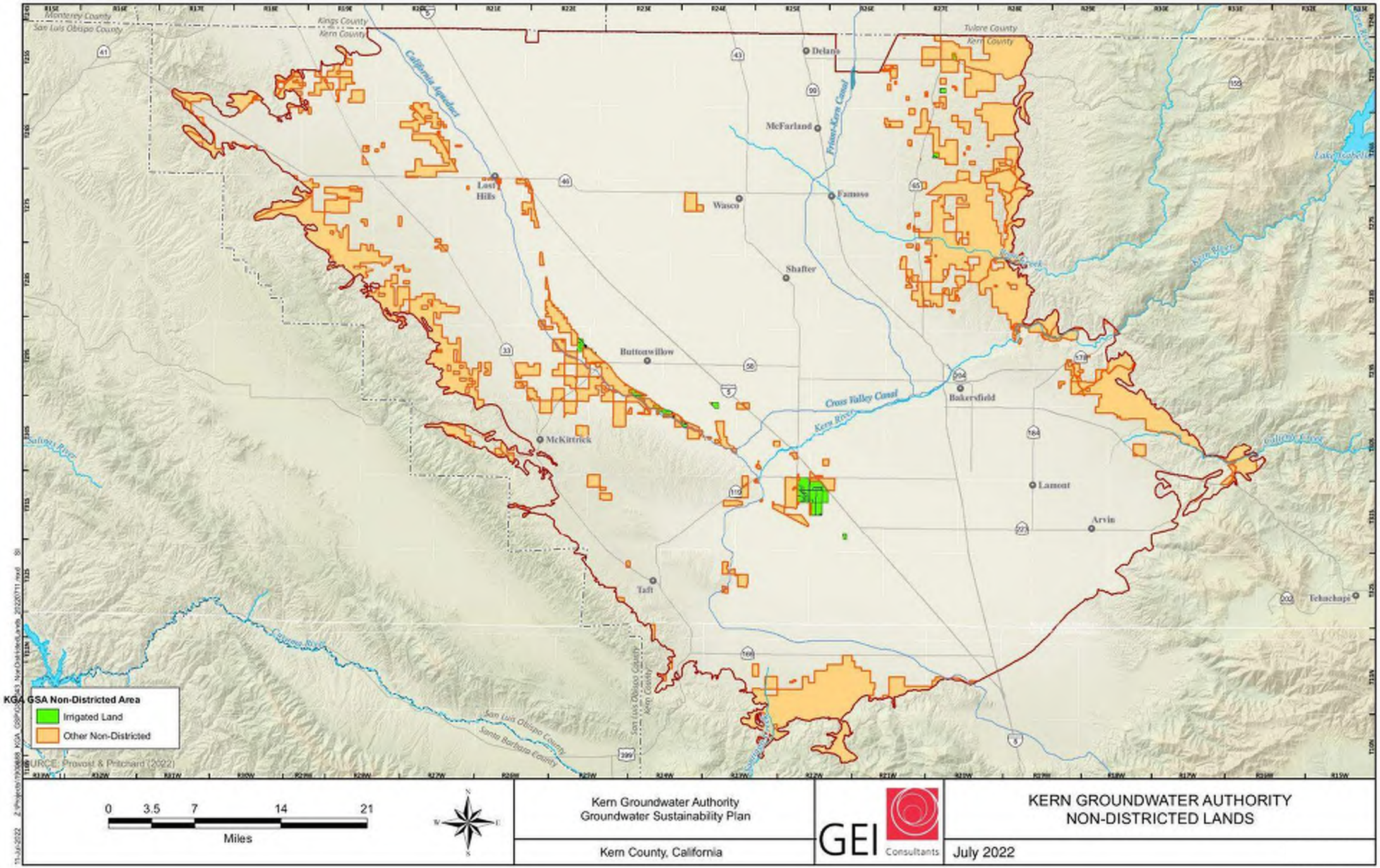


Figure 1-5a. REVISED Kern County Subbasin Non-Districted Lands

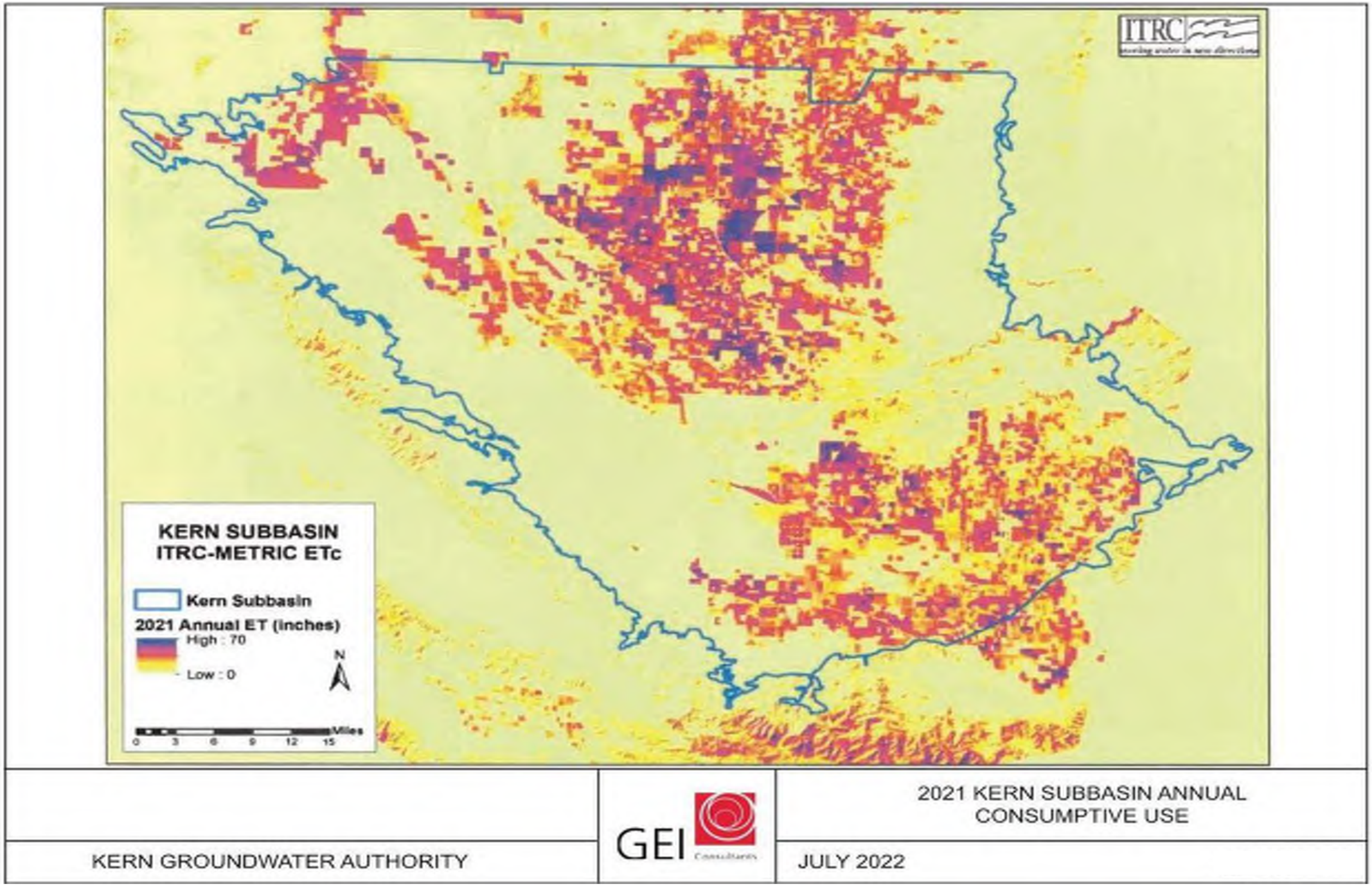


Figure 1-5b. NEW 2021 Kern Subbasin Annual Consumptive Use

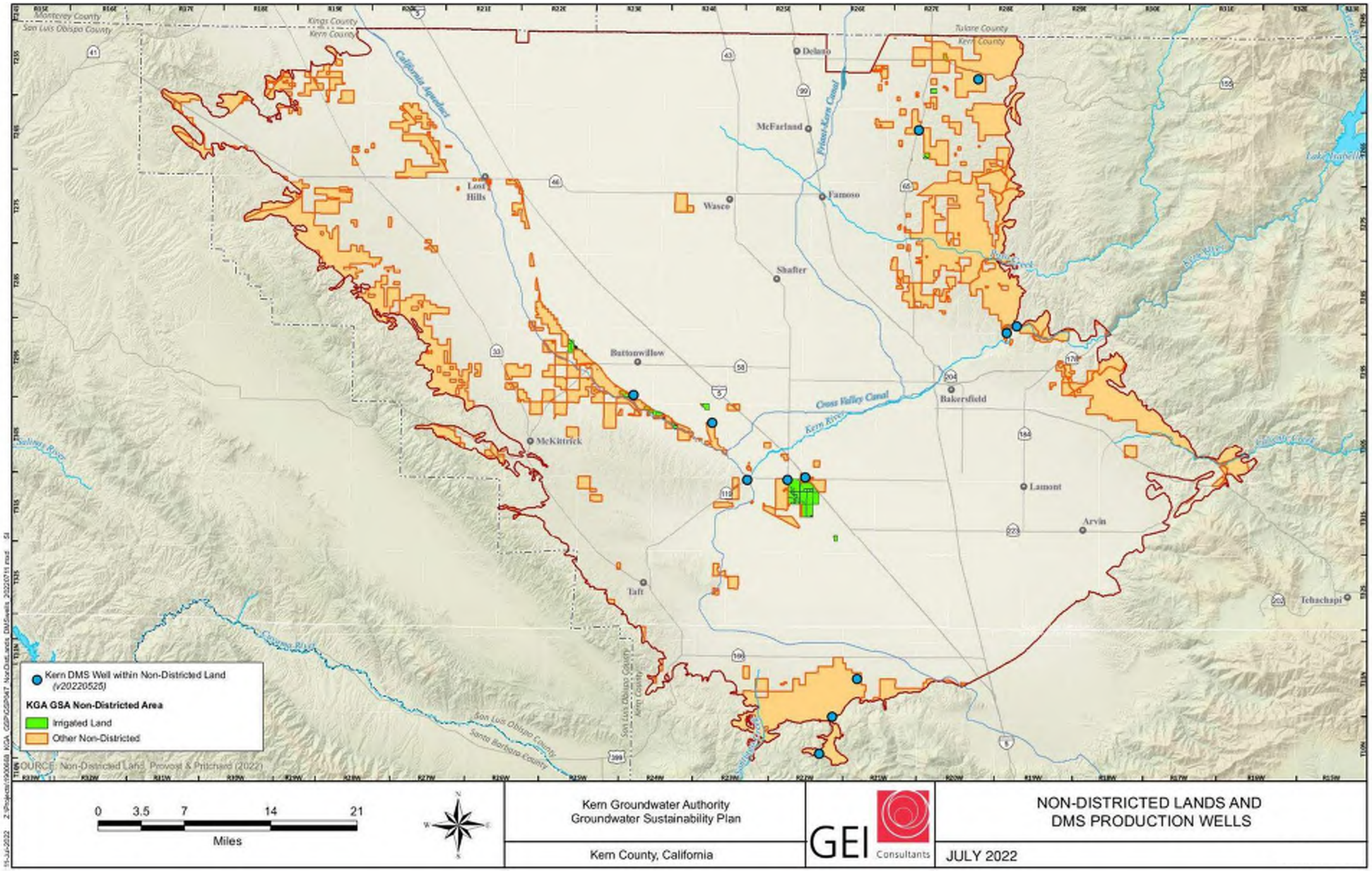


Figure 1-6a NEW. Kern County Subbasin Wells within Non-Districted Lands

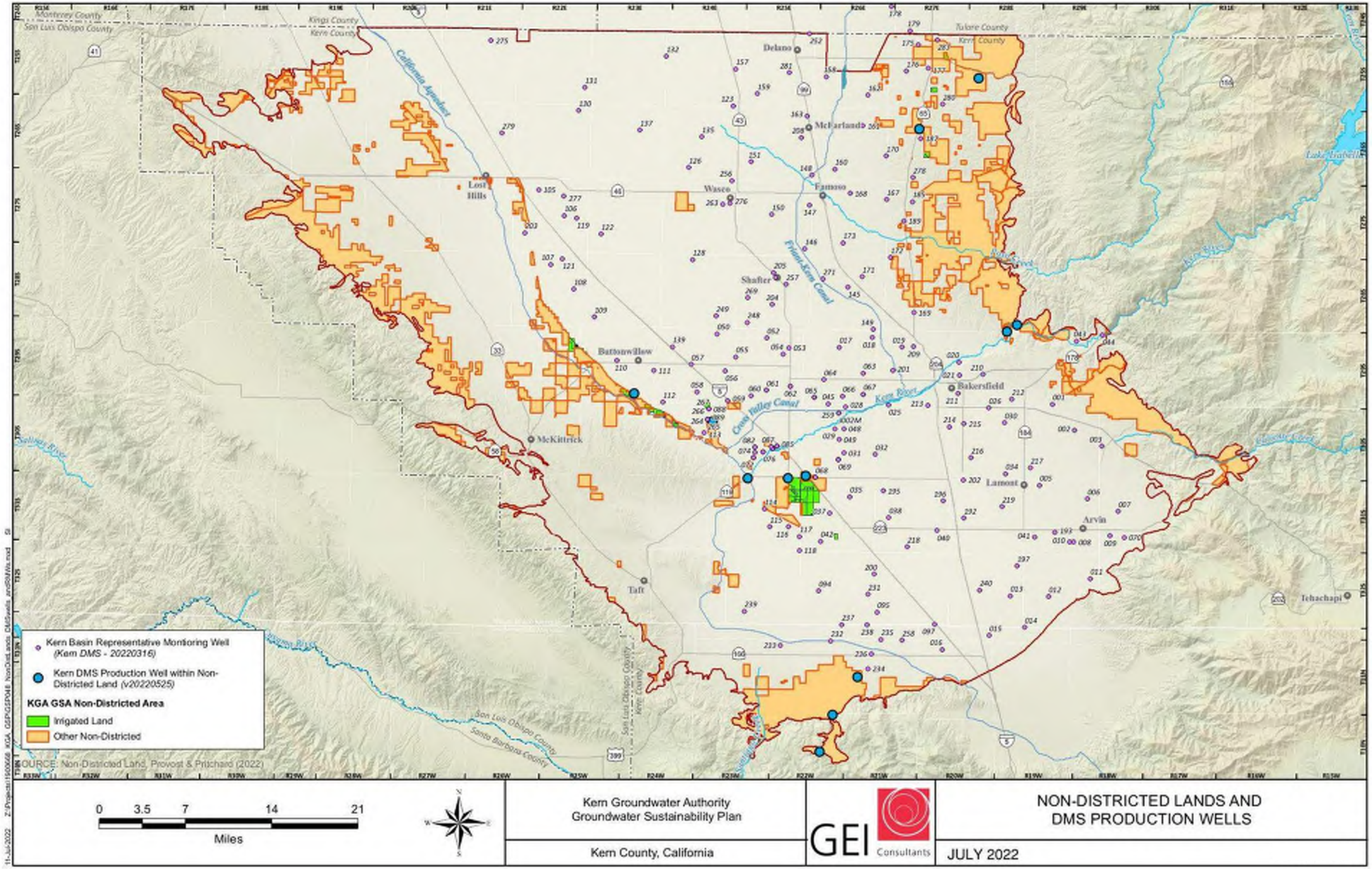


Figure 1-6b NEW. Non-Districted Lands and DMS Production Wells

This Page is Intentionally Blank

1.4.4 Legal Authority of the GSA

The KGA has been working proactively to coordinate with all GSAs and its associated GSP within the Subbasin to ensure that all GSPs developed within the Subbasin meet the requirements of the Kern County Subbasin Coordination Agreement. All the GSAs in the Subbasin have collaborated in the development and adoption of a Coordination Agreement, as required under SGMA, for the coordinated management and implementation of the five GSPs prepared in the Subbasin. Attachment B provides a copy of the Kern Subbasin Coordination Agreement. Table 1-7 provides the additional information of the six GSPs in the Subbasin.

Table 1-7: GSAs preparing GSPs within the Kern County Subbasin

GSA	Contact Person Title	Mailing Address	Phone Number	Website
Buena Vista Water Storage District	Tim Ashlock General Manager	PO Box 756 Buttonwillow, CA 93206	661-324-1101	www.bvh2o.com
Henry Miller Water District	Joef Wyrick President	101 W. Walnut Street Pasadena, CA 91103	626-583-3000	N/A
Kern Groundwater Authority	Patty Poire Executive Director	1800 30th Street Ste #280 Bakersfield, CA 93301	661-479-7171	www.kerngwa.com
Kern River Groundwater Sustainability Agency	Art Chianello Water Resources Manager	1600 Truxtun Avenue Bakersfield, CA 93301	661-326-3767	www.kernrivergsa.org
Olcese GSA	Brian Grant	P.O. Box 60679 Bakersfield, CA 93386-0679	661- 872-5050	www.olcesewaterdistrict.org
South of Kern River GSA	Jeevan Muhar	20401 Bear Mountain Blvd PO Box 175 Arvin CA 93202	661-854-5573	www.aewsd.org

The KGA was granted the legal authority of a GSA by complying with CWC Section 10723.8. The KGA held the required public hearings regarding the establishment of a GSA as stated in CWC Section 10723(b) and passed a resolution to form the KGA GSA. The authority granted to the KGA is to develop, adopt, and implement a GSP that would be available to those lands within the boundaries of the KGA members. KGA provided the required notification of intent to prepare a GSP to DWR on December 20, 2017. Under CWC Section 10723.2, the KGA within its boundaries shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing GSPs.

The KGA was formed for the purpose of:

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

The intent of the members under this JPA is to provide each member the sole right and responsibility to implement SGMA within its respective boundaries and/or management areas, in a manner determined by the member. Members expressly intend that the KGA will not have the authority to limit or interfere with the respective members rights and authorities over their own internal matters, including, but not limited to, a member's surface water supplies, groundwater supplies, facilities, operations, water management, and water supply matters.

1.4.5 GSP Implementation Costs & Funding

The KGA has developed the costs in Table 1-8 for its own administrative and coordination efforts as it serves as the coordination entity for the KGA member agencies. These costs will be funded through cost share agreement with the KGA member agencies.

The cost of implementing SGMA at the member agency level can be found in the management area plans attached to this GSP.

Table 1-8: Estimated Costs for GSP Implementation

Item	Description	Estimated Cost
Annual Administration	Administrative activities for ongoing coordination among Member Agencies and other GSA in the Subbasin and coordination with DWR.	$659,700
Sustainability Management and Coordination	KGA coordination with Member Agencies for coordinated implementation of sustainability management practices	$230,000
Coordinated Monitoring Activities	Basin-wide coordinated monitoring activities, such as, subsidence and evapotranspiration monitoring.	$200,000
Annual Report	Data collection and consolidation from Member Agencies to facilitate annual reporting to DWR	$350,000
5-Year GSP Update and Report	Data collection, consolidation and report generation of KGA 5-year update	$500,000

1.5 GSP Organization

The KGA Umbrella GSP provides SGMA coverage for all the Subbasin lands covered in the management areas of its member agencies. The members of the KGA have prepared management area plans that provide details for all GSP required elements, including the technical detail for setting sustainable management criteria specific for their respective management area. The KGA Umbrella GSP provides an overview and summary, a roll-up concept, of the GSP elements developed in the management area plans. There is a total of 12 management area plans attached to this GSP. This GSP is organized as follows:

1. Introduction
2. Plan Area and Basin Setting
3. Sustainable Management Criteria

4. Projects and Management Actions
5. Plan Implementation
6. References
7. Attachments
8. Management Area Plan Attachments
    1. Cawelo Water District
    2. Eastside Water Management Authority
    3. Kern County Water Agency – Pioneer Project
    4. Kern Tulare Water District
    5. Kern Water Bank Authority
    6. North Kern Water Storage District & Shafter-Wasco Irrigation District
    7. Rosedale-Rio Bravo Water Storage District
    8. Semitropic Water Storage District
    9. Shafter Wasco Irrigation District – 7th Standard Annexation Management Area
    10. Southern San Joaquin Municipal Utility District
    11. West Kern Water District
    12. Westside District Water Authority

2 Plan Area and Basin Setting

2.1 Description of Plan Area

KGA's jurisdictional boundary is entirely within the Subbasin, as defined in DWR Bulletin 118, South of the Tulare Lake Hydrologic Region of the San Joaquin Valley Groundwater Basin. The following section describes the area covered by the KGA GSP.

2.1.1 Summary of Jurisdictional Areas and other Features

The Subbasin is located within the southernmost portion of the Tulare Lake Hydrologic Region of the San Joaquin River Basin and is bounded by the Sierra Nevada on the east; by the Tehachapi Mountains, San Emigdio Mountains, and White Wolf Subbasin on the South; and the Coast Range (Temblor Range) on the west. As shown in Figure 2-1R, KGA's jurisdictional boundary represents 1,617 square miles or approximately 58 percent of the Subbasin. There are no Adjudicated Areas within the Kern County Subbasin.

Hydrologic systems in the Subbasin include numerous rivers, lakes, and canals, many of which are located in the KGA boundaries or are used to supply water to the entire Subbasin. The prominent natural surface water body in the Subbasin is the Kern River, which originates in the Sierra Nevada to the northeast of the Subbasin. Canals and conveyance systems within the Subbasin supply water for beneficial uses throughout the Subbasin. A detailed description of these hydrologic systems is included in Section 2.2 of the basin setting of this Umbrella GSP.

There are several incorporated cities within KGA's jurisdictional boundary as shown in Figure 2-1R. There are a number of de minimis domestic water users and multi-parcel water systems located within the KGA jurisdictional area, which will be covered under the management area GSPs.

2.1.2 Plan Area Setting

Land use designations within the KGA jurisdictional boundary are predominantly agricultural (Figure 2-2). Most urban and incorporated land use areas are in the eastern portion of the Subbasin while the agricultural lands dominate the northern, western, and southern portions. For lands covered by a water district, source of water is a combination of surface water and groundwater, as shown in Figure 2-3. Generally, all other lands not covered by a district are dependent on groundwater.

This Page is Intentionally Blank

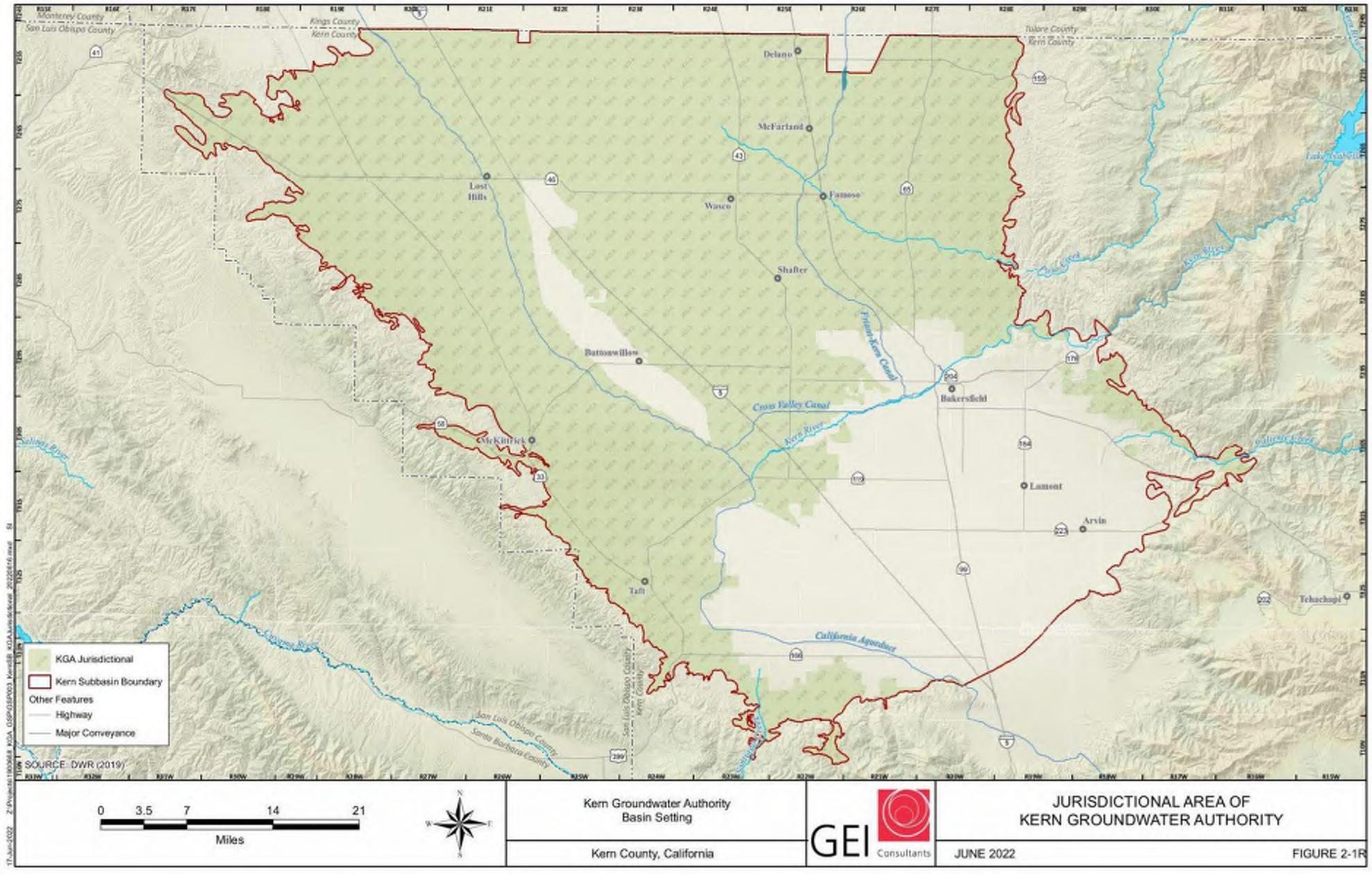


Figure 2-1R. REVISED Jurisdictional Area of Kern Groundwater Authority

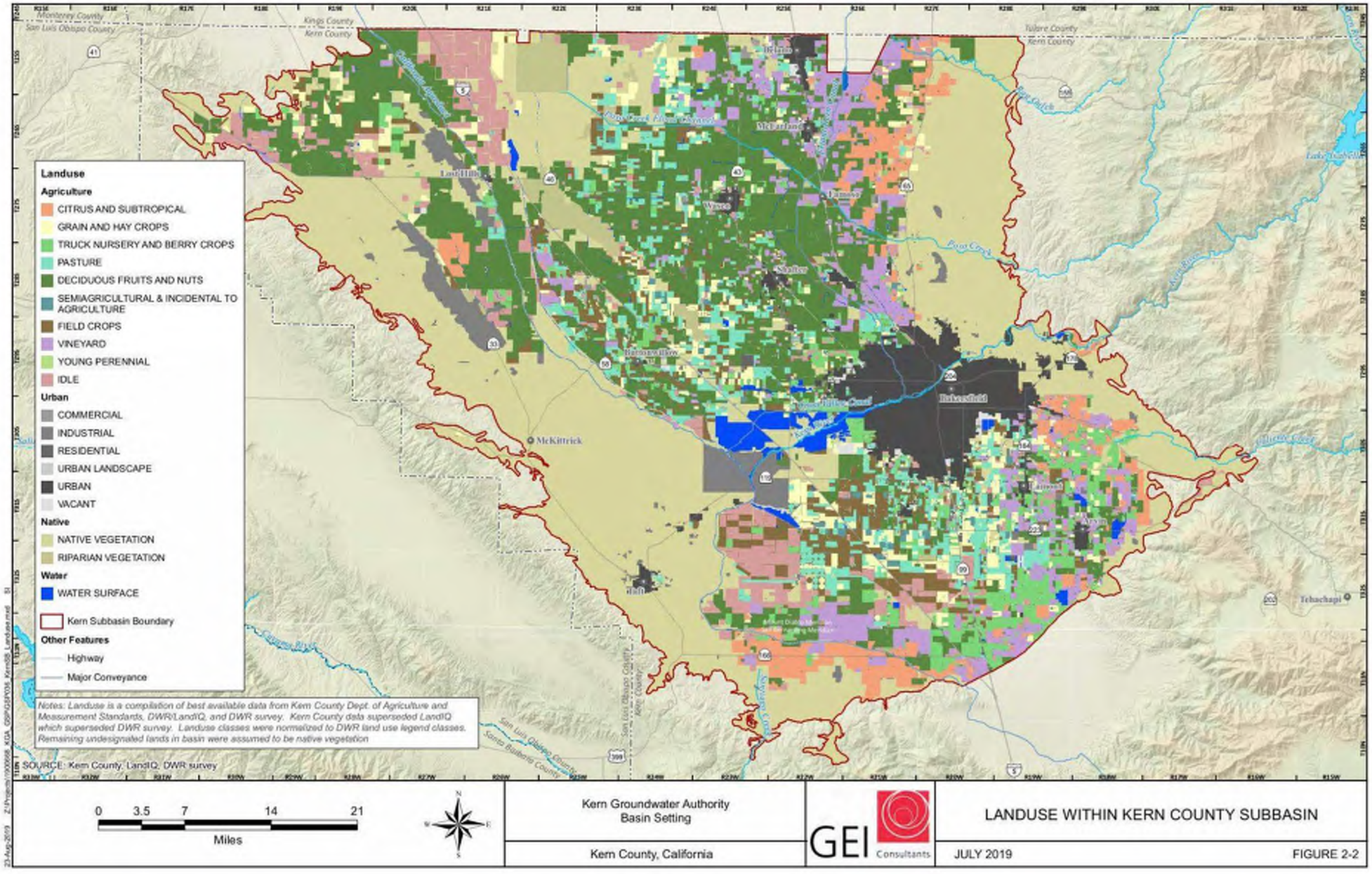


Figure 2-2. Land Use within Kern County Subbasin

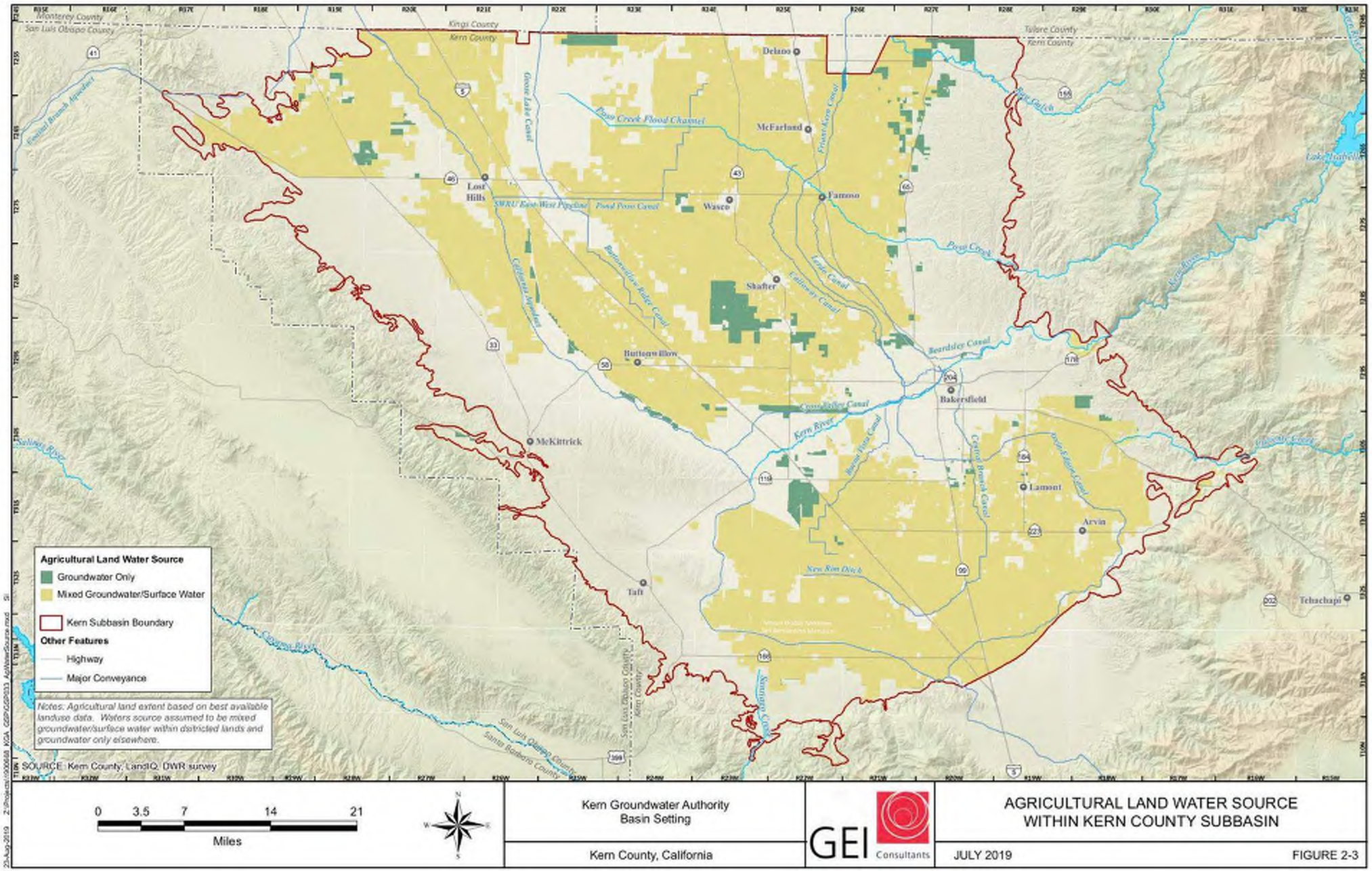


Figure 2-3. Agricultural Land Water Source within Kern County Subbasin

This Page is Intentionally Blank

Well densities for production, domestic, and public supply wells within the Subbasin are presented on Figures 2-4 through 2-6, respectively. This dataset is based on well statistics provided by DWR (2019) from the Online System for Well Completion Reports and is intended to be for qualitative informational purposes. Production wells include those described in completion reports as irrigation, municipal, public, or industrial wells. In summary, higher well densities can be found in the central portion of the Subbasin whereas moderate to lower densities are found in the north-east and south-east regions. The western region ranges in areas of low densities to no wells at all. For further information on well types and densities for each management area within the Subbasin, refer to the individual management area plans.

Under the KGA jurisdictional boundary, there are state, small multi-parcel water systems, and domestic water users that are groundwater dependent. In addition, there are incorporated cities within the KGA jurisdictional boundary as shown in Figure 2-7.

2.1.3 Existing Plans in the Plan Area

In general, the goals, policies, and implementation measures established by existing plans (e.g. the Kern County General Plan) are complementary to sustainable groundwater management of the local management areas relative to future land use development and conservation. The plan encourages development of the County's groundwater supply to ensure that existing users have access to high quality water, and states that future growth should be accommodated only while ensuring that adequate high-quality water supplies are available to existing and future users. Below is a list of all existing general plans within the Subbasin. The agencies that developed and adopted the general plans below have retained their jurisdiction over land use and zoning as well as the elements included into their respective general plans. The KGA nor its members have any jurisdiction over the development of general plans within the Subbasin, however, as general plans are being updated in the future, the KGA and its members will actively participate in the coordination of general plan update with the GSP implementation. The descriptions of plans associated with specific management areas are described in greater detail in the management area plans.

- **Kern County General Plan –** This plan was adopted in 2004 and is being updated through the year 2040. Its overall goal is to ensure the county can accommodate anticipated growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving valuable natural resources and assuring the provision of adequate public services (Kern County, 2009).
- **Metropolitan Bakersfield General Plan –** The current plan was first adopted in 2002. This plan aims to achieve goals related to new development, protecting natural resources from environmental damage, as well as preserving agricultural land (City of Bakersfield, 2016) The Metropolitan Bakersfield General Plan is mostly located within the Kern River GSA. There also exists a Metropolitan Habitat Conservation Plan that is mostly located within the Kern River GSA jurisdiction.

- **City of Shafter General Plan –** This plan's goals include, but is not limited to, recognizing and retaining commercial agriculture as a desirable land use and as a major segment of the community's identity and economic base (City of Shafter, 2005).
- **City of Wasco General Plan –** This plan was adopted in 2002 and contains objectives, policies and standards specific to the protection of groundwater resources as well as soils and air quality within the City of Wasco and its planning area.
- **City of Delano General Plan –** This plan was adopted in 2005 and aims to protect natural resources, including groundwater, soils, and air quality.
- **City of McFarland General Plan –** This plan was adopted in 1991; however, current versions of the plan do not specifically address groundwater.
- **City of Taft General Plan –** This plan was adopted in 2010; however, the adopted version does not specifically address groundwater.

Successful implementation of this GSP will help to ensure that the Subbasin's groundwater supply is managed in a sustainable manner. Implementation of existing policies are expected to be compatible with management areas strategies in the Subbasin to achieve groundwater sustainability. It is anticipated that implementation of this GSP, while consistent with existing plans and policies to protect water resources, will alter the water supply assumptions and potentially land use plans over the planning horizon. Given that the existing plans are being updated concurrently with the development of this GSP, it is anticipated that future plans would take into account this GSP and utilize consistent water supply assumptions over the 2040 planning horizon.

Land use plans vary between each management area, as they implement policies which best fit their communities. Management area plans provide specific information regarding land use plans and effects of those plans in the individual management areas.

The implementation of land use plans outside of the Subbasin could potentially affect the ability of the KGA to achieve sustainable groundwater management, especially to the north of the Subbasin. However, at this stage, coordination with neighboring Subbasin's has been limited. Future activities of the KGA include increased coordination with neighboring groundwater Subbasins, which will be documented in future updates to this GSP.

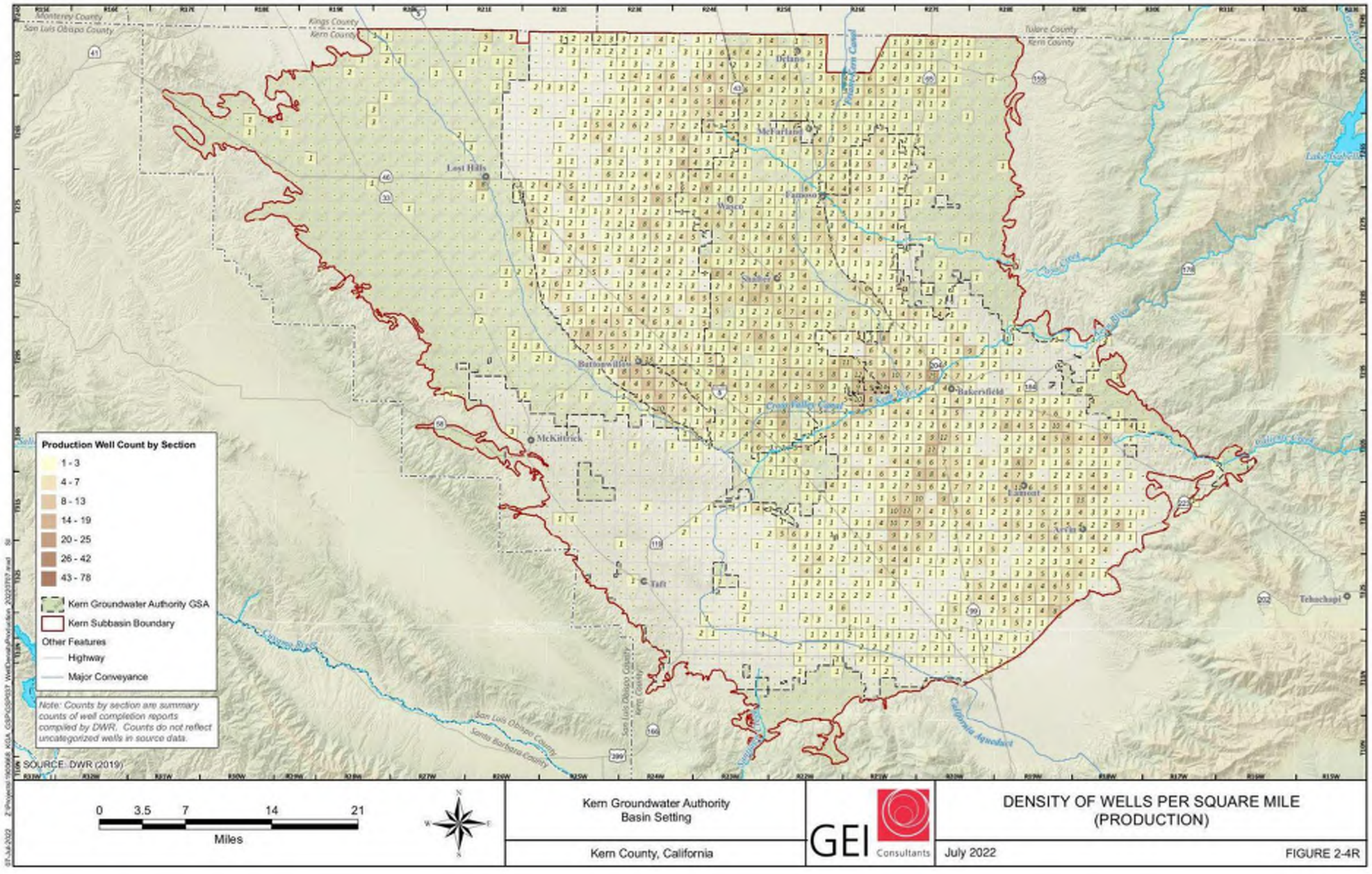


Figure 2-4R. REVISED Density of Well Per Square Mile (Production)

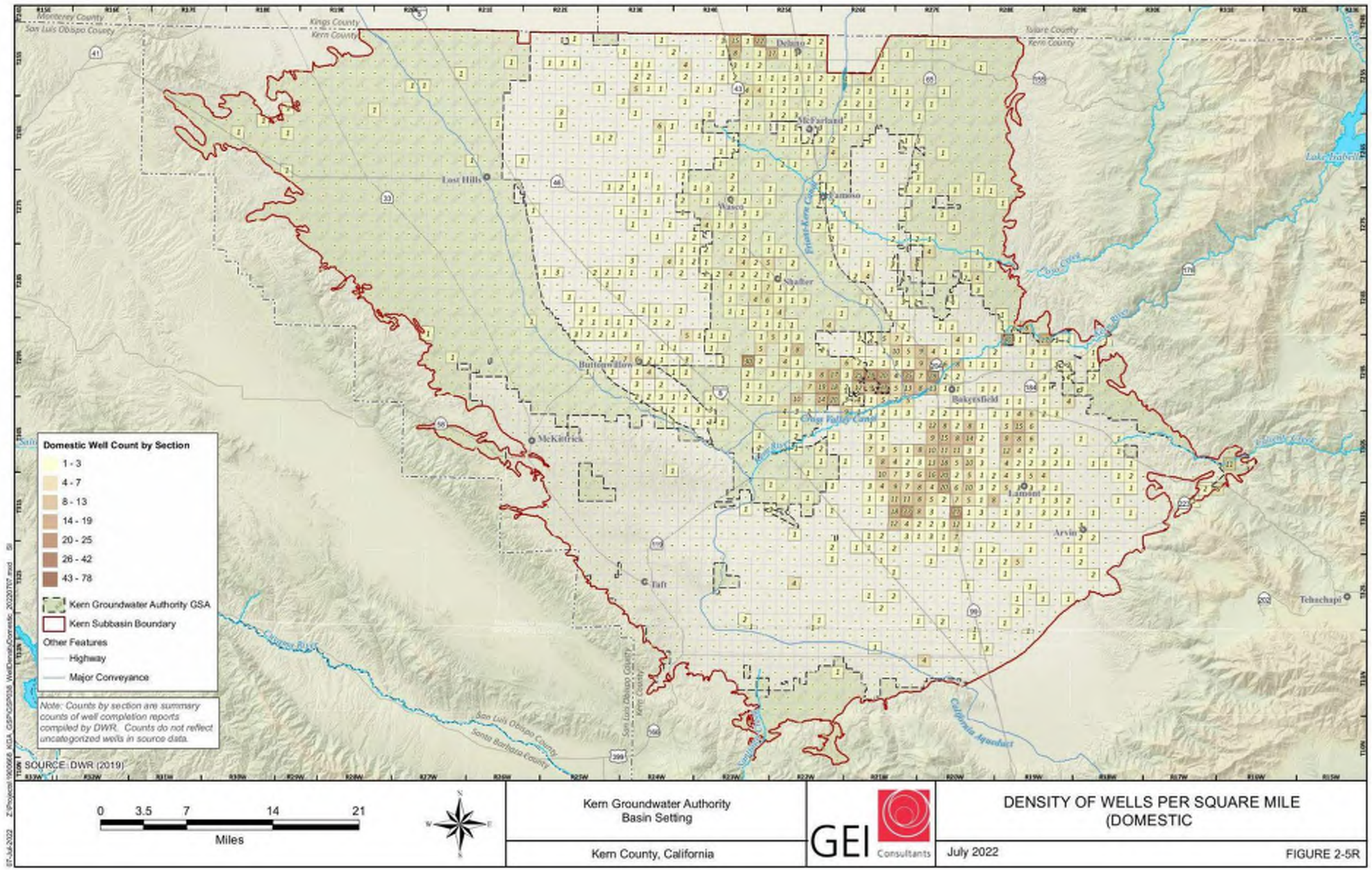


Figure 2-5R. REVISED Density of Well Per Square Mile (Domestic)

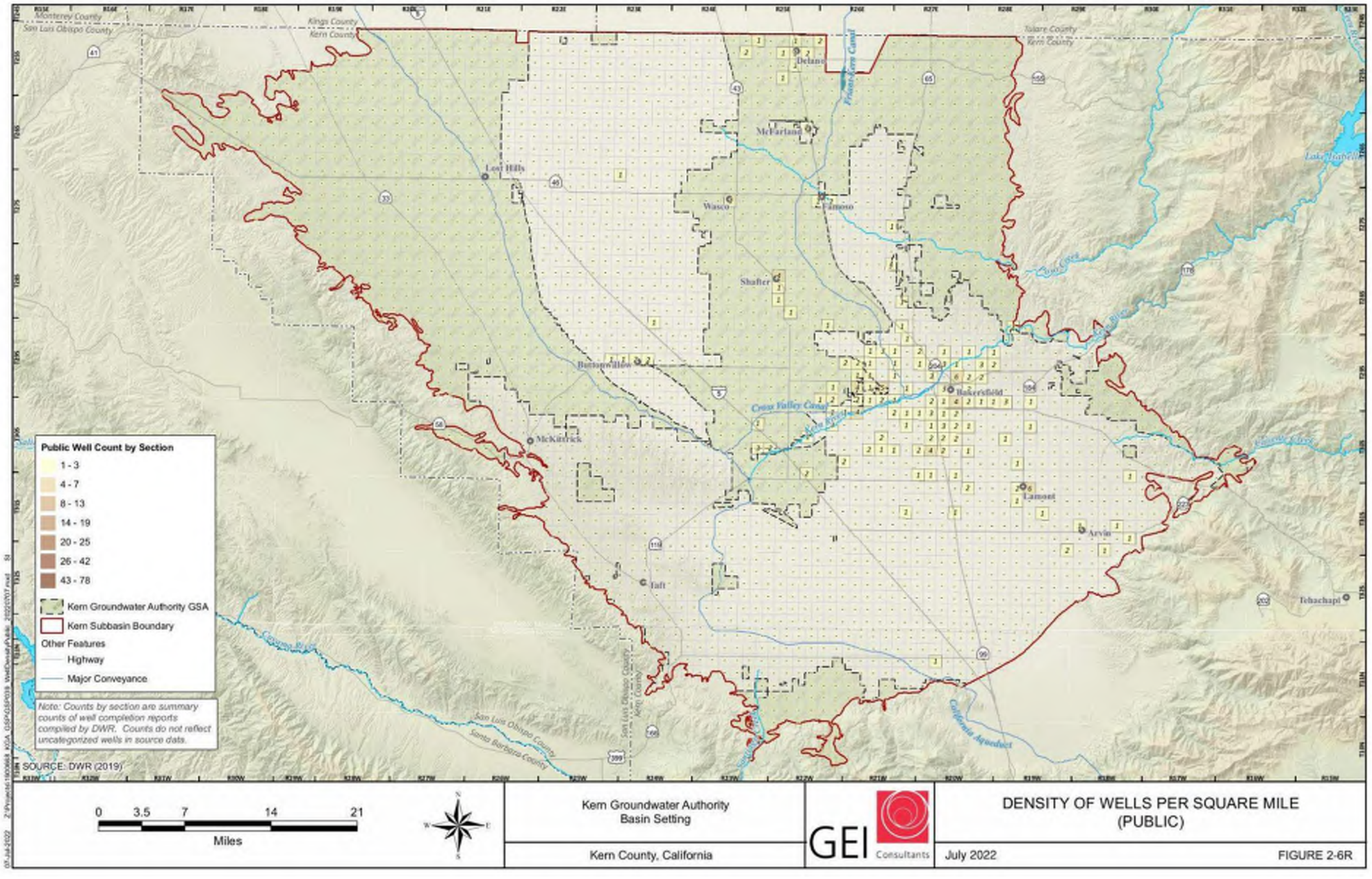


Figure 2-6R. REVISED Density of Well Per Square Mile (Public)

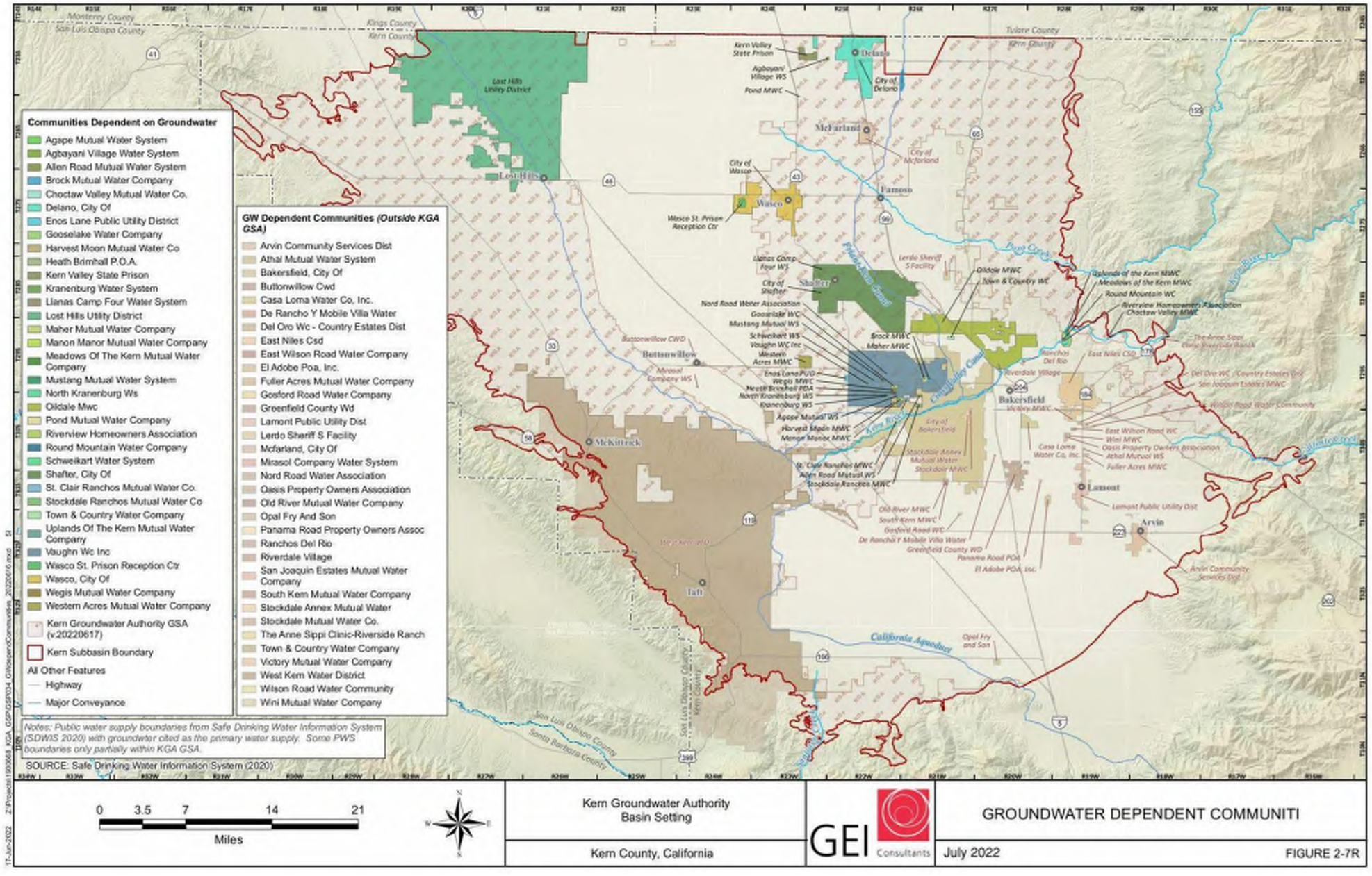


Figure 2-7R. Groundwater Dependent Communities

2.1.4 Existing and Ongoing Water Resource Programs

Per Section 354.8(c) of the GSP regulations, this section identifies and describes existing water resources programs in the KGA jurisdictional area. This section provides an overview of each program being implemented within the KGA. Table 2-1 provides a matrix showing which programs are being implemented within each management area. Additional details are provided in the individual management area plans.

2.1.4.1 Management Plans

The State of California has pre-SGMA programs for the management of groundwater supply and quality. These programs are managed at various levels of government by existing public agencies, either individually or collaboratively with neighboring agencies within the same groundwater basin. The following section provides an overview of these management programs and the elements addressed in each.

2.1.4.1.1 Groundwater Management Plans

In 1992, the State of California passed the Groundwater Management Act (AB 3030). This legislation provided guidelines for the agencies and districts to provide planned and coordinated monitoring, operation, and administration of groundwater basins with the goal of long-term sustainability. There are several types of Groundwater Management Plans, which are described below.

Pre-SB 1938 Plans: These plans, typically adopted before 2002, could be prepared by a local agency in a Bulletin 118-desginated basin on a voluntary basis. The voluntary components of these plans include:

- The control of saline water intrusion.
- Identification and management of wellhead protection areas and recharge areas.
- Regulation of the migration of contaminated groundwater.
- The administration of a well abandonment and well destruction program.
- Mitigation of conditions of overdraft.
- Replenishment of groundwater extracted by water producers.
- Monitoring of groundwater levels and storage.
- Facilitating conjunctive use operations.
- Identification of well construction policies.
- The construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
- The development of relationships with state and federal regulatory agencies.

- The review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination.

SB 1938 Plans: These plans were generally adopted during or after 2002, incorporating the elements of the Pre-SB 1938 Plans. With the passage of SB 1938, the following components were required as part of any Groundwater Management Plan:

- Basin Management Objectives: The Groundwater Management Plan shall include Basin Management Objectives relating to the monitoring and management of groundwater levels within the groundwater basin, groundwater quality degradation, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.
- Agency Cooperation: The local agency shall prepare a plan to involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin.
- Mapping: The local agency shall prepare a map that details the area of the groundwater basin, as defined in DWR's Bulletin 118, and the area of the local agency, that will be subject to the Groundwater Management Plan, as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a Groundwater Management Plan.
- Monitoring Protocols: The local agency shall adopt monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence (in basins for which subsidence has been identified as a potential problem), and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin.
- Located outside Bulletin 118 Groundwater Basins: Plans located outside DWR Bulletin 118 alluvial groundwater basins will incorporate the above components and shall use geologic and hydrologic principles appropriate to those areas.

Table 2-1: Summary of KGA Water Resources Programs

KGA Management Area Plan	Groundwater Management Plans			Water Management Programs						
	Pre-SB 1938 Plans	SB 1938 Plans	AB 359 Plans	Integrated Regional Water Management Plans	USBR Water Management Plans	Irrigated Lands Regulatory Program	Groundwater Export Ordinance	Title 22 Drinking Water Program	Urban Water Management Plans	Agricultural Water Management Plans
Cawelo Water District		X		X		X			X	X
Eastside Water Management Area						X				
Kern Water Bank										
Kern-Tulare Water District		X								
North Kern Water Storage District and Shafter-Wasco Irrigation District		X		X		X	X	X		X
		X		X		X	X	X	X	X
Pioneer				X					X	
Rosedale- Rio Bravo Water Storage District			X	X		X				
Semitropic Water Storage District		X		X		X	X	X		
Shafter-Wasco Irrigation District (7th Standard Rd.)										
Southern San Joaquin Municipal Utility District		X		X		X	X	X	X	X
West Kern Water District	X			X					X	
Westside District Authority				X		X				X

This Page is Intentionally Blank

AB 359 Plans: When AB 359 was enacted in 2013, it required additional technical components related to groundwater recharge areas and modification to several of the existing groundwater management plan adoption procedures in place as part of SB 1938. The additional technical components are as follows:

- The groundwater projects to which these requirements apply include projects that are part of an integrated regional water management program or plan.
- Groundwater projects require a description of how recharge areas identified in the plan substantially contribute to the replenishment of the groundwater basin and a map identifying the recharge areas, as defined, for the groundwater basin to be included in a groundwater management plan for purposes of the state funding requirements.
- Require the local agency to provide the map of the recharge areas to local planning agencies and notify the department and other interested persons when a map is submitted to those local planning agencies.

2.1.4.1.2 Integrated Regional Water Management Plans

In 2002, the Regional Water Management Planning Act (SB 1672) created the Integrated Regional Water Management (IRWM) Program. The IRWM Program is used as a collaborative effort to identify and implement water management solutions on a regional scale that increase regional self-reliance, reduce conflict between agencies and users, and manage water to concurrently achieve social, environmental, and economic objectives. By collaborating on projects, participants in the IRWM Program can provide these benefits and meet their water supply and quality goals. In the Kern County Subbasin, there are two IRWM Plans: the Poso Creek IRWM Plan and the Kern County IRWM Plan.

2.1.4.1.3 USBR Water Management Plans

The Central Valley Improvement Act of 1992 and Section 210(b) of the Reclamation Reform Act of 1982 requires certain entities to prepare and submit a Water Management Plan. Entities required are those that enter into a repayment contract or water service contract with the Bureau of Reclamation. Not all member agencies under KGA are required to have a plan under USBR. Refer to management area plans for specific details.

2.1.4.1.4 Irrigated Lands Regulatory Program

The Tulare Lake Basin General Order (Order R5-2013-0120) was passed by the Regional Water Quality Control Board (RWQCB) in 2006. This order requires that any irrigated land having the potential to discharge to surface water or groundwater must comply with the requirements set by the RWQCB. Compliance includes membership in a Coalition or obtaining coverage through an Individual Order from the RWQCB. Several districts in the KGA jurisdictional area are members of the Kern River Watershed Coalition Authority, which was formed in 2011.

2.1.4.1.5 Groundwater Export Ordinance

Kern County adopted a groundwater export ordinance in 1998, which requires a Conditional Use Permit for export of water to areas both outside the County and within watershed areas of

underlying aquifers in the County. The ordinance applies only to the southeastern drainage of the Sierra Nevada and Tehachapi mountains in the South Lahontan Hydrologic Region in eastern Kern County.

2.1.4.1.6 Title 22 Drinking Water Program

The Division of Drinking Water regulates public drinking water systems, which include municipal and state small water systems. These systems are required to comply with the standards set forth in Title 22 of the California Code of Regulations. For single parcel/single-connection systems, Kern County Environmental Health Services provides regulation and oversight to meet the requirements of Title 22.

2.1.4.2 Conjunctive Use Programs

Conjunctive use or "the coordinated use of surface water and groundwater" has been used for many years in Kern County, for the benefit of water users, to allow for flexibility in the way water is delivered, whether climatic conditions allow for imported surface water, or if groundwater is needed in any given year. Conjunctive use is further described by the Water Education Foundation with the following: "In its passive form, also called in-lieu conjunctive use, surface water is used in wet years and groundwater is used in dry years. In active conjunctive use, surface water is directly injected into aquifers and wells to be used as needed as part of groundwater banking" (Water Education Foundation, 2019).

In the Kern Subbasin, conjunctive use plays a vital role for all beneficial users to coordinate the use of surface water and groundwater to improve the overall reliability of water supply. Whether it be water used to irrigate crops or to service communities for drinking water purposes, all users benefit from conjunctive use programs throughout the Subbasin. Conjunctive use programs in the Subbasin have been developed to capture and transport wet year surface water for the purpose of groundwater recharge and offset use of groundwater pumping. In turn, this prepares the basin for dry periods when groundwater may be limited. Projects such as interties, pipelines, and recharge basins have been developed, financed, and implemented by districts within the Kern Subbasin to deliver, bank, and return surface water, as well as replenish aquifers to better prepare for and manage during times of dry periods when beneficial users are more reliant on groundwater. Many of these types of projects have been incorporated in other state programs, such as the IRWM program. In the Kern Subbasin, there are two IRWM regions including the Poso Creek IRWM Region and the Kern IRWM Region. Both regions have developed plans to manage water use and delivery as well as the development of water related projects. Further information on the types of conjunctive use programs in the Kern Subbasin can be found in each of these plans. Additionally, many of the projects captured in the IRWM plans are included in the management area plans as project and management actions to be implemented within the Kern Subbasin to achieve groundwater sustainability.

The majority of the KGA member agencies partake in groundwater banking and recharge programs. The purpose of these programs is to bring surface water into the Subbasin to recharge groundwater levels and better prepare for and manage water during times of dry periods or in wet periods where water is of excess. Groundwater banking refers to recharging specific amounts of

water in a groundwater basin that can later be withdrawn and used by the entity that deposited the water.

KGA member agencies have banking agreements amongst each other. For example, members of the Poso Creek IRWM such as Semitropic WSD and North Kern WSD, operate long-term water banking programs that allow banking partners, including districts outside of the Poso Creek IRWM Region, to store surplus water in another district and to recover their water when needed. These districts receive surface water from the banking partners in years of ample supplies and deliver it to their landowners for irrigation use in-lieu of groundwater pumping (*Poso Creek Integrated Regional Water Management Plan, 2019 Update*). Once banked, the entity depositing the water receives a credit and groundwater which otherwise would have been pumped remains in storage. In the Poso Creek IRWM Region alone, there is approximately 25,000 acre-feet per month of recharge capacity that can be used to bank imported surface water.

In addition to banking programs within the Poso Creek IRWM Region, other prominent groundwater banking facilities in the Kern Subbasin include the Kern Water Bank and Kern County Water Agency - Pioneer Project. These are facilities managed by the Kern Water Bank and the Kern County Water Agency, respectively. Kern Water Bank contains approximately 7,000 acres of recharge ponds, which can recharge up to 72,000 acre-feet per month. When water is available to the Kern Subbasin which cannot be absorbed, these water banking projects provide additional storage facility for otherwise potentially lost surplus surface supplies available during wet years. Most members of the KGA participate in banking and recharge programs in one way or another. For further explanation of banking and recharge programs as well as district involvement, refer to individual management area plans.

2.1.4.3 Well Permitting Process

Well permits within the Subbasin are issued by the Kern County Public Health Services Department Water Well Program and will continue under SGMA. Kern County will continue to retain jurisdiction over the water well permitting process. The Water Well Program issues permits to construct, reconstruct, and destroy water wells. All wells must be constructed in accordance with Kern County Ordinance Code, Section 14.08, and the State Department of Water Resources' Bulletin 74-81 and Bulletin 74-90, except as modified by subsequent revisions. The ordinance requires, among other things, that domestic and agricultural wells be installed a minimum distance from potential pollution and contaminant sources; water quality be tested for new and reconstructed wells; an NSF 61 approved flowmeter be installed; and the final well construction be inspected by Kern County staff.

Through a collaborated process, the Kern Subbasin GSAs, with the KGA taking the lead, worked with the Kern County Public Health Services Department to develop a supplemental well application for wells to be installed within the Kern Subbasin (Figure 2-8). This new form requires the applicant to provide additional information regarding construction of the well, proposed use, and amount of water to be pumped. If the applicant knows the water district and GSA in which the well will be located, it is indicated on the form. The application is completed and submitted to the Kern County Public Health Department where it is forwarded to the

ENVIRONMENTAL HEALTH DIVISION
2700 M Street, Suite 300, Bakersfield, CA 93301
Phone # (661) 862-8740 Fax (661) 862-8701
Email EH@kerncounty.com

Overdrafted Basin Supplemental Well Application

FOR OFFICE USE ONLY Corcoran Clay: ☐ Yes ☐ No WP _____

Assessor's Parcel Number: _____ Township/Range/Section: _____

GPS Coordinates: Lat _____ Long _____ Well Elevation (ft): _____

Water District/GSA: _____ Est Cumulative Extraction Volume (ac ft) by 12/31/19: _____

☐ Irrigation ☐ Livestock ☐ Domestic ☐ Municipal ☐ Industrial ☐ Other _____

PROPOSED WELL DESIGN INFORMATION	
Proposed Well Depth (ft):	
Proposed Well Capacity (gal):	
Estimated Pumping Rate (gal/day):	
Proposed Pumping Schedule:	
Est Annual Extraction Volume (ac ft):	

GEOLOGIC SITING INFORMATION PROPOSED WELL	
Water Table Depth (ft):	
Seasonal Fluctuations in Water Table:	
Recharge Area (Yes/No):	
Recharge Rate (if known):	
Area to be served by well (in acres):	

EXISTING ON SITE WELL INFORMATION	Well 1	Well 2	Well 3
Type/Use of Well:			
Depth (ft):			
Diameter (in):			
Screen Interval (ft):			
Pumping Rate (gal/day):			
Est. or Annual Extraction Volume (ac ft):			
Capacity or Pump Test (gal) (if available):			

In addition to the above information, the following information ***must be shown*** on a detailed site map and include actual measurements (to scale not necessary). If in the Corcoran Clay, you may include 2 maps to satisfy the requirements below.

☐ Distance to potential sources of pollution, including but not limited to, septic systems, sewer lines, wells (all types), animal/fowl enclosures, or transmission lines; either existing or proposed.

☐ Distance from lakes, ponds, streams within 300 ft of proposed well

☐ If in Corcoran Clay, location of canals, ditches, pipelines, utility corridors, and roads within 2 miles.

Submitted By _____ Title _____ Date _____

Figure 2-8. Kern County Public Health Services – Over-drafted Basin Supplemental Well Application

appropriate water district or GSA, through the KGA Planning Manager. The district in which the well is located is able to provide comments on the application advising the applicant of sustainability criteria that may impact the operation of the well. This process has been in place since January 2019 and demonstrates coordination between Kern County Public Health Services requirements and SGMA requirements concerning water well permitting processes.

2.1.4.4 Plan Elements from CWC Section 10727.4

Per Section 354.8(g) of the GSP regulations, each plan shall include a description of any additional GSP elements included in Water Code Section 10727.4 appropriate to the region. While management area plans provide full details for each element, this section provides a brief overview.

(a) Control of saline water intrusion.

- Because the Kern County Subbasin is located far from coastal areas, saline water intrusion is not considered to be an issue.

(b) Wellhead protection areas and recharge areas.

- Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct, and destroy water wells (see Section 2.1.4). Recharge areas are managed by individual water districts in the Subbasin to bring in surface water to recharge the groundwater aquifers. Many districts engage in banking programs and work conjunctively to exchange water to support the sustainability of the Subbasin.

(c) Migration of contaminated water.

- The mitigation, remediation, and management of groundwater contamination plumes is regulated in the Subbasin by the Central Valley Regional Water Quality Control Board (CVRWQCB) and the County of Kern. Groundwater contamination plumes have been identified by individual districts, which actively monitor groundwater sampling and work with the CVRWQCB to address groundwater contamination issues. Contamination plumes are not found in every district under KGA, refer to management area plans for specific information.

(d) A well abandonment and well destruction program.

- Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct, and destroy water wells (see Section 2.1.4).

(e) Replenishment of groundwater extractions.

- KGA member agencies actively manage the groundwater basin within their respective boundaries through conjunctive use and other programs. For specific details pertaining to each management area refer to their management area plan.

(f) Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage.

- KGA member agencies actively manage the groundwater basin within their respective boundaries through conjunctive use and other programs. Refer to management area plans for specific details pertaining to each management area.

(g) Well construction policies.

- Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct, and destroy water wells. To see how this process is coordinated under SGMA with the Subbasin GSAs, see Section 2.1.4.3.

(h) Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.

- Oversight of groundwater contamination cleanup is provided by the CVRWQCB and the County of Kern.
- Recharge policies exist across the Subbasin that allows on-farm banking as well as banking and exchanges with other districts in the region.
- Conservation and irrigation efficiency practices have been encouraged and incorporated both at the district and grower level.
- In-lieu use, diversions to storage, water recycling, conveyance, and extraction projects on managed on a district level in the Kern Subbasin.

(i) 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.

- KGA Member Agencies are constantly pursuing efficiency with their water management practices through management plans as outlined in the management area plans.

(j) Efforts to develop relationships with state and federal regulatory agencies.

- Many of the member agencies under KGA hold state and federal water contracts as well as work closely with DWR on projects and management practices. Refer to management area plans for further details.

(k) 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.

- There are a number of water use and land use programs member agencies are involved in within the Kern Subbasin that require land use plans. Refer to management area plans for further details.

(l) Impacts on groundwater dependent ecosystems.

- This element is covered in the KGA Umbrella Chapter, Section 2.3.8, as well as the individual management area plans.

2.1.5 Notice and Communication

SGMA requires that GSAs consider the interests of all beneficial uses and users of groundwater and to encourage and include them in the GSP development process. To capture the intent of SGMA, as legislation better served under local control, KGA member agencies played a vital role in the development of this GSP. This process included communication and outreach at the local level, with each KGA member agency engaging with its beneficial users to gather vital input, data, and feedback to ensure the success of this GSP and individual management area plans.

In May of 2018, the KGA initiated the development of a Communication and Engagement Plan (C&E Plan) (Attachment C) to facilitate and assist KGA member agencies in stakeholder engagement and outreach. KGA communication and outreach consisted of stakeholder meetings and workshops; maintaining an interested parties list for KGA events; and development of a Stakeholder Survey and Agricultural Survey for the benefit of KGA member agencies. In addition to outreach and communication through the KGA, each member agency was tasked with conducting their own communication and outreach to better capture the diverse needs of their beneficial users within their jurisdictional areas. By receiving information directly for member agencies using a local control approach, users greatly benefitted.

For more detailed information on KGA member agency communication and outreach efforts please see the member agencies' management area plans.

2.1.5.1 Description of Beneficial Uses and Users in the Subbasin

As was previously stated, as required by SGMA, GSAs must consider the interests of all beneficial uses and users of groundwater and include them in the GSP development process. For the KGA and its member agencies, beneficial users are stakeholders who have an interest or a need in groundwater use within the boundaries of the KGA. With the development of the C&E Plan the focus was to address the opportunities for engagement and to encourage participation by beneficial users. Located within the C&E Plan are lists of beneficial users as well as a stakeholder engagement timeline based on phases of the GSP development and implementation processes. The engagement timeline for the KGA are shown in the following figures; Figures 2-9, Phase 1: GSA Formation and Coordination; Figure 2-10, GSP Preparation and Submission; and Figure 2-11, GSP Review and Evaluation.

Another component of the C&E Plan was the development of the interest parties list. The interested parties list began development immediately and is constantly updated to include all interested parties who sign in/attend any of the monthly meetings held by the KGA and/or its member agencies.

The development of the Stakeholder Survey and Agricultural Survey was a vital instrument in the KGA outreach during the process of the development of the management area plans. To capture as many diverse beneficial users as possible, the Stakeholder Survey was developed in both English and Spanish and was available at workshops, stakeholder meetings, and both were accessible on the KGA website where they could be completed online. The information provided

by the beneficial user assisted the KGA member agencies in the development of their projects and management actions. These surveys are located on the KGA website and can be completed online anytime during the process of the development of the management area plans. Monthly, the KGA took the information provided from those surveys and provided a summary report to the KGA Board of Directors, the KGA member agency managers, and to the public for their consideration.

2.1.5.2 Communication

2.1.5.2.1 Decision-Making Process

KGA was formed by a JPA that stipulates that each member agency has the sole right and responsibility to develop and implement SGMA within its respective boundaries; however, the KGA Board is the final decision-maker for the KGA and its member agencies, except for the implementation of SGMA within a management area. Implementation of SGMA is to be governed by the member agency within its jurisdiction.

This Page is Intentionally Blank

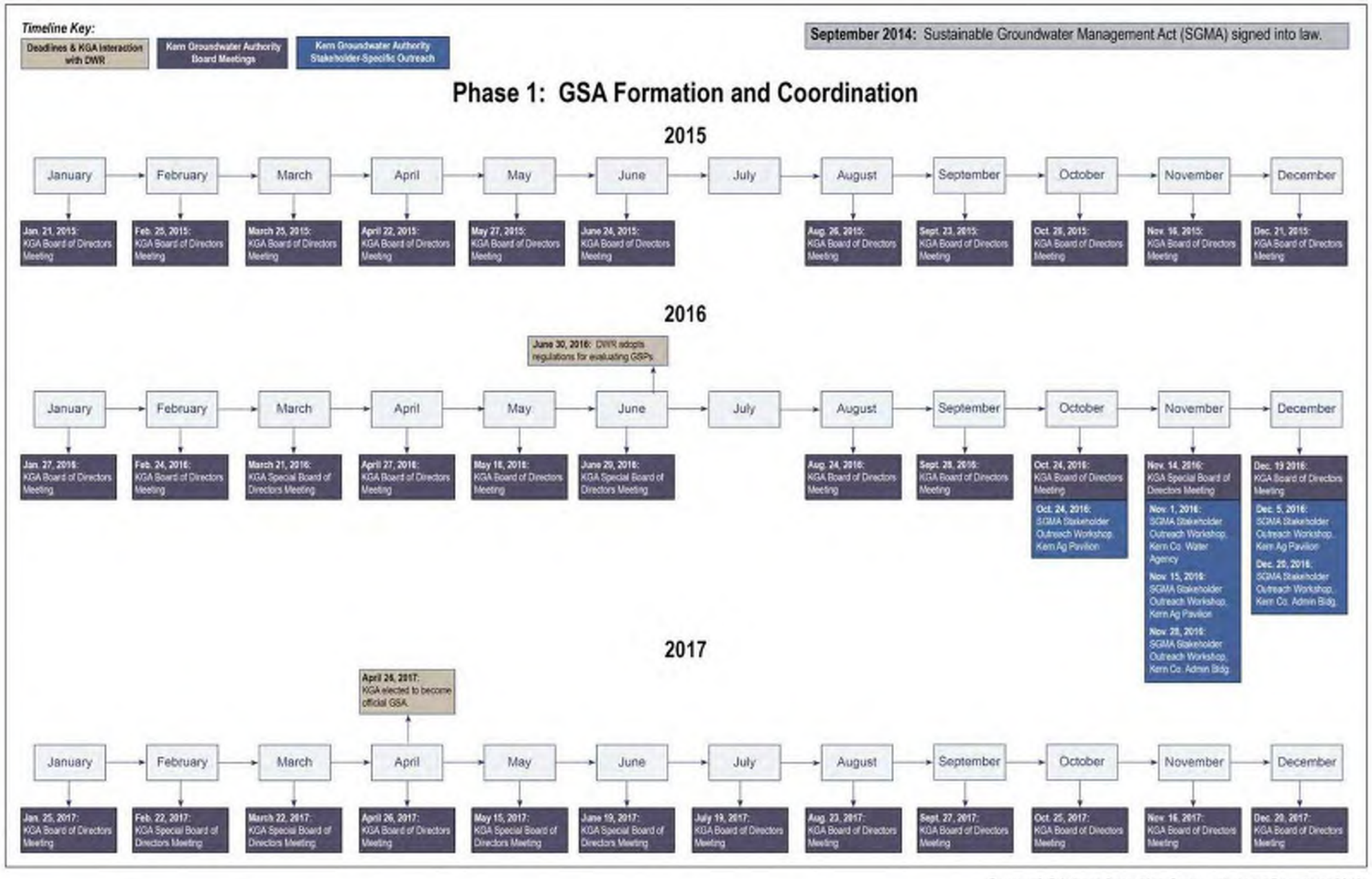


Figure 2-9. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 1: GSA Formation and Coordination

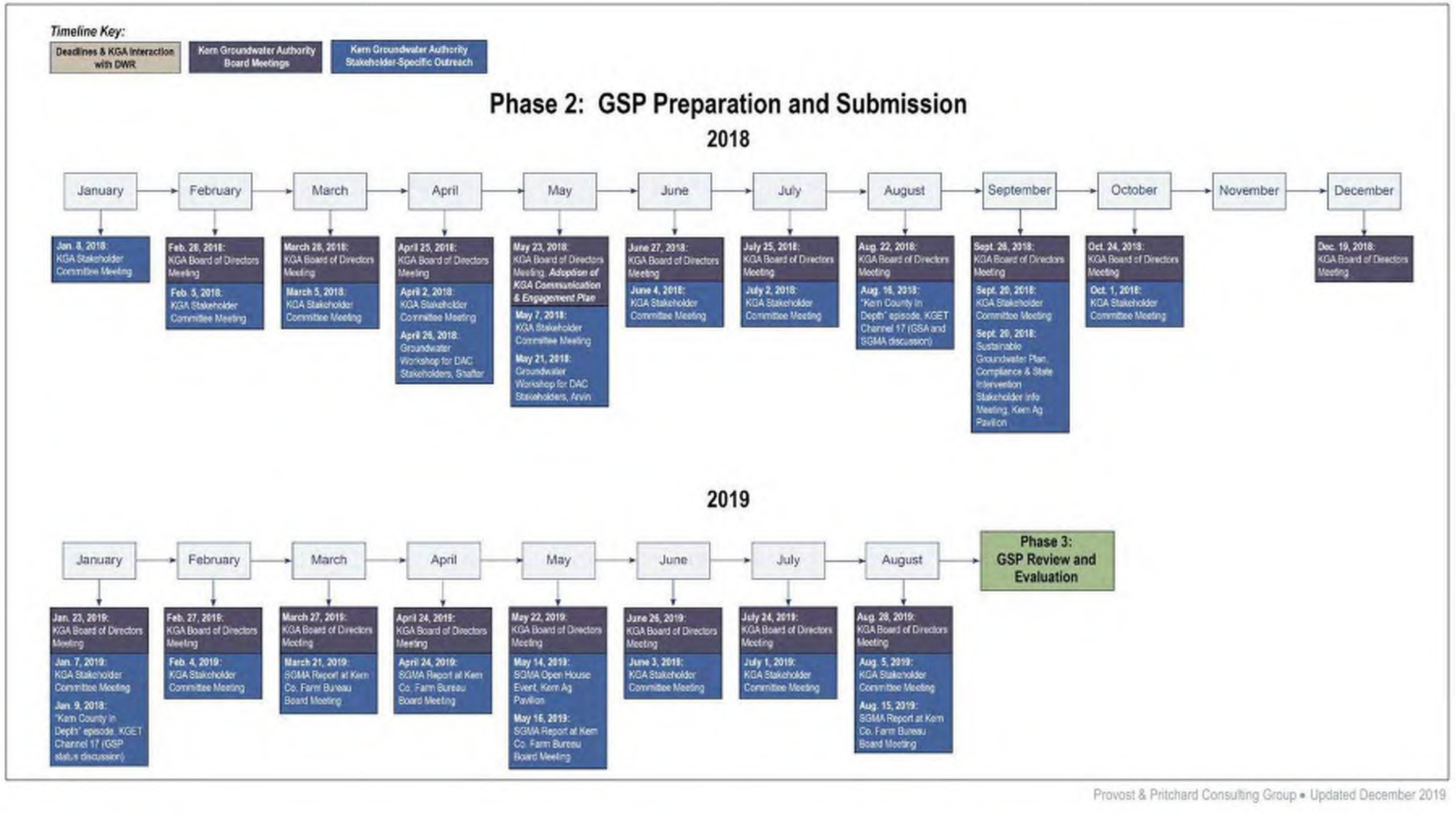


Figure 2-10. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 2: GSP Preparation and Submission, and Phase 3: GSP Review and Evaluation

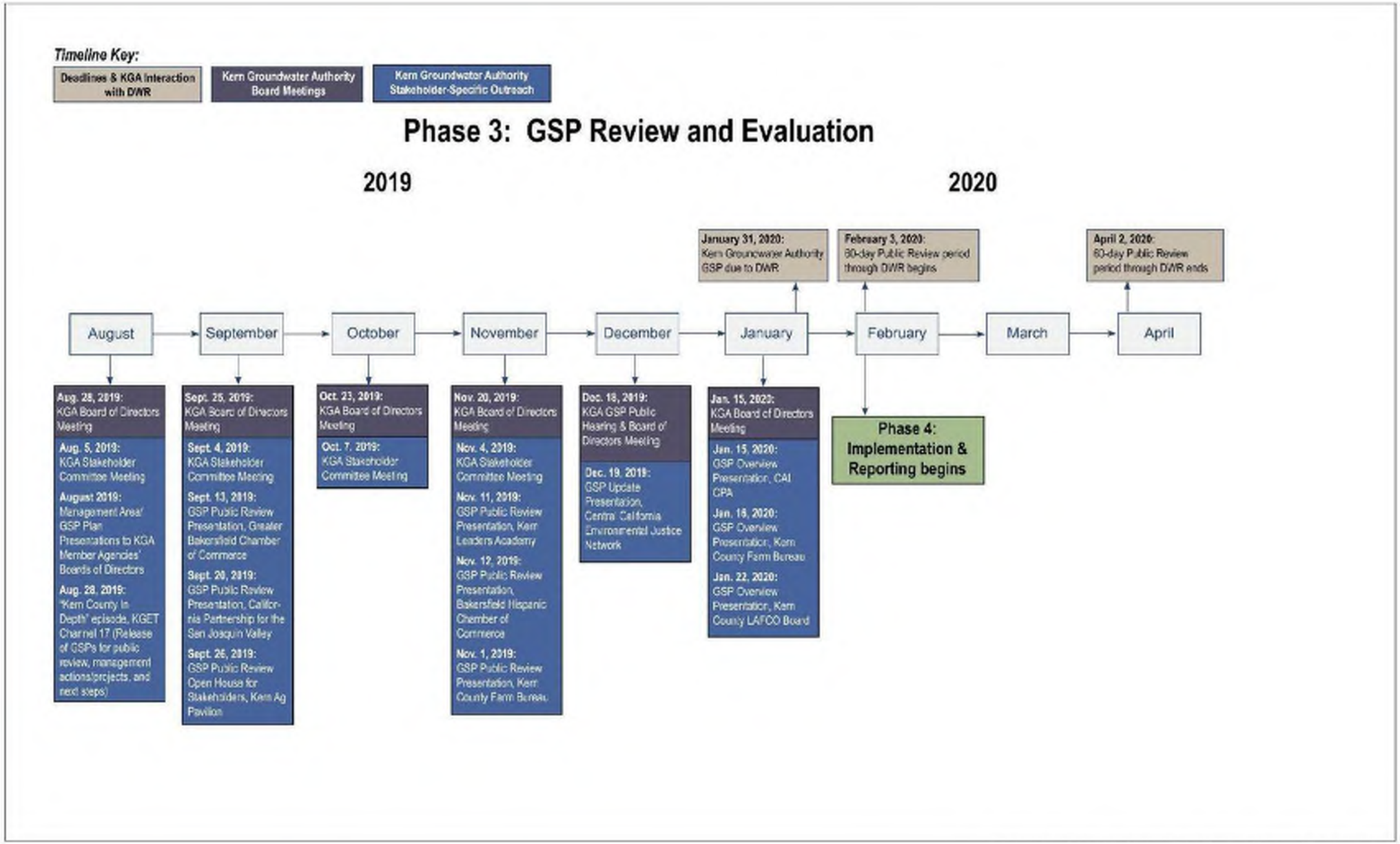


Figure 2-11. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 3: GSP Review and Evaluation

This Page is Intentionally Blank

The JPA is written to provide open and transparent communication to all beneficial users; thus, the KGA's decision-making process consists of several public meeting opportunities:

- The KGA Board of Directors public meetings are on the fourth Wednesday of every month and include presentations regarding the development of the GSP as well as decisions on coordinated SGMA requirements with the other GSAs in the Subbasin. Public meetings also include administrative and financial decisions. Meeting notification includes public posting of the board agenda and background materials on the KGA website and an email notification to the interested parties list a week prior to the meeting, which also includes all relevant meeting materials.
- As the Subbasin GSPs were developed, KGA and the other GSAs established coordination meetings. These meetings began in July 2018 to coordinate each of the five GSPs scheduled to be developed and submitted to DWR. These meetings are held every Friday morning and are attended by all KGA member agency managers and the other four GSA managers. These meetings included discussions to obtain an understanding and consensus on the data and methodologies used in the five GSPs. Once an understanding and consensus was reached, the data and methodology were then discussed at the Kern GSA Coordination Committee meeting, where each of the five GSAs are represented by a policy or board member and a staff manager, as well as at stakeholder public meetings.
- Stakeholder public meetings were held on the first Monday of every month where presentations were made concerning the development of this GSP as well as items that need to be coordinated under SGMA with the other GSAs. These meetings began under the name of the Coordination Committee and then changed to Stakeholder meetings in 2018. Typically, meetings were open discussions with occasional presentations for specific GSP elements. If there were no new developments on the GSP, meetings were cancelled to take into consideration beneficial users' time. All meeting dates and presentation materials are located on the KGA website with email notifications sent out to the interested parties list prior to meetings, which included all relevant meeting materials.
- Kern GSA Coordination Committee meetings were established to coordinate the data and methodologies at a policy-level. These meetings were held on the third Wednesday of every month and were attended by one policy decision-maker from each of the GSAs and staff members to assist in the discussion. These meetings were established to maintain the coordination as well as the requirement of utilizing the same data and methodologies throughout the development of the five GSPs.

2.1.5.2.2 Public Engagement Opportunities

As previously stated, each KGA member implemented its own outreach programs to provide opportunities for beneficial users to participate in the development of individual management area plans. The details of these outreach programs can be found in the management area plans. However, the KGA held several public workshops, stakeholder meetings (mentioned above),

Farm Bureau meetings discussions, and media outreach. These meetings are listed in the C&E Plan and are also indicated in the list below.

2.1.5.3 Informing the Public about GSP Development Progress

2.1.5.3.1 KGA Website

The website was established immediately upon approval as an exclusive GSA and is updated monthly with materials from all the meetings including presentation materials and board packages. There is also a Resource & Outreach tab that provides the technical reports and workshop materials.

2.1.5.3.2 Interested Parties List

An email distribution list of stakeholders and beneficial users was developed and is constantly updated for outreach and notices throughout the GSP planning process. The list is maintained and updated by the KGA and is included in the C&E Plan.

2.1.5.3.3 Media

The KGA has participated in several media segments televised by Kern Golden Empire Television (KGET) Channel 17 – Kern County in Depth segment. There have been three tapings since the establishment of SGMA, one for the formation of the GSAs, the withdrawal of Kern County impacts to SGMA and the beginning process of the GSP, and the release of the GSP and the process moving forward. These are televised for a month and are also located on KGET Channel 17 website.

2.1.5.4 Public Comments

Public comments were collected throughout GSP development process and incorporated into the development of KGA Umbrella GSP and the management area plans of the KGA members, as described above. Additionally, the KGA prepared a Public Draft Kern Groundwater Authority Groundwater Sustainability Plan in August 2019. The draft KGA GSP was made available during a noticed public comment period from August 30, 2019 to November 28, 2019. Comments received were considered and responded to either in this final version of the KGA GSP or were forwarded to the appropriate KGA member agency for their consideration. All comments received and responded to those comments are included in Attachment D.

2.2 Basin Setting

This basin setting focuses on the area encompassed within the jurisdiction of the KGA, its participating members agencies, and collaborators. Figure 2-1R presents the current extent of the KGA jurisdictional area and member agencies. Due to the proximity of adjacent GSAs, details and data from adjacent GSAs are included herein. This basin setting is intended to represent an overview of the entire Subbasin. Additional details are included in the basin setting description of other GSPs prepared in the Subbasin and in the management area plans prepared by KGA member agencies.

2.2.1 Hydrogeologic Conceptual Model

Numerous descriptions and reports of local hydrogeologic conditions are available for the Subbasin. Details from previous investigations relating to the regional geologic and structural setting of the Subbasin; geologic features affecting groundwater flow; vertical and lateral boundaries; primary aquifers and aquitards; groundwater elevations and flow direction over time; and water quality are described below. This information is the foundation for the hydrogeologic conceptual model (HCM).

This HCM has been prepared under the supervision of Matthew Mayry, Certified Hydrogeologist.

2.2.1.1 Kern County and Lateral Boundaries

The Kern County Subbasin (5-022.14) (Figure 2-12), is within the southernmost portion of the Tulare Lake Hydrologic Region of the San Joaquin River Basin (5-022). The Subbasin encompasses a surface area of 1,792,000 acres (2,800 square miles) and contains approximately 32,000 feet (6 miles) of marine and continental sediments (DWR, 2006; Page, 1986). The Subbasin has approximately 40,000,000 acre-feet (AF) of groundwater storage with another 10,000,000 AF of storage capacity, including areas where water levels have declined (DWR, 2006). A recent U.S. Geological Survey (USGS) estimate of sediment thickness is 3 miles for the San Joaquin Valley (Faunt et al., 2009). Continental sediments comprise up to approximately 3,400 feet of the material along the Kern River near the town of Tupman (western side of the valley), and the base of the fill is over 18,000 feet deep (Davis et al., 1959).

The lateral boundaries of the Subbasin, are defined by various jurisdictional and geomorphic segments, as presented by DWR (2016b). The Subbasin is bounded by the Sierra Nevada on the east; by the Tehachapi mountains, San Emigdio mountains, and White Wolf Subbasin (5-022.18) on the south; and the Coast Range (Temblor Range) on the west. To the north of Subbasin are the following Subbasins: Kettleman Plain (5-022.17), Tulare Lake (5-022.12), and Tule (5-022.13).

2.2.1.2 Regional Geologic and Structural Setting

A brief description of the evolution of valley sediments and fill is included below, as it relates to the regional aquifer system of the Tulare Lake Region of the San Joaquin Valley Basin.

During pre-Tertiary time granitic rocks were deposited in the present-day area of the Sierra Nevada and Tehachapi Mountains (eastern and southeastern flanks of the Subbasin). Plutonic and tectonic activity also formed metamorphics that occur along the margins of the Subbasin. As tectonic activity uplifted these granitic and metamorphic deposits, erosion with subsequent transport of sediment into the basin occurred. These rocks form an almost impermeable boundary for the groundwater basin, but fractures and joints permit small yields of water to wells (Page, 1986).



Figure 2-12. Kern County Subbasin and Vicinity

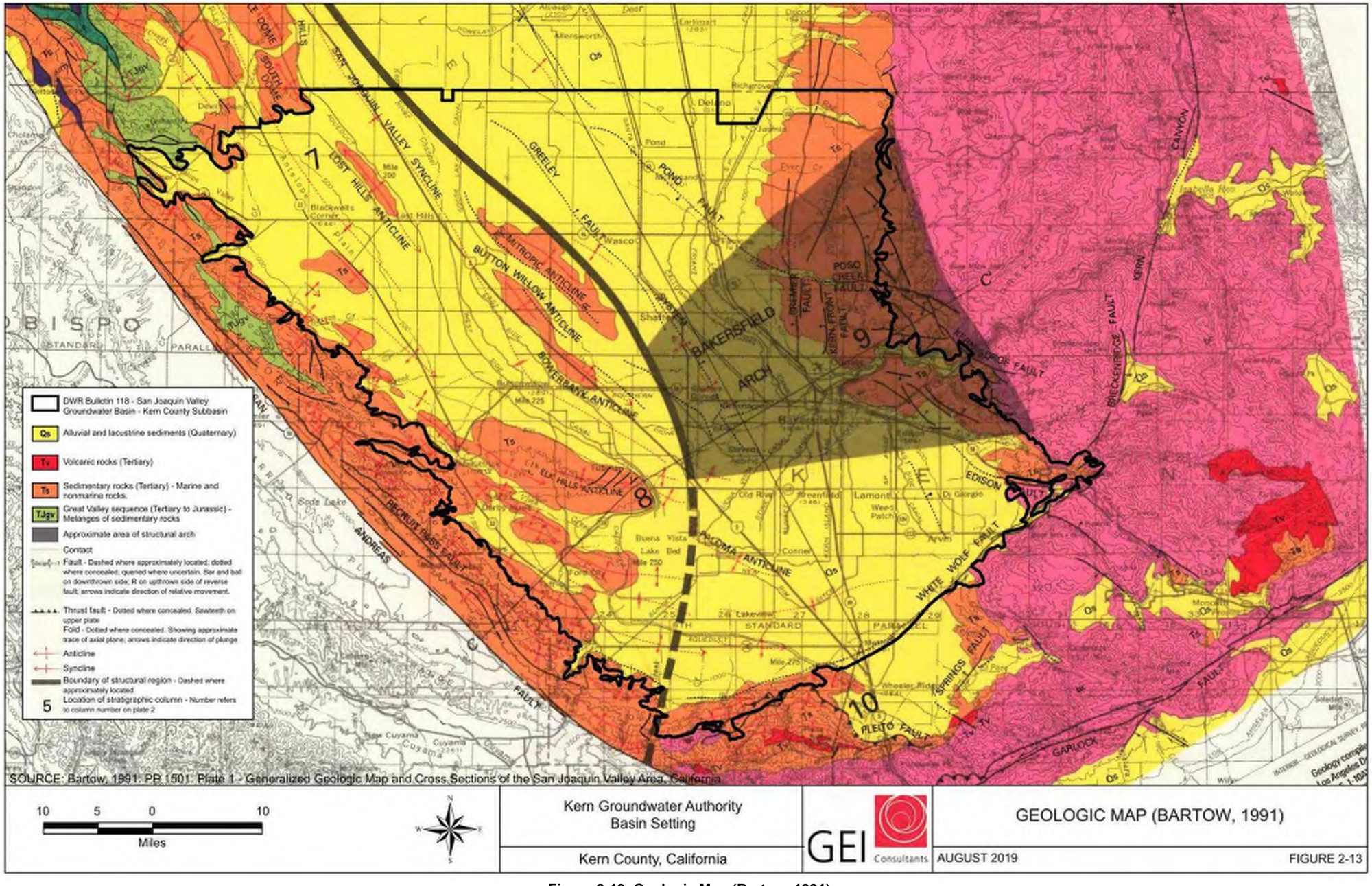
Near the end of the Late Cretaceous, tectonic movements elevated the Coast Ranges to the west of the Central Valley which created a marine embayment in the present-day Southern San Joaquin region. During the Tertiary, seas advanced and retreated within this southern embayment, resulting in deposits comprised of both continental and marine sediments. The most recent of which are the Pyramid Hills, Vedder Sand, Olcese Sand, Santa Margarita Formation, and San Joaquin and Etchegoin Formations.

During the late Tertiary, uplift of basement occurred near present-day Bakersfield forming what researchers have termed the Bakersfield Arch. The Arch effectively resulted in depocenters for thick sequences of sediment to accumulate to the north and south of the Kern River (Bartow, 1991; Vasconcellos, 2016; Figure 2-13) during later Tertiary and Quaternary time. Tertiary crustal uplift and shifting caused the formation of the Sierra Nevada, Temblor, and Coast Ranges (Bartow, 1991). Crustal deformation along the proto-San Andreas and present-day San Andreas led to the formation of the structural traps for oil and gas accumulation throughout the west-side.

The Quaternary Period (Pleistocene and Holocene), marked a time when the seas retreated, and continental deposits from alluvial and fluvial systems formed (Tulare and Kern River Formations (Page, 1986). Marine rocks and deposits are, in part, the source rocks for the Tulare Formation on the west and the granitic from the Sierra Nevada on the east are the source rocks for the Kern River Formation. Some of the marine deposits on the west, contain saline water, that could have migrated into adjacent and overlying continental deposits (Page, 1986). Overall, the continental rocks make up most of the regional aquifer system in the central and eastern sides of the Subbasin while brackish to freshwater deposits and eroded marine deposits of the Coast Range make up a very small portion of the water-bearing units on the western side of the Subbasin.

The Pleistocene Epoch was dominated by brackish and freshwater lakes within the Subbasin, resulting in thick deposits of clay, as found throughout the upper Tulare Formation. In particular, the Corcoran Clay has been mapped over much of the San Joaquin Valley (including Tulare Lake Region), and its equivalents have been correlated to clays beneath the Kern and Buena Vista dry lake beds in the southern part of the Subbasin, as well as the Tulare Lake sediments on the northern boundary of Kern County (Croft 1972; Page, 1986) (Figure 2-14). This clay makes up a considerable impermeable to semipermeable zone that divides shallower poor-quality water from higher quality water of the regional aquifer system.

This Page is Intentionally Blank



SOURCE: Bartow, 1991. PP 1501. Plate 1 - Generalized Geologic Map and Cross Sections of the San Joaquin Valley Area, California

Figure 2-13. Geologic Map (Bartow, 1991)

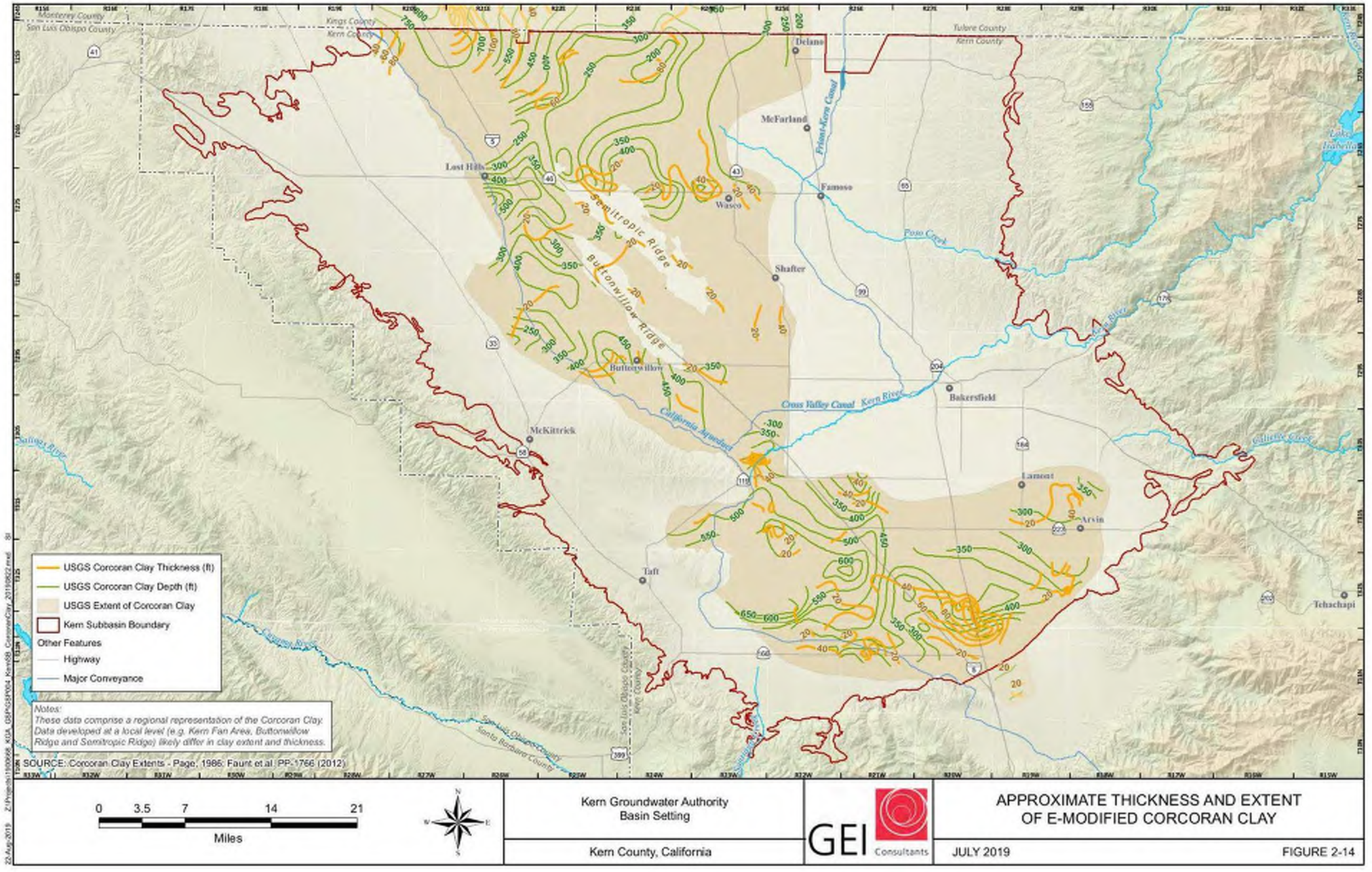


Figure 2-14. Approximate Thickness and Extent of E-Modified Corcoran Clay

Since the Pleistocene Epoch, stream channels, lakes, and rivers have deposited alluvium throughout the Subbasin. Alluvial fans have formed on both sides of the valley, but most notably on the eastern side where the Sierra Nevada granitics are the main source of sediment (Poso Creek Fan, Kern River Fan, and Caliente Creek Fan). On the eastern side of the valley, these stream channels are large, laterally migrating distributary channels. Over time, shifting stream channels have created coalescing fans, forming broad sheets of inter-fingering, wedge-shaped lenses of gravel, sand, and finer detritus (Page, 1986), which make up the shallow continental water-bearing deposits of the regional aquifer system. Page (1986) identified various depositional environments for the continental sediments, including alluvial fan and deltaic conditions on the eastern side of the valley, and flood-plain, lake, and marsh conditions on the western side. Consequently, coarse-grained deposits are predominant on the eastern side while fine-grained deposits are predominant within the central and western areas of the Subbasin.

Figure 2-15 is a conceptual block diagram that generally illustrates the highlands surrounding the Subbasin with folded beds separating the west side from the east side. This diagram displays the succession of marine deposition to more recent continental deposition and alluvium with fresher water deposits.

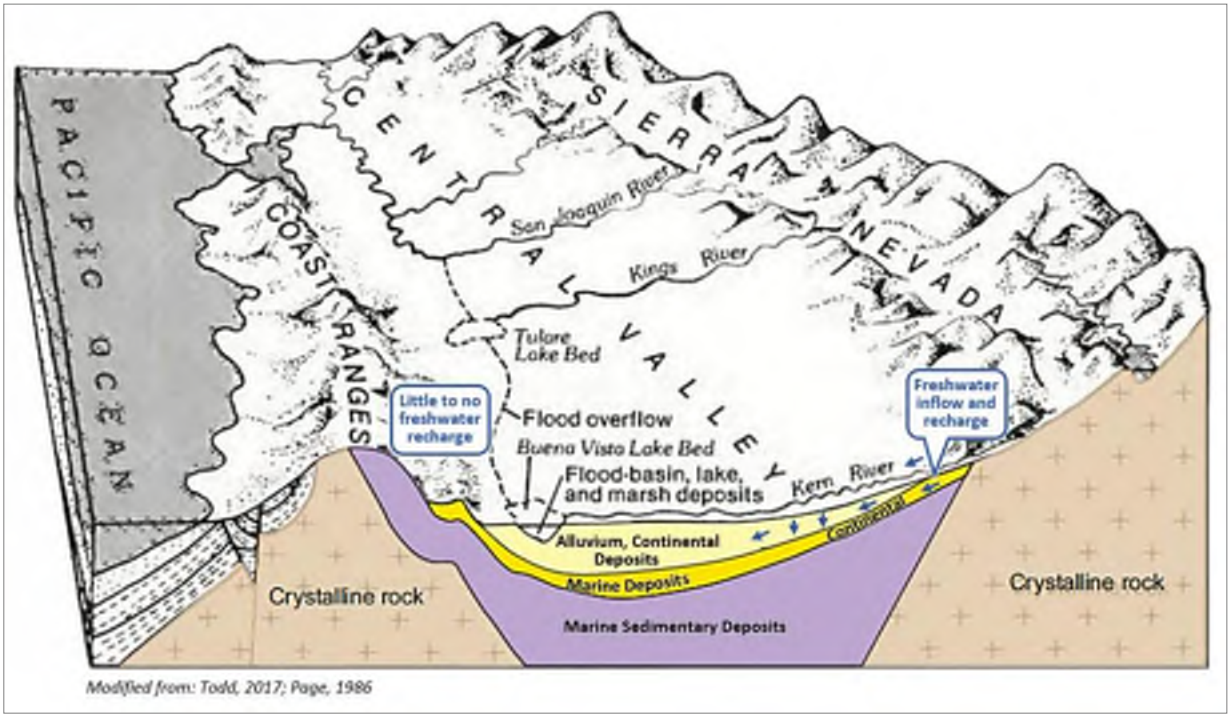


Figure 2-15. Conceptual Block Diagram Looking North from Kern River

The geologic history discussed above is related to the stratigraphy described below, and as summarized in Table 2-2. The description also includes a discussion of the portions of the formations that bear groundwater that have been utilized historically.

Table 2-2. Generalized Hydrostratigraphy of Kern County Subbasin

Age	Geologic Units of Interest	General Description		Deposition		AE	General Hydrogeologic Context
Recent	Alluvium	Discontinuous beds of sand, silt, clay and gravel, becoming finer grained toward the valley.		Continental / Alluvial	Alluvial Fans		Shallow unconfined aquifer in some areas of the subbasin.
Pleistocene	Older Alluvium						
	Tulare Formation	Interbedded gravel, sand, silt, and clay.			Marine, Debris Flows, Fluvial, Semi-arid to arid (West)/ Fluvial-Lacustrine (East)		Major freshwater aquifer of the subbasin.
	Corcoran Clay	Silt and clay. Lacustrine.					Confining/semi-confining aquitard in the west-central and central-southern subbasin.
	Tulare Formation	Alluvial Fan Deposits. Interbedded gravel, sand, silt, and clay.	Interbedded gravel, sand, silt, and clay. Siltstone, clayey, diatomaceous with thin lenticular sand beds.			AE	Major fresh water aquifer of the subbasin.
Pliocene	San Joaquin Formation			Transitional	Continental and brackish to restrictive marine		Fresh water production limited to deep wells.
Miocene	Etchegoin Formation	Fresh water production on east side of the valley.	Clay and silt to sand, gravel, and sandstone		Marine to partly continental	AE	Fresh water production limited to deep wells.
	Santa Margarita Sandstone	Conglomerate with lenses of coarse sand and clays. Non-Marine Clastic. Limited fresh water production on east side.	Fine to coarse white sand, gravel, and sandstone.		Shallow Marine Clastic	AE	Fresh water aquifer on east/northeast side of the valley
	Round Mountain Silt	Brown siltstone, diatomaceous		Marine	Marine		Aquitard on east side of the subbasin.
	Olcese Sand	Light gray sandstone with a few pebble and siltstone beds.			Marine/ nonmarine clastic wedge	AE	Fresh water aquifer on the east/northeast side of the subbasin.
	Freeman-Jewett Silt	Brown siltstone with interbedded ash.			Marine to shallow water	AE	Aquitard
Oligocene	Pyramid Hills and Vedder Sands	Interbedded sandstone and siltstone			Marine to shallow water	AE	Possible fresh water aquifer on the east/northeast side of the subbasin.

Kern River Formation — AE

Chanac Formation — AE

Data sources from: Page, 1986; Bartow, 1983 and 1991; Provost and Pritchard, 2003; Todd Engineers et al, 2007; Scheirer et al, 2007; SWSD, 2012; Tor Nilsen, 1996; and KTWD, 2016.

Aquifer Exemptions present (AE) - California Department of Conservation, https://www.conservation.ca.gov/dog/Pages/Aquifer-Exemptions-Status.aspx.

This Page is Intentionally Blank

2.2.1.2.1 Stratigraphy

The Oligocene Pyramid Hills and Vedder Sands are interbedded sandstone and siltstone deposited in a shallow to deep marine environment and in a limited non-marine environment. They may produce fresh groundwater on the east and southeast sides of the Subbasin (Page, 1986).

The Miocene Olcese Sand and Santa Margarita Sandstone are current sources of drinking water in the northeastern portion of the Subbasin where they occur as confined aquifers (KTWD, 2016). The origin of the Miocene Olcese Sand and Santa Margarita Sandstone varies from continental to marine going from east to west across the Subbasin (Scheirer, et al, 2007a). The Miocene Olcese Sand ranges up to 600 feet in thickness and consists of unconsolidated medium- to coarse-grained sand containing a few pebble and siltstone beds. The formation is exposed in the Poso Creek area (Page, 1986) and is utilized by the Olcese Water District in the Kern River Canyon. The Santa Margarita Sandstone ranges in thickness from 200 to 600 feet and consists of coarse-grained sand (DWR 2006), and includes an upper bed of fine, silty, well sorted gray sand, and a lower bed of brownish-gray and brown fossiliferous micaceous sandy siltstone. According to Page (1986), the sandstone is a major aquifer that reportedly yields as much as 1,950 gallons per minute (gpm) to wells. Croft (1972) reported that the formation also yields water to wells in the foothills southeast of Bakersfield. The Round Mountain Silt is an aquitard that separates the Miocene Olcese Sand from the Santa Margarita Sandstone and acts as a confining unit for the Miocene Olcese Sand (KTWD, 2016). This silt unit consists mostly of a gray and brown siltstone that contains beds of diatomite and silty sand (Page, 1986), and ranges in thickness from 0 to about 200 feet.

The Mio-Pliocene Etchegoin Formation varies considerably, ranging from clay and silt to sand, gravel, and sandstone. It ranges in thickness from a few tens of feet to more than 2,000 feet. Several wells near the foothills and a few deep wells in the valley derive fresh water from the Etchegoin; however, its depth is more than 3,000 feet beneath most of the valley and is limited to deep well production (Page, 1986).

Overlying the Etchegoin Formation is the Pliocene San Joaquin Formation of marine deposition. It contains silt and silty sandstone, with a conglomerate at the base of the formation. In the deep subsurface northeast of the Kettleman Hills, the formation is considered a shoreline deposit because the material is coarser and more permeable than in the Kettleman Hills area and yields fresh water to many wells. The San Joaquin Formation is the youngest marine deposit in the Central Valley (Page, 1986), representing the end of marine deposition in this area. Overlying sediments were deposited by alluvial, fluvial, and lacustrine processes.

The Tulare Formation is Plio-Pleistocene in age, and in conjunction with the Kern River Formation (Mio-Pliocene to possibly early Pleistocene), represents west-east facies change across the Subbasin. The Tulare and Kern River formations are moderately to highly permeable and are major freshwater sources within the Subbasin (Page, 1986; SWSD, 2012).

The Tulare Formation (western-central Subbasin) contains up to 2,200 feet of interbedded, oxidized to reduced sands, gypsiferous clays, and gravels derived primarily from Coast Range

sources. The permeable deposits of the Tulare Formation are divided into upper and lower units, separated by the E-modified Corcoran Clay member (Corcoran Clay) of the formation. Groundwater beneath the Corcoran Clay is typically confined to semiconfined (Page, 1986; SWSD, 2012). In addition to its confining properties, laboratory tests indicate that the clay is highly susceptible to compaction (Faunt, et al., 2009). On the west side of the Subbasin, the Tulare Formation is also divided by upper and lower units by potential equivalents to the Corcoran Clay that are reported locally (Rector, 1983; Geomega, 2001). While the central part of the basin was deposited in a fluvial-lacustrine environment, the west side has lacustrine claystones, fan-delta deposits, debris-flow dominated alluvial-fan deposits, but also paleosols representing an arid to semiarid setting (Nilsen and Campbell, 1996). The difference in Tulare deposition illustrates fundamental differences between the west side and east side aquifer system.

The Corcoran Clay occurs laterally in the north Subbasin (~34 miles wide in extent) from Delano to Lost Hills (Figure 2-14) and narrows to the south where it is not a confining bed in the Kern Fan Area. Although the USGS data present a clay in the western part of the Kern Fan area, local data do not support the presence of an extensive confining clay in the Kern Fan area. A clay in the south part of the Subbasin has been correlated as the Corcoran Clay by many investigators including Croft (1972) and Page (1986). It extends from Buena Vista Lake Beds to just east of Arvin and DiGiorgio (~31 miles wide in extent). In the south Subbasin, the Corcoran Clay is present at depths between 250 and 650 feet (DWR, 1981). Within the central area of the Subbasin between the Kern River and Highway 46, the depth to the Corcoran Clay varies from 300 to 450 feet. Further north to the county line, the depth varies from 200 to 750 feet. The Corcoran Clay, most notably the modified E-clay (Page, 1986) is generally very fine grained; however, isolated, coarser zones are possible, particularly where the clay is less than 20 feet thick. The thickness of the clay is as much as 100 feet in a small area of the southern Subbasin but typically varies between 20 and 40 feet. In the northern Subbasin, the clay might be as thick as 60 to 80 feet in isolated areas, but the thickness typically varies between 10 and 30 feet. The Corcoran Clay does not exist under the Kern Alluvial Fan (Kern Fan), where the shallow unconfined layers are separated from deeper layers by an intermediate zone of interbedded sands and silts which retard vertical groundwater flow and create an increase in semi-confinement with depth. The Corcoran Clay is also not present in the eastern/northeastern part of the Subbasin from the cities of McFarland and Bakersfield, to Edison (Faunt et al., 2009).

The Kern River Formation includes from 500 to 2,000 feet of poorly sorted, lenticular deposits of clay, silt, sand, and gravel derived from the Sierra Nevada. The Kern River Formation crops out in the east Subbasin and reaches its maximum thickness of 2,600 feet in the subsurface west of mapped outcrops (Bartow and Pittman, 1983). The formation consists mostly of poorly sorted fluvial sandstone and conglomerate with interbeds of siltstone or mudstone that becomes finer grained northward and westward. Some of the thicker siltstone or mudstone interbeds may represent deposits of small ephemeral lakes or ponds (Bartow and Pittman, 1983). The Kern River Formation is coarsest in its easternmost exposures, generally the area south of the Kern River, where the composition includes a cobble conglomerate with boulders near the base and pebbly sandstone. (Bartow and Pittman, 1983). Two oil-producing zones occur in the lower part

of the formation where it is believed to have migrated to the Kern River Formation from older marine sediments (Bartow and Pittman, 1983).

The Kern River Formation unconformably overlies the Chanac Formation and may be contemporaneous with the Etchegoin, San Joaquin, and the Tulare formations (Bartow and Pittman, 1983 and Bartow, 1991); however, Graham and others (1988) concluded that the Kern River Formation predates the Corcoran Clay, which has a basal age of about 725,000 years. Radiometric dating of a volcanic ash layer near the top of the Kern River Formation at the Kern River oilfield may agree with the aforementioned basal age; however, others dated this ash bed at 6 million years which would place the Kern River Formation solely in the Miocene (Scheirer et al., 2007a). Nevertheless, the gradational relationship between the Kern River Formation and seemingly younger units such as the Etchegoin, San Joaquin, and Tulare formations would have to be reexamined.

Older alluvium and terrace deposits overly the Tulare and Kern River formations. These deposits also make up a portion of the regional aquifer system. They are composed of up to 250 feet of Pleistocene-age lenticular deposits of clay, silt, sand, and gravel that are loosely consolidated to cemented. These deposits are moderately to highly permeable and yield sufficient water to wells. They are often indistinguishable from the underlying Tulare and Kern River formations (DWR, 2006).

The Holocene-age younger alluvium and flood basin deposits vary in character and thickness in the Subbasin. Along the eastern and southern Subbasin margins, these younger deposits consist of up to 150 feet of interstratified and discontinuous beds of clay, silt, sand, and gravel. In the southwestern portion of the Subbasin, the deposits are finer-grained and less permeable as they grade into fine-grained flood basin deposits underlying the historic lakebeds of Buena Vista and Kern lakes in the southern portion of the Subbasin. The flood basin deposits consist of silt, silty clay, sandy clay, and clay interbedded with poorly permeable sand layers. These flood basin deposits are difficult to distinguish from underlying fine-grained older alluvium (Page, 1986; DWR, 2006).

As described above for the deposition of the Tulare and Kern River formations and Quaternary facies differ from west to east across the basin. The below diagram (Figure 2-16) illustrates the general distribution of facies fluvial-deltaic deposition dominating the east-side; alluvial, lacustrine, and marsh deposition dominating the central portions of the basin, and alluvial and debris flow deposition dominating the western side of the Subbasin during the Quaternary.

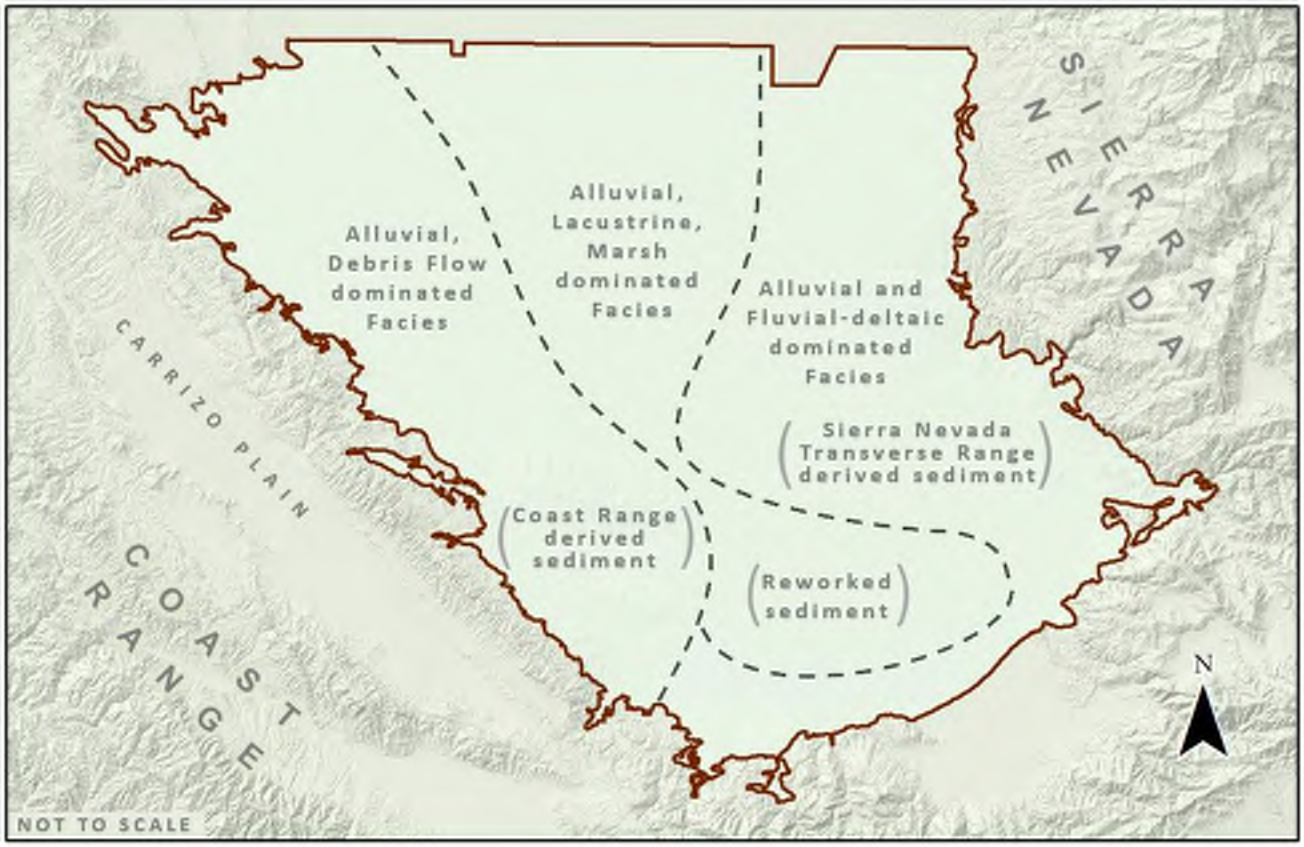


Figure 2-16: Generalized Quaternary Depositional Facies

2.2.1.3 Geologic Features that Significantly Affect Groundwater Flow

The primary structure in the Subbasin that affects groundwater flow is the large asymmetric structural trough (San Joaquin Valley Syncline) that has been the depocenter of thousands of feet of sediments since late Mesozoic time (Bartow, 1991). Groundwater naturally flows northwest along the trend of the syncline. Likewise, the Bakersfield Arch is a broad southwest-plunging arch of basement rock that separates the small Maricopa-Tejon sedimentary basin at the south end with the remainder of the sedimentary basin to the north and west (Figure 2-13, from Bartow, 1991). Groundwater recharging from the Kern River will flow north and south along the flanks of the arch away from the center of the Subbasin.

Numerous faults and folds are located in the Subbasin, as shown in local geologic maps (Figures 2-13, 2-17, and 2-18). Bartow (1991) identified portions of three types of structural regions in Subbasin, excluding the Bakersfield Arch. The northeastern third of the Subbasin, including the north half of the Arch, is located on the minimally-deformed eastern limb of the valley syncline. Normal faulting is associated with the Bakersfield Arch, occurring mostly in the older sediments (QPc; Ts) but extending into and concealed by the younger sediments (Qoa, Q; Qs), notably the Pond-Poso Creek Fault. Fault orientations vary from northwest to northeast due to alternating compressional and extensional forces.

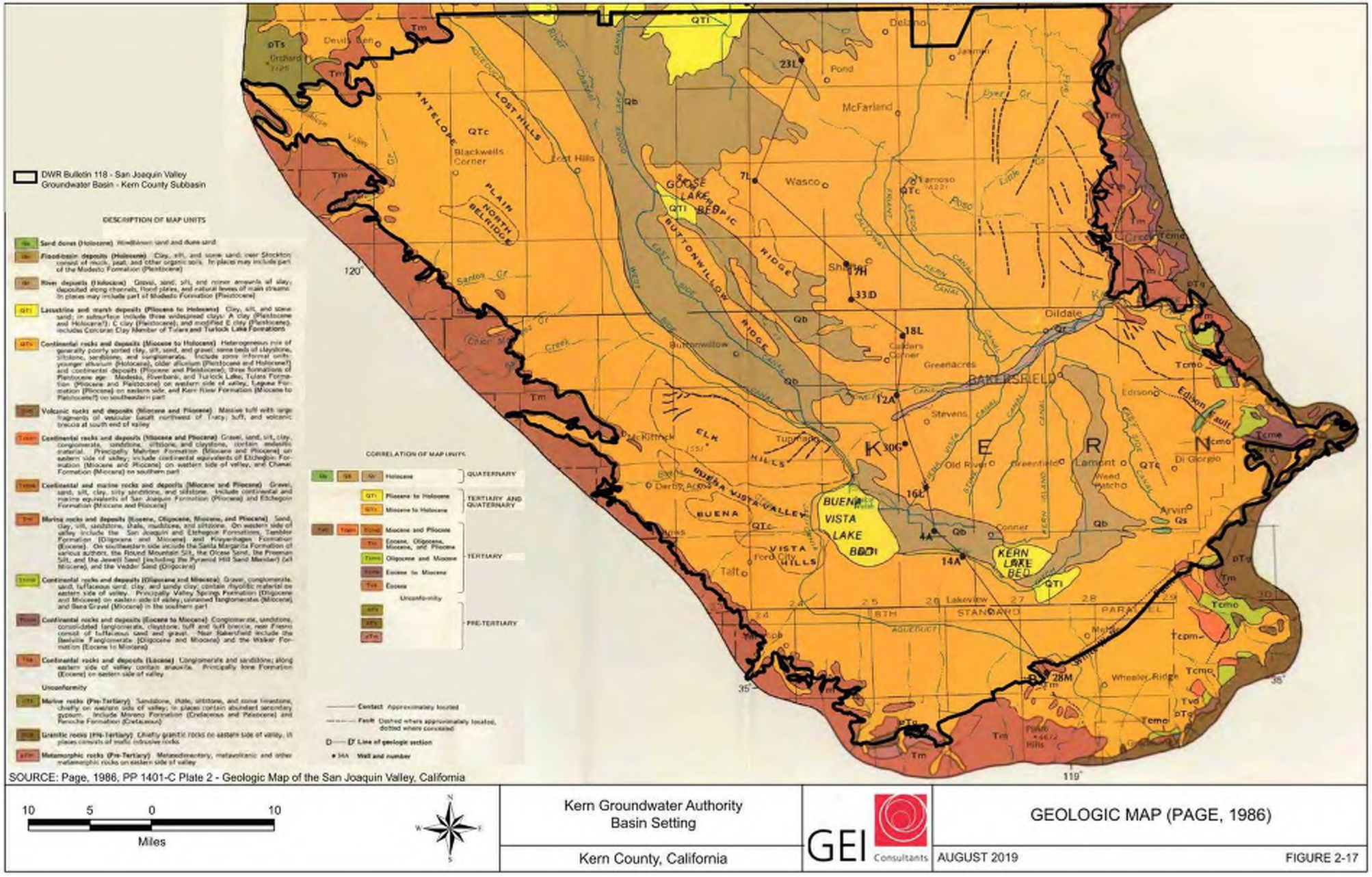


Figure 2-17. Geologic Map (Page, 1986)

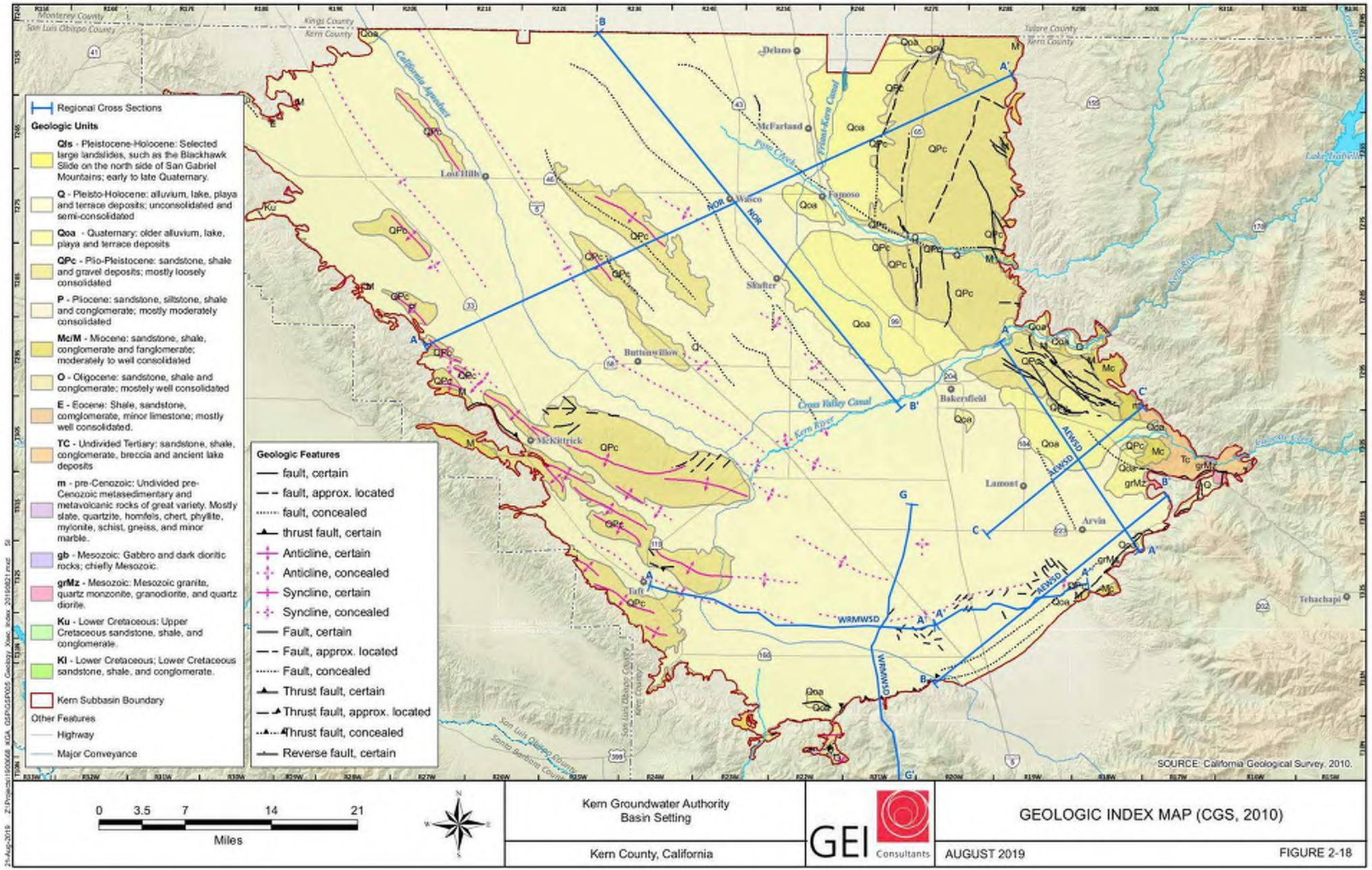


Figure 2-18. Geologic Map Index (CGS, 2010)

2.2.1.3.1 Faults

Several faults have historical displacement or have been identified as features that affect groundwater flow. The following are: Pond-Poso Fault, Edison Fault, White Wolf Fault, Kern Front Fault, Premier Fault, New Hope Fault, and small portions of the Pond Fault (California Geological Survey, 2010a). The Edison Fault and White Wolf Faults also affect the flow groundwater (DWR, 2006).

The southeastern quarter of the Subbasin, including the south half of the Bakersfield Arch, is considered to be "highly deformed" and the "most complex tectonic history" (Bartow, 1991) due to the alternating north-south compressional and extensional forces since the Cretaceous Period. The southern boundary of the Subbasin is delineated by the northeast-trending White Wolf Fault, a reverse fault with active displacement (DMG, 1955), that may have originally been a normal fault (Bartow, 1991). The White Wolf Fault separates the Subbasin from the new White Wolf Subbasin to the south. Two northeast-trending thrust faults are located at the southwestern corner of the Subbasin, including the Wheeler Ridge and Pleito Faults. During the 1952 Bakersfield earthquake, a group of small ground fractures developed in an alignment just north and subparallel to White Wolf Fault. Numerous normal faults are located along the eastern margin of the southern Subbasin, including the Edison Fault and many unnamed fault segments that were active during the 1952 earthquake. More detailed descriptions of local faults and folds of interest are described in the chapters herein.

2.2.1.3.2 Folds

Several concealed folds have been delineated in the central Subbasin, the Paloma anticline, Buttonwillow and Semitropic anticlines, San Joaquin Valley syncline, and other unnamed anticlines and synclines in the Subbasin.

2.2.1.3.3 West-Side Fold Belt and Groundwater Flow

The west-side fold belt includes anticlines: Kettleman Hills, Lost Hills, Elk Hills, and at the east boundary of the fold-belt, Buttonwillow and Semitropic anticlines (Bartow, 1991) (Figure 2-17; Page, 1986). These structures are oriented toward the northwest, subparallel to the Coast Range and the San Andreas Fault. Page (1986) and DWR (2006), identified the anticlinal folds of the highlands, specifically Lost Hills, as restrictions to groundwater flow within the lowlands, and this condition likely applies to other anticlines in the Subbasin.

Structurally, and to a large degree, lithological, the western side differs from the central and eastern portions of the Subbasin. Western Plio-Pleistocene deposits are derived from weathering and erosion of the Coastal Range made up of marine deposits yielding clays and silts and some sands. On the other hand, the east side is made up of quartzose and feldspathic coarser sized sediments from the Sierra Nevada.

In addition to structure, the thickness of fresh water bearing deposits and the sources of groundwater recharge differ between the west side and the central and east side of the Subbasin. In general, the differences result in more restrictive localized groundwater system with poorer quality water on the west side of the Subbasin.

2.2.1.4 Kern County Subbasin Boundaries

As described above, the lateral boundaries are defined by jurisdictional and structural boundaries (DWR, 2003, 2016a, 2016b). Within the jurisdictional boundaries of the Subbasin, are effective lateral boundaries of usable groundwater or effective extents of the principal aquifers.

These boundaries will be discussed in the remainder of this section, and include the presence or absence of: a sufficient quantity of groundwater for beneficial use; water quality changes rendering groundwater unusable; and aquifer exemptions of portions of the Subbasin that either contain commercially producible hydrocarbons or minerals, are high in total dissolved solids, and/or are otherwise isolated from the rest of the Subbasin by geologic boundaries. The characteristics of the effective groundwater Subbasin, as described above, also apply to the bottom of the groundwater basin and are discussed in Section 2.2.1.5.

2.2.1.4.1 Criteria for the Extent of Groundwater with Beneficial Use in the Subbasin

An aquifer may not be suitable for beneficial use if:

- It is not currently serving as a source of drinking water,
- It has commercially producible minerals or hydrocarbons, or
- It is not expected to supply a public water system, and
- It is either economically or technologically infeasible for treatment or recovery now or in the future for domestic, agricultural, or industrial use.

The purpose of this GSP is not to exempt aquifers, nor is it to define the maximum depth or water quality concentration at which groundwater is economically recoverable or treatable now or in the future. However, by applying the criteria of 40 CFR §144.3 and 40 CFR §146.4, active oil and gas aquifers and exempted aquifers are not a part of the groundwater basin for beneficial use.

The groundwater Subbasin's extent, where no exemptions or commercially producible hydrocarbons exist, likely ranges between 3,000 milligrams per liter (mg/l) and 10,000 mg/l total dissolved solids (TDS) depending on the feasibility of treatment and recovery of the groundwater for beneficial use. The estimated lateral extents of the Subbasin are further presented with the bottom of the Subbasin and cross sections of this plan.

2.2.1.5 Bottom of Subbasin

As described above, the following whichever is shallowest, are the lateral and vertical boundaries of the groundwater Subbasin:

- depth to producible minerals or hydrocarbons,
- depth to and aerial extent of exempted aquifers,
- depth that makes recovery of water for domestic, commercial, or industrial purposes no longer economically or technologically feasible, or

- the depth at which groundwater cannot now or in the future serve as a source of drinking water.

For example, water bearing zones below the depth to producible hydrocarbons are not within the groundwater basin; likewise, water bearing zones below an exempted aquifer are not within the groundwater basin.

In some parts of the Subbasin the lateral and bottom boundaries of the groundwater are subject to depths to producible hydrocarbons and extent of depths to aquifer exemptions. As described above, any water bearing zone below these three criteria are outside of the groundwater Subbasin. The available depth to hydrocarbons and aquifer exemptions at the time of this GSP compilation, although possibly generalized, are incorporated into Figures 2-19 and 2-20 for comparison.

As discussed above, it is not the intent of this plan to evaluate at which depth the groundwater is economically recoverable or treatable in the future; but, for discussion purposes only, a TDS of 2,000 mg/l is presented in Figure 2-19, to consider the vertical and lateral distribution of a fresh groundwater dataset in the Subbasin. A TDS of 2,000 mg/l has been mapped throughout the region by Page (1973), historically, it was considered a limiting TDS concentration for the irrigation of most crops (Page, 1973); however, it does not define the bottom of the groundwater Subbasin (or the depth to water that is no longer economically or technologically feasible for groundwater beneficial use). Other local datasets for a TDS of 2,000 mg/l are included in management area plans.

By comparison the depth to TDS of 10,000 mg/l (Gillespie et. al. 2017) (one of the criteria for classification as an underground source of drinking water (USDW)) is presented on Figure 2-20. As discussed above, this depth may not represent the USDW if there are aquifer exemptions or producible hydrocarbons shallower in the subsurface.

In addition to the datasets mentioned above, the SWRCB Resolution Number 88-63 (SRWCB, 1988), has also listed criteria for the suitable sources of drinking water for municipal or domestic water supply. These sources are defined as waters that: have a TDS of less than 3,000 mg/l; are reasonably expected by Regional Boards to supply a public water system, including sufficient yield; are not contaminated or beyond reasonable treatment; and are not exempted by 40 CFR §146.4 (SRWCB, 1988). At this time, there is no dataset developed to present basin-wide correlations of the SRWCB 88-63 base of drinking water.

An additional informal description of the bottom of the Subbasin may be referred to by some researchers, at times, as the “current operational bottom of the Subbasin” which basically describes the depth of active groundwater well pumping; however, this description should not be used to satisfy SGMA requirements § 354.14(b)(3) of the California Code. The range of well depths and perforations generally deepen in the alluvial aquifer system from the margins of the basin toward well discharge points in the south-central and north-central Subbasin. The historical operational bottom of the depth and/or the current operational bottom of the basin are not mapped herein because the operational bottom of the Subbasin has increased with depth as groundwater elevations have decreased over the years. In general, groundwater wells extend to

depths of more than 1,000 feet (Page, 1986), and the maximum thickness of freshwater deposits is calculated at about 4,400 feet, occurring at the south end of the valley (Page, 1986). Cross sections included in this plan provide a representation of current well depths in the Subbasin.

2.2.1.5.1 Page (1973) Base of Freshwater

Although, not the bottom of the groundwater basin, the base of fresh groundwater (Figure 2-19) has historically been defined by Page (1973), as the depth at which specific conductance (SpC) is 3,000 micromhos per centimeter (µmhos/cm) or microsiemens per centimeter (µS/cm), and is considered to be generally equivalent to a TDS concentration of 2,000 mg/l. These values have been reported because they may be considered a limiting factor for irrigation. The conversion factor from SpC to TDS used for this determination was 0.67, which is midway between the typical range of 0.55 to 0.75 (Hem, 1985), and is dependent on the composition of groundwater.

The base of fresh groundwater is quite variable in the Subbasin ranging over 4,000 feet, as listed below:

Location			Elevation, feet msl	Depth, feet below ground
Southeast,	T31S/R28E-Section 32,	West of Arvin	> -4400	~ 4700
Northwest,	T26S/R20E-Section 34,	Lost Hills area	0	~ 400
Northeast,	T25S/R27E-Section 6,	South of Richgrove	-2800	~ 3300
East central,	T29S/R27E-Section 12,	Oildale	-2000	~ 2500
West central,	T29S/R24E-Section 16,	East of Buttonwillow	-800	~ 1100

On the east side of the Subbasin, the base of fresh groundwater trends parallel to nearby faulting. The 2,400-foot below mean sea level (bmsl) contour (and other deep contours) on Figure 2-19 represents a northwest-trending trough of fresh groundwater between Bakersfield and Wasco. This trough lies between the concealed Poso Creek fault to the northeast and the pre-Quaternary Greeley Fault on the southwest that extends from the Kern River to the Kern National Wildlife Refuge. This “graben” of deeper fresh groundwater appears to be trending with these faults.

A smaller, northwest-trending trough of fresh groundwater is located east of Delano and south of Richgrove on the west side of several northeasterly-trending faults. This trough of fresh groundwater may be more of an indicator of freshwater in the Santa Margarita and Olcese aquifers.

On the west side of the Subbasin, notably, west of Lost Hills, Buttonwillow, and Elk Hills, Page (1973), reported very little data for groundwater less than 3,000 µmhos/cm. The lack of data is a combination of evidence suggesting that there is very little fresh water (<3,000 µmhos/cm), on the west side as corroborated by other sources (Gillespie et. al., 2017; and Metzger and Landon, 2018), and a potential data gap where additional data may be useful.

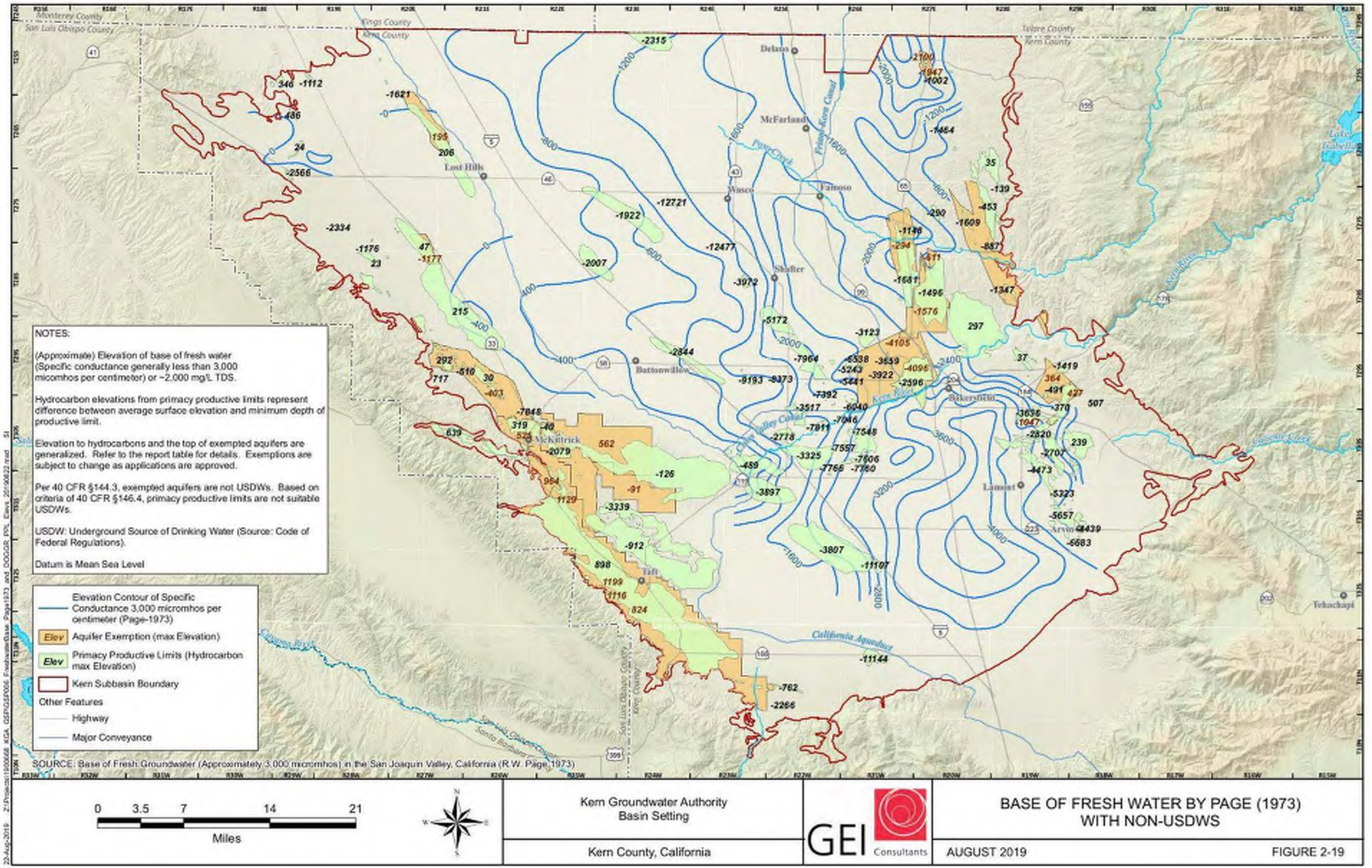


Figure 2-19. Base of Fresh Water by Page (1973) with Non-USDWs

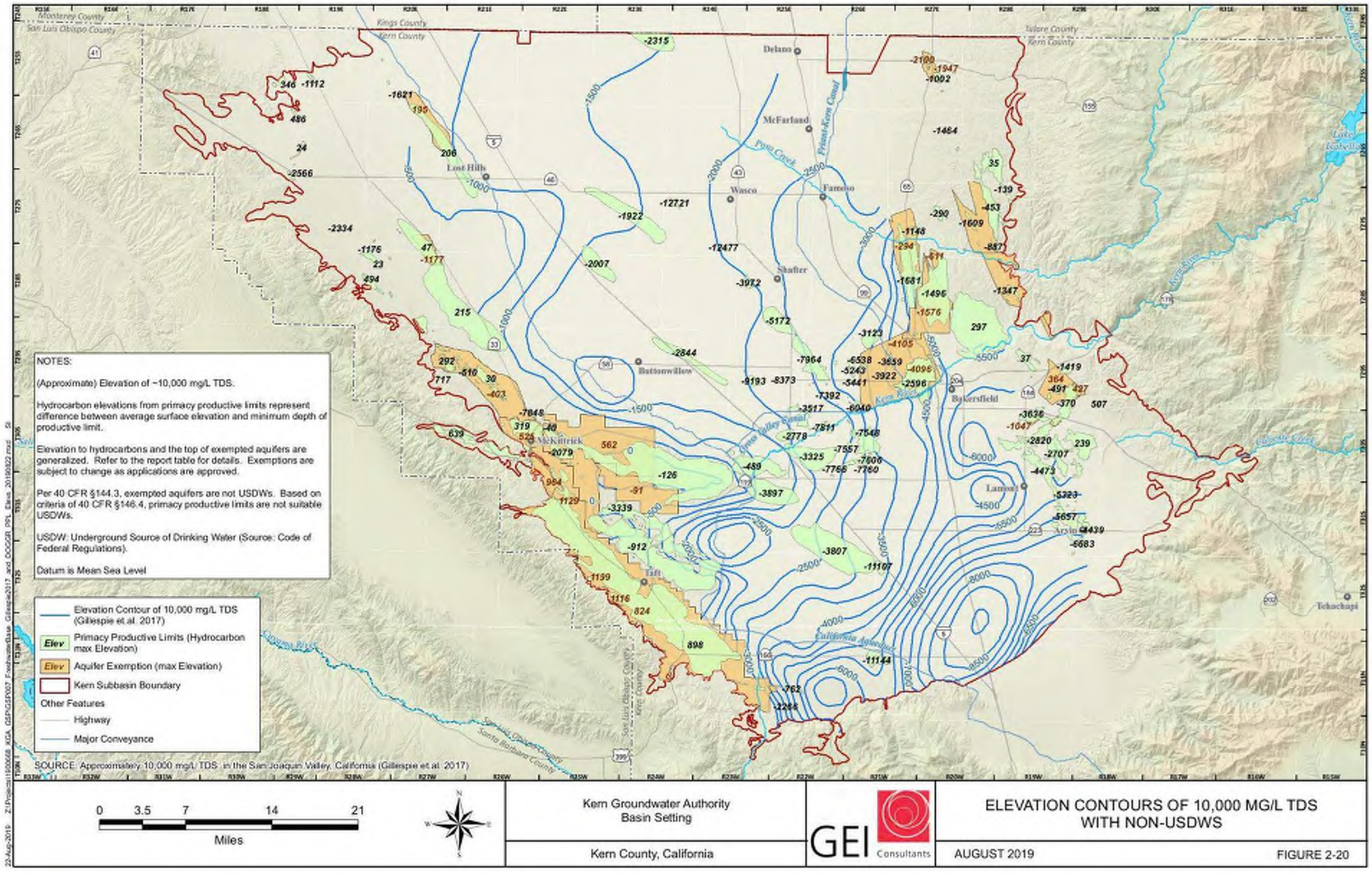


Figure 2-20. Elevation Contours of 10,000 MG/L TDS with Non-USDWs

2.2.1.5.2 Gillespie et. al. 10,000 mg/L TDS

The depth to groundwater with a TDS of 10,000 mg/l (Figure 2-20), is the deepest possible USDW. Gillespie et. al. (2017) and Kong (2016) developed these data based on geochemical analysis of water samples and geophysical log analysis. The depth to 10,000 mg/l TDS is generally consistent with regional trends within the Subbasin. Southeast of the City of Bakersfield, the 10,000 mg/l TDS is mapped to a depth of 6000 ft. This is consistent with the knowledge that this area of the Subbasin receives the greatest amount of fresh water recharge from the Sierras.

In the Maricopa depocenter in the south part of the Subbasin a couple miles north of Wheeler Ridge the 10,000 mg/l TDS contour may be as deep as 10,000 ft. No chemical analysis data were available to verify this geophysical log interpretation; however, the results from Page (1973), also mapped the depth to 2000 mg/l groundwater at 4600 ft (which was the deepest fresh water in the Subbasin) (Gillespie et. al., 2017). The Maricopa depocenter appears to have fresh water that extends deeper than anywhere else in the Subbasin.

Salinities in the west Subbasin are much higher, and depths to the base of USDW are more variable (Gillespie et. al., 2017). The structural complexity along the west side of the valley may be a contributing factor to the variable distribution of water salinity in this area. Gillespie et. al. (2017), cite that numerous wells contain waters between 3000 and 10,000 parts per million (ppm) in the nonmarine Tulare Formation and overlying alluvium in the western Subbasin.

Figure 2-21 below is a conceptual profile illustrating the general difference between the shallow and deep aquifer systems (fresh water continental deposits and alluvium, and saline water marine deposits), and the differences between the west and east side aquifer systems. In general, groundwater is more saline on the westside, while the freshwater column is thickened in the eastern-central part of the Subbasin.

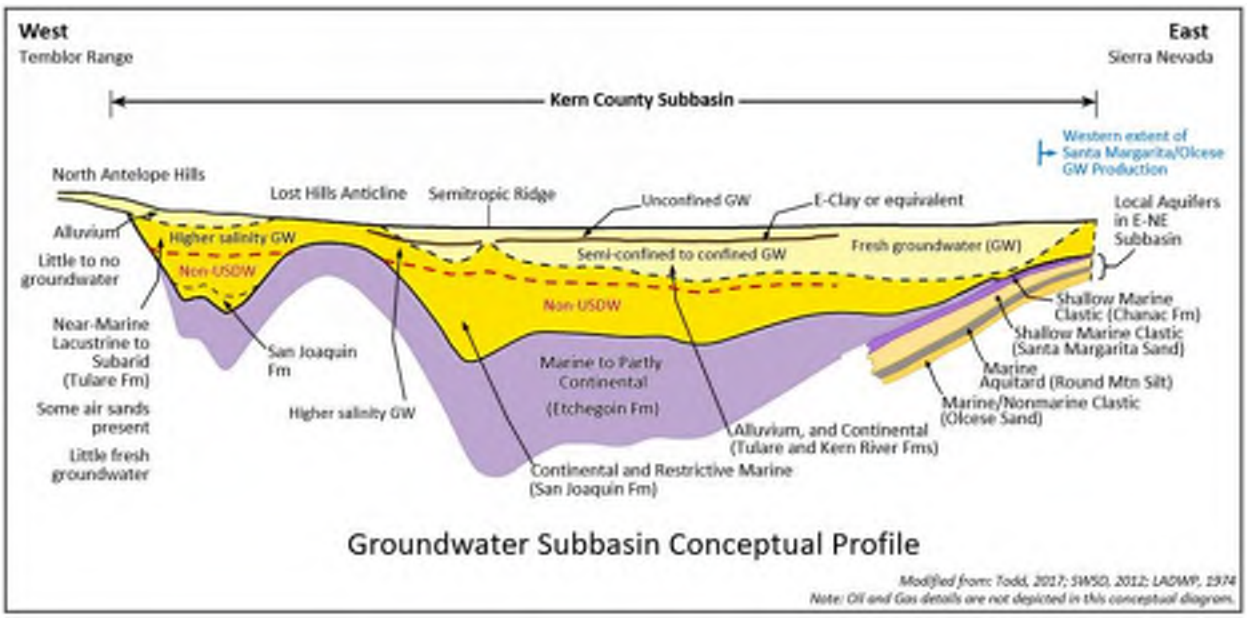


Figure 2-21. Groundwater Subbasin Conceptual Profile

2.2.1.6 Principal Aquifers and Aquitards

The groundwater aquifers of the Subbasin are geologically diverse with differing zones of confined, semiconfined, and unconfined groundwater conditions. As depicted in the below Figure 2-22, the primary aquifer system occurs in the central-northern, central, and central southern portions of the Subbasin. It consists of the Tulare formation, Kern River formation, and overlying alluvium. On the eastern side of the Subbasin are the confined Santa Margarita, Olcese, Pyramid Hills, and Vedder Sands. Groundwater wells extract water where these aquifers are not exempted and where they are feasible for groundwater supply use without hydrocarbons, On the western side of the Subbasin, very little usable groundwater occurs. In the northwest, groundwater supply production is likely limited and may occur in alluvium and/or the Tulare Formation.

In addition to the formations described above, groundwater may also be pumped from the San Joaquin and Etchegoin (Page, 1986; Bartow and Pittman, 1983) in the central portion of the Subbasin; however, little information is available to further document the groundwater characteristics or extraction within these zones.

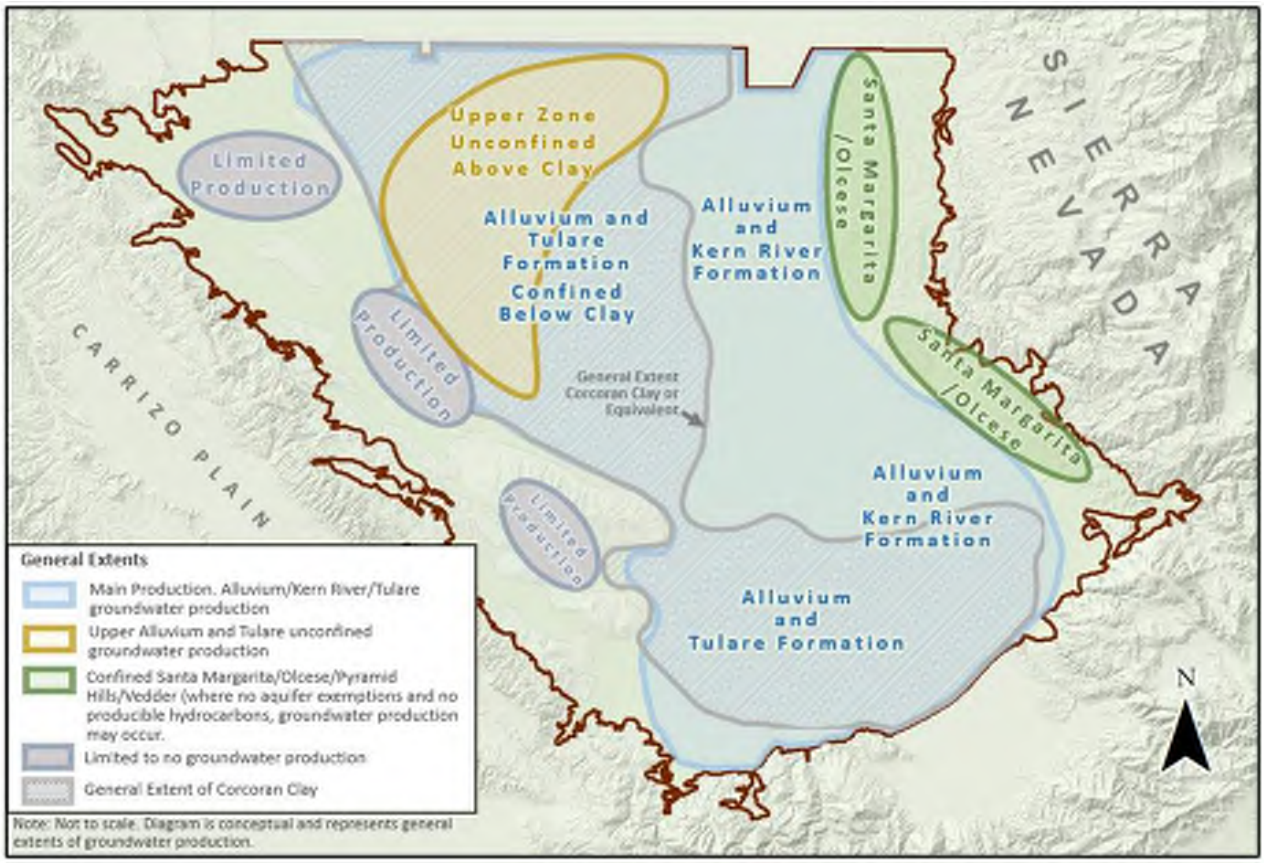


Figure 2-22. General Distribution of Groundwater Aquifer Supply Production in Kern County Subbasin

2.2.1.6.1 Formation Names

Table 2-2 presents the hydrostratigraphy and summary of the geologic units of interest with general details and a general summary of deposition and aquifer context.

The Subbasin groundwater system is dominated by alluvial/fluvial deposits on a basin-wide scale and produces an intricate, heterogenous grouping of aquifers. Although formations can be mapped across the Subbasin, much of the material is not distinctive in the subsurface and designation of a particular formation is difficult. Additionally, the E-modified layer of the Corcoran Clay member of the Tulare Formation is correlated across much of the Tulare Lake Hydrologic Region; however, there are still localized debates and questions on the extent and correlation of the E modified clay.

Refer to the discussion on stratigraphy in section 2.2.1.2. for a brief description of the formations and their general context in relation to the aquifer system.

2.2.1.6.2 Primary Aquifer System

The primary aquifer system of the Subbasin is within the Tulare and Kern River formations and overlying alluvium. It includes differing zones of confined, semiconfined, and unconfined groundwater conditions, due to the presence of clays that act as local aquitards. The Corcoran Clay and other equivalent clays occur within the Tulare Formation in the central and southern parts of the Subbasin (Page, 1983 and Page, 1986). Where extensive clays are present, some areas of the aquifer system may consist of a deeper confined zone and a shallower unconfined to semi-confined zone. Within the eastern portion of the Subbasin and in the vicinity of the Kern River Alluvial Fan, the aquifer system is made up of an unconfined to semi-confined zone. Shallow zones are also present locally in the northwestern and southern portions of the central Subbasin. The shallow zone is not a part of active groundwater extraction, but data are included in the groundwater conditions section of this report to evaluate changes over time.

Some researchers in the Subbasin define the primary aquifer system as one principal aquifer because the confining beds such as the E-modified Corcoran Clay or equivalent, are not laterally continuous across the Subbasin, or lithologically consistent allowing for continuous confinement. In addition, there are older wells in some parts of the Subbasin, that are screened across the Corcoran Clay which could allow interconnection of water between the upper and lower zones. However, for the past few decades, local county enforcement has worked to eliminate well construction practices with screens across encountered upper unconfined zones and lower confined zones.

In addition, to the aquifer zones described above, there is a shallow groundwater zone occurs above the A-Clay or other shallow clay; however, this zone has poor quality water and is not a part of the groundwater supply aquifer system.

Table 2-3 below is a summary of generalized aquifer characteristics of the primary aquifer system.

Table 2-3. Primary Aquifer System of Kern County Subbasin

Generalized Hydrostratigraphy	Relative Depth	Basin Extent	Water Quality	Corresponding Formations
Unconfined Zone	Middle to Deep	East side "main production zone"	Good	Eastside Alluvium and Kern River Formation
		Central, above the Corcoran Clay	Moderate	Central Subbasin, above the Corcoran Clay Member (E) of the Tulare Formation, or other equivalent fine-grained layers.
Confined, Semi-confined, or Lower Zone		Central "main production zone"	Good to Moderate	Confined to Semiconfined. Alluvium, Kern River Formation, and Tulare Formation

2.2.1.6.3 Eastern Confined Aquifers

Along the eastern margins of the Subbasin, other principal aquifers, where classified as USDWs and not exempted, include, semiconsolidated rock such as the Santa Margarita Sandstone, and Olcese Sands. These confined aquifers are hydraulically separated from the Kern River Formation aquifer system by Pliocene marine deposits. Other aquifers to the east, where classified as USDWs and not exempted, include the Pyramid Hills, Vedder Sand, and the Chanac Formation (Page, 1986; Bartow and Pittman, 1983). The extent of groundwater production in these aquifers is limited by the extent of producible hydrocarbons, aquifer exemptions, and increased salinity with depth.

2.2.1.6.4 West-side Aquifers

Alluvial aquifer zones on the west side of the Subbasin may contain groundwater that is higher in TDS. This groundwater occurs in the fold belt associated with folded and faulted strata. Where aquifers are classified as USDWs and not exempted per 40 CFR §144.3, groundwater may be pumped for beneficial use. The Tulare Formation makes up most of the aquifer system on the west side; however, the Tulare Formation differs in facies and origin than what is documented in the central portion of the Subbasin. West-side aquifers are described in more details in the management area plans.

2.2.1.6.5 Physical Properties of Each Aquifer and Aquitard

Aquifer parameters within the Subbasin are available from both well pumping tests and calibrated groundwater models. Data are summarized in Table 2-4 and Figure 2-23. Aquifer properties reported herein include hydraulic conductivity which is a volume of water that will move in a unit of time, under a unit hydraulic gradient through a unit area, and the specific yield

(unconfined systems) and storage coefficient (confined systems), which are functions of an aquifer's ability to store and release water from storage (storativity).

Table 2-4. Aquifer Parameters for Kern County Subbasin

Data Source	Calculated Horizontal Hydraulic Conductivity (feet/day)	Vertical Anisotropy Kh/Kz	Storage Coefficient	Specific Yield
Kern Pumping Tests Compilation (Todd, 2018)	7 to 250	--	0.0008 to 0.034	--
USGS - Kern Pumping Tests (Observation Wells)	20 to 1600	--	0.0004 to 0.002	--
USGS - Kern Recovery Tests	100 to 800	--	--	--
USGS - CVHM Range	0.24 to 3300	--	--	0.09 to 0.40
DWR - C2VSim Range				
Layer 1	15 to 78	275 to 500	--	0.12 to 0.40
Layer 2	< 1 to 100	20 to 4000	5.E-07 to 8.E-06	--
Layer 3	3.0 to 7.0	60 to 100	--	--
Todd Groundwater 2018 Model Range				
Layer 1	32 to 85	10 to 200	--	0.15 to 0.25
Layer 2			3.E-02	0.02 to 0.21
Layer 3	29 to 75	50 to 500	1.4E-07 to 9.4E-07	0.00004 to 0.00022
Layer 4	10 to 70	500		0.0011 to 0.0019
Todd Groundwater 2017 Model Average				
Layer 1	300 to 335	1150 to 1200	--	0.21
Layer 2	2	1050 to 1250	8.6E-06 1.4E-05	--
Layer 3	67 to 70	1000	0.00024	--
Layer 4	22 to 37	2200 to 3700	0.00058	--
USGS - Water Supply Paper 1618				
White-Poso Unit (upper 200 ft)	--	--	--	0.086 to 0.095
Kern River Unit (upper 200 ft)	--	--	--	0.125 to 0.132
Edison-Maricopa Unit (upper 200 ft)	--	--	--	0.12 to 0.14
USGS - Water Supply Paper 1618				
Clay and Fine Grained Units	--	--	--	0.03
Silt, Gravelly Clay, Sandy Clay Units	--	--	--	0.05
Fine, tight sand, tight gravel	--	--	--	0.10
Loose, well sorted sand, gravel	--	--	--	0.25

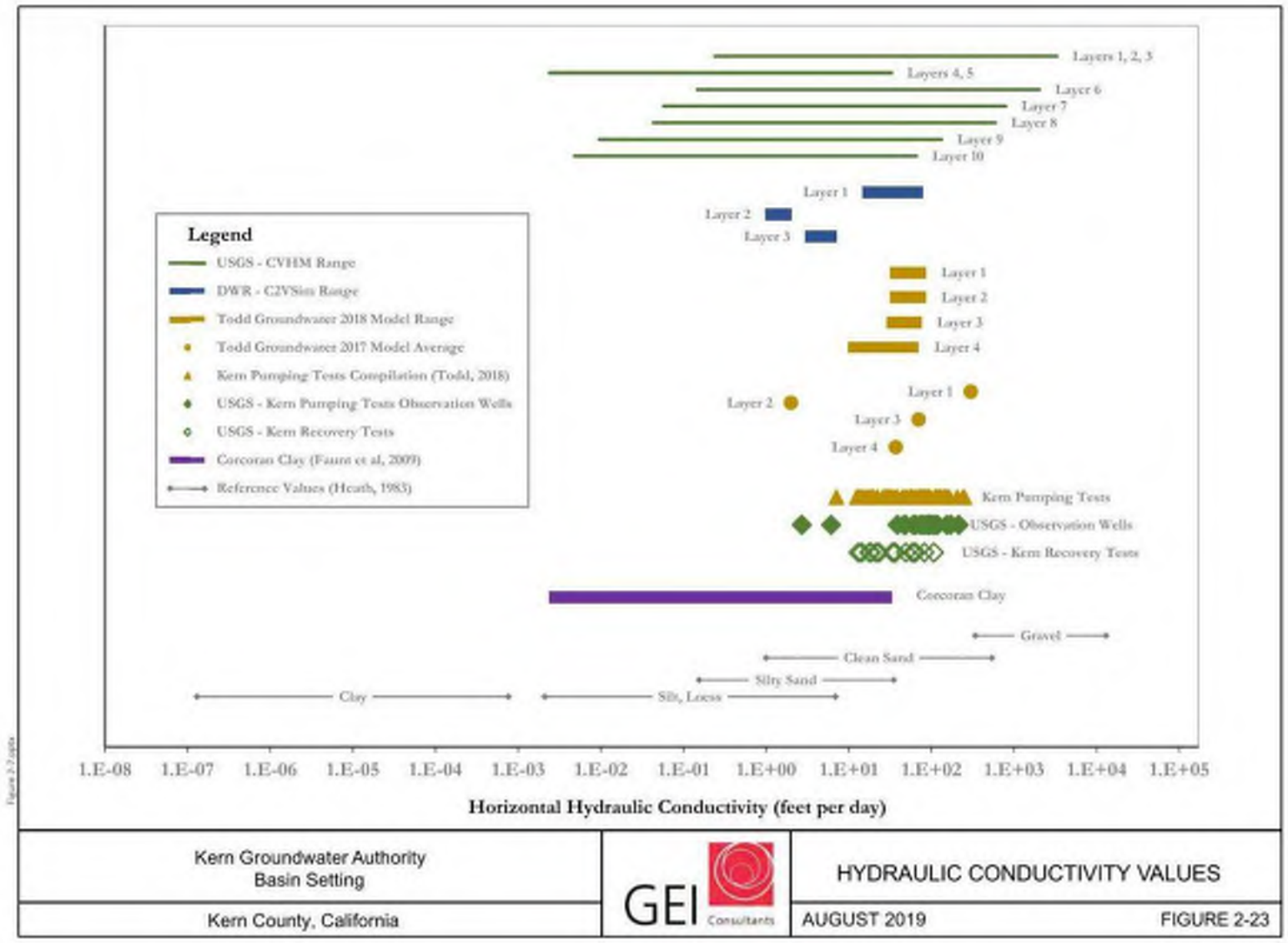


Figure 2-23. Hydraulic Conductivity Values

This Page is Intentionally Blank

2.2.1.6.6 Hydraulic Conductivity

Aquifer data derived from pumping tests were taken from two sources: 1) relatively short (1.5- to 5-hour) pumping tests by the USGS at irrigation wells during the late 1950s and 1960 (McClelland, 1962), and 2) from constant rate pumping tests from engineering consultants in the 2000's (Todd, 2018). The depth of these test wells varied from 98 to 1,500 feet below ground surface (bgs) (median: 650 ft bgs), and pumping rates varied from 44 to 4,480 gpm (median: 2,500 gpm). The analysis included the use of water level recovery data from pumping wells and water levels from observation wells. From these tests, the hydraulic conductivity was estimated and ranges from 3 to 250 feet per day (ft/d; median: 60 ft/d), which is consistent with published ranges for clean, medium- to coarse-grained sand (Heath, 1983), or for a fine sand to coarse gravel (Schwartz & Zhang, 2003). These values also fall within the range of the groundwater models that were partially calibrated with these data (C2VSim; CVHM; Todd, 2018; Todd, 2017) (Figure 2-23).

The Corcoran Clay of the Tulare Formation is most commonly known for its fine-grained beds; however, lithology does vary from fine (clay and silt) to coarse (sand) texture (Page, 1986; Faunt et al., 2009). These coarser-grained beds are isolated and principally occur where the Corcoran Clay is less than 20 feet thick. Faunt et al., (2009) compiled and estimated horizontal hydraulic conductivities within the range of 0.0024 to 33 ft/d, which is within the range of silt to fine/medium sand (Figure 2-23) (Heath, 1983). A range of vertical hydraulic conductivity was estimated from permeameters and field tests between 6.6×10^{-6} ft/d to 1.5×10^{-3} ft/d (Faunt et al., 2009), representing a potential vertical anisotropy range of 3.6×10^{2} to 2.2×10^{4}. As noted by Faunt et al., (2009) laboratory permeameter tests may have underestimated the hydraulic conductivity while field testing may have overestimated hydraulic conductivity due to potential for intra-borehole flow across the clay. Additionally, recent inelastic compaction of the Corcoran Clay in areas of subsidence may have further reduced vertical hydraulic conductivity (Faunt et al., 2009).

2.2.1.6.7 Specific Yield and Storage

Storage of an aquifer is primarily described and quantified by the storativity or the volume of water released from storage per unit surface area of the aquifer per unit decline in hydraulic head (Heath, 1983). It is important to note that while storativity applies to both confined and unconfined systems, it can be further simplified for these two systems. Storativity accounts for aquifer compression and water expansion (specific storage components), which are the primary factors for estimating storage in confined systems; thus, for confined systems, the specific storage or storage coefficient is most often reported. In contrast, for unconfined systems, the specific yield or effective porosity (gravity-driven dewatering of an aquifer) better represents storativity because aquifer compressibility and water expansion are somewhat negligible in unconfined systems. For unconfined systems, specific yield is most often reported, and is a function of porosity and specific retention.

For confined systems, the aquifer compressibility of the storage coefficient can be further defined as elastic and inelastic skeletal specific storage, where inelastic storage will be lost once compression and dewatering occur. It is estimated that in the Central Valley, the inelastic

specific storage typically is 30 to several hundred times larger than the elastic skeletal specific storage (Faunt et al., 2009; Ireland et al., 1984). Where fine-grained deposits with inelastic storage are thick in the aquifer system, water released could be a major source of water, but could also result in a permanent loss in storage capacity of fine-grained sediments.

Specific yield of unconfined zones and the storage coefficient of confined zones within the Subbasin have been estimated by laboratory testing of sample cores, calculation based on lithology type, and groundwater model calibration (Dale, 1966; Davis et al., 1959; Davis et al., 1964; Faunt et al., 2009; DWR, 2013; Todd, 2017 and 2018). A range is presented in Table 2-4 and is within the range of values published for similar grain sizes and lithology (Heath, 1983; Morris and Johnson, 1967) (generally 0.02-0.40).

2.2.1.6.8 General Water Quality of Principal Aquifers

As required in the regulations, this section is a general summary of water quality of the principal aquifers in the Subbasin. This section does not replace the discussion of water quality issues under Groundwater Quality Section 2.3.3.

This discussion provides a high-level description of water quality variation in the principal alluvial aquifer system of the Subbasin, both laterally (from west to east across the Subbasin) and vertically (shallow–deep within the Subbasin). For local details on water quality for specific areas of an aquifer, refer to the management area plans.

Total dissolved solids are discussed in this section only for the purpose of comparing and contrasting different portions of the aquifer system for Subbasin characterization. For details regarding water quality issues and current groundwater conditions, refer to Section 2.3.3 and individual management area plans. In general, water quality is higher in TDS in the western third of the Subbasin than in the rest of the Subbasin. Higher nitrate and other solutes concentrations are typically present in shallow perched zones and in the unconfined zone above the Corcoran Clay. Groundwater is progressively fresher and lower in TDS below the Corcoran Clay, toward the center of the basin, and in the eastern half of the Subbasin. In contrast, arsenic concentrations increase with depth and in close proximity near portions of the Corcoran Clay. Arsenic and salinity progressively increase with depth approaching the base of USDW.

Kern County Water Agency Water Supply Reports which end in 2011 presented groundwater quality maps using data pre-1997. These maps report that unconfined groundwater (typically above the E-modified Corcoran Clay) in the central portion of the Subbasin generally ranges from less than 500 to 1,500 ppm for TDS, while the west side unconfined groundwater ranges from 1,000 to 5,000 ppm for TDS. The confined aquifer zone (typically below the E-modified clay) in the central portion of the Subbasin generally ranges from less than 200 to 500 ppm for TDS, while west side confined water typically ranges from 1,000 to 4,000 ppm.

The high TDS groundwater in the west side with respect to the east side has recently been reported in a preliminary groundwater salinity mapping study conducted by the USGS (Metzger and Landon, 2018). Within the Subbasin, the study reported much higher TDS in west side water when compared with east side groundwater. Metzger and Landon suggest that higher TDS could

be related to a combination of natural conditions (west side sediments derived from marine deposits with some connate water) and anthropogenic factors such as infiltration from disposal ponds and/or agricultural drainage ponds. The researchers suggest that groundwater on the east side of the Subbasin have the lowest TDS and greatest depths to non-USDWs because they are adjacent to Sierra Nevada that is a source of low TDS (fresh water Ca-HCO_3 type) recharge, whereas, aquifer zones on the west side of the Subbasin have higher TDS values. The west side aquifer zones likely receive very little recharge from the Temblor Range which is made up of marine deposits, and west side aquifer zones such as the west side Tulare Formation likely contain connate water derived from marine deposits (Wood & Dale, 1964). This higher TDS water (Na/Ca-SO_4 type) in west side water is consistent with historical reports and is documented for more than 60 miles from north to south in the Subbasin (KCDEH, 1980; KCDEH and KCWA, 1982; Sierra Scientific Services, 2013). Additional sections of this GSP provided by west side entities, discuss further details on the west-side Subbasin aquifer system.

2.2.1.6.9 Primary Use of Each Principal Aquifer

The unconfined zone in the eastern portion of the Subbasin and in the Kern Fan, and the confined zone below the Corcoran Clay are the primary production zones of the Subbasin aquifer system. In addition, the upper unconfined zone is pumped for beneficial use in the north central and west central areas of the Subbasin. The primary uses of the Subbasin aquifer system include agricultural, municipal, domestic, and storage for the banking of surface water.

2.2.1.6.10 Summary of Beneficial Uses and Users of Groundwater

Land use in the Subbasin includes agriculture, urban/industrial/residential, and open space use. According to the 2014 SGMA legislation, beneficial users of groundwater and property interests potentially affected by the use of groundwater include:

- Agricultural Users
- Domestic Users
- Municipal Well Operators
- Public water systems
- Local Land Use Planning Agencies
- Environmental Users

According to DWR well completion reporting and the CASGEM program, groundwater wells are constructed for a variety of uses including:

- Domestic / Residential
- Irrigation
- Stock
- Municipal / Public
- Monitoring / Observation

- Industrial
- Cathodic Protection
- Other / Unknown

2.2.1.7 Data Gaps and Uncertainty

The primary data gaps in the hydrogeologic conceptual model include:

- Physical properties of the westside aquifers and eastside aquifers,
- Physical properties of the upper zone of the primary aquifer system,
- Groundwater characterization on the eastern and western flanks of the Subbasin and in the upper and shallow zones, and
- Groundwater quality of the primary aquifer zones and confined zones on the eastern and western flanks of the Subbasin, from wells screened solely in a single aquifer zone.

As improvements to monitoring networks are made, data can be used to fill data gaps in the Subbasin.

2.2.1.8 Cross Sections

A general summary of regional subsurface information is provided below in the context of cross sections developed for this plan. Where applicable, detailed discussions of the subsurface are included in some management area plans of the Subbasin.

Cross sections were developed to illustrate the subsurface conditions of the Subbasin. The locations of the cross sections discussed below are provided on Figure 2-18. Section A-A' north of the Kern River (Figure 2-24a) is northeast-trending and perpendicular to the numerous faults and folds within the valley. Section B-B' north of the Kern River (Figure 2-24b) is northwest-trending to be parallel to the axis of the valley. Geologic and hydrogeologic data were compiled from DWR well logs, DOGGR well logs, Page (1973), Gillespie et al (2017), *California Oil and Gas Fields* (DOGGR, 1998), and other regional investigations.

Cross sections spanning the southern and southeastern portions of the Subbasin were developed for management area plans and are included herein (Figures 2-24c to 2-24g). For a discussion of the subsurface across the White Wolf Fault, data including a cross section are presented in the *White Wolf Subbasin Technical Report* (EKI, 2016), that was a part of the 2016 Basin Boundary Modification Request.

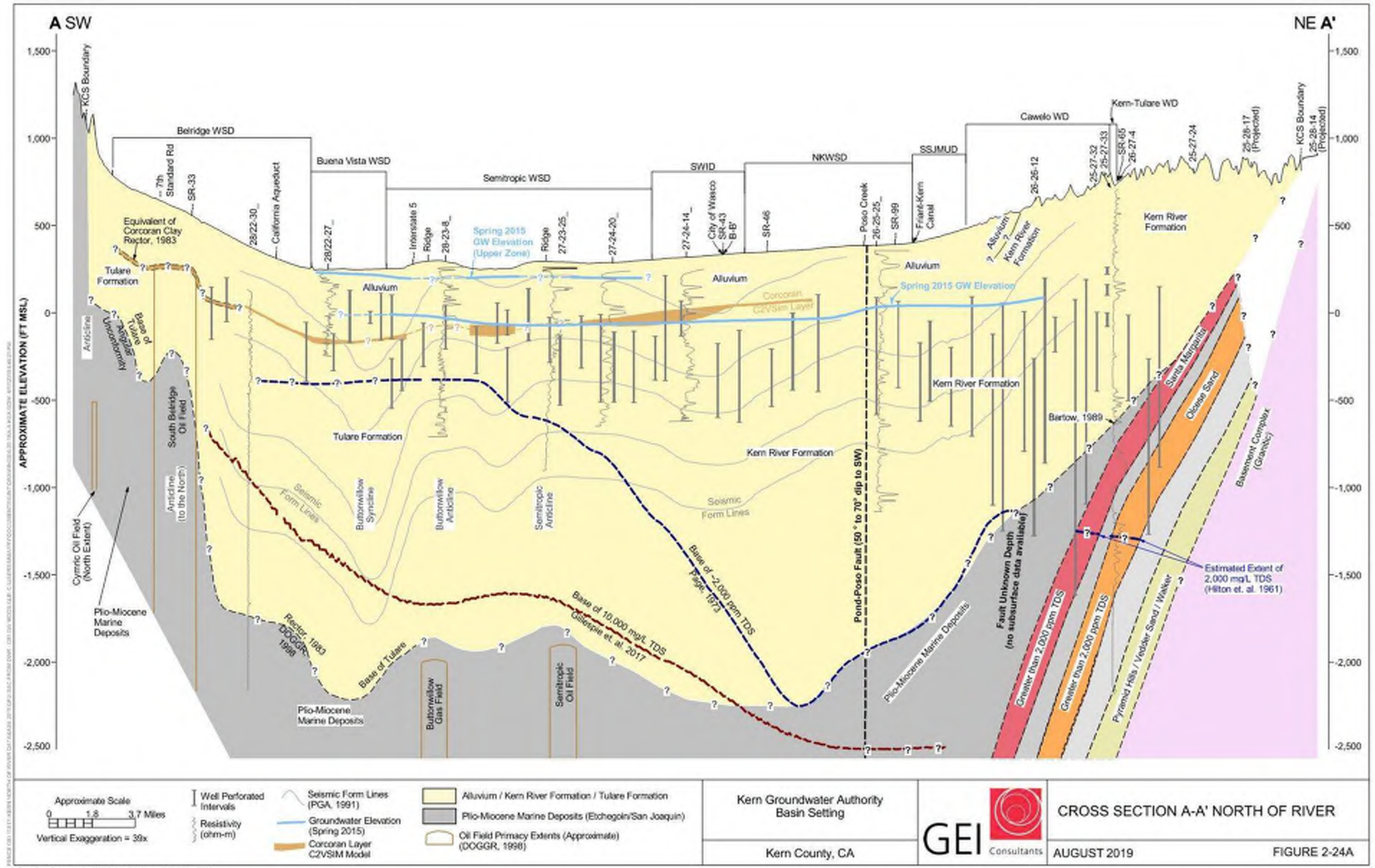


Figure 2-24a. Cross Section A-A’ North of River

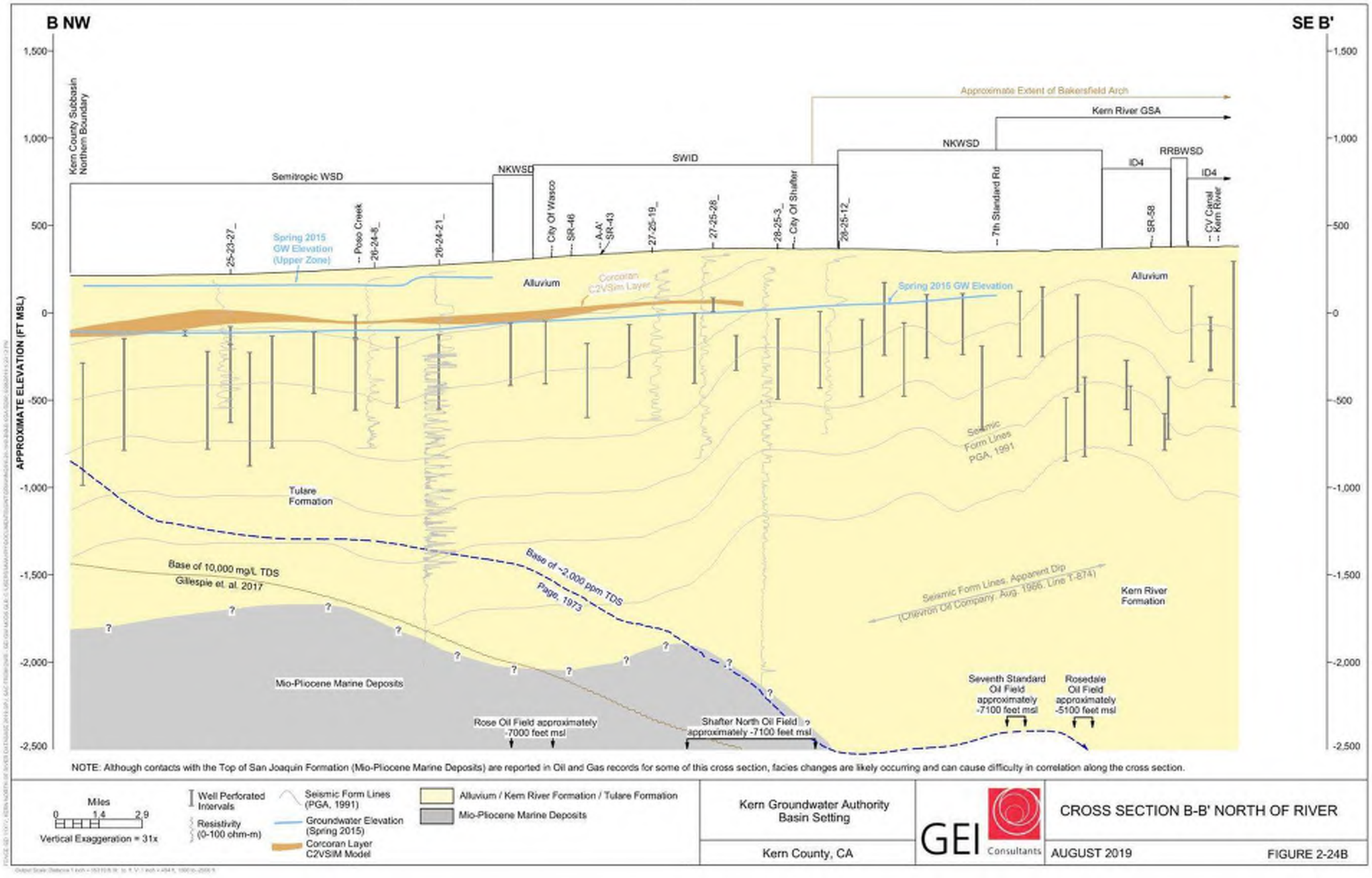


Figure 2-24b. Cross Section B-B’ North of River

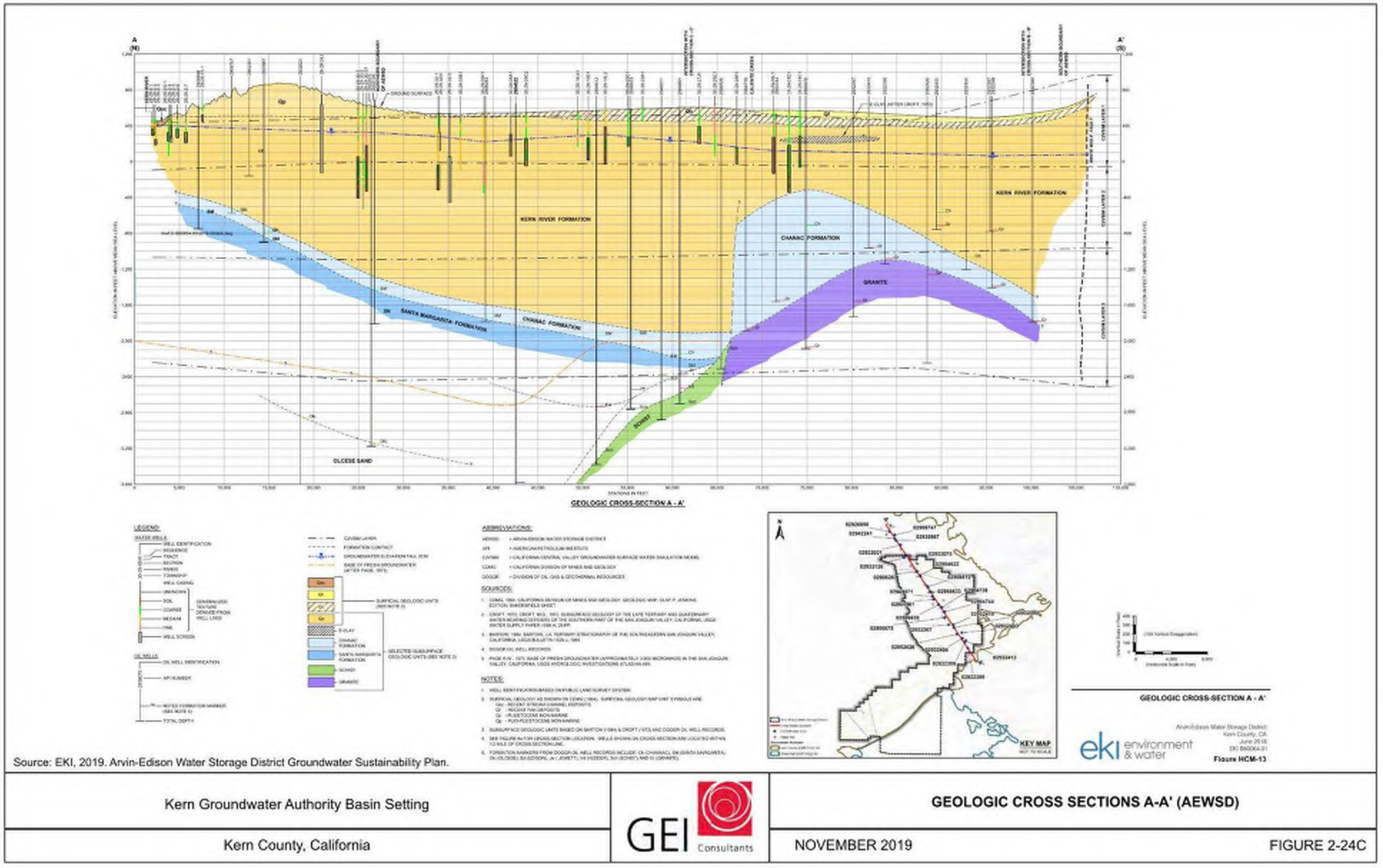
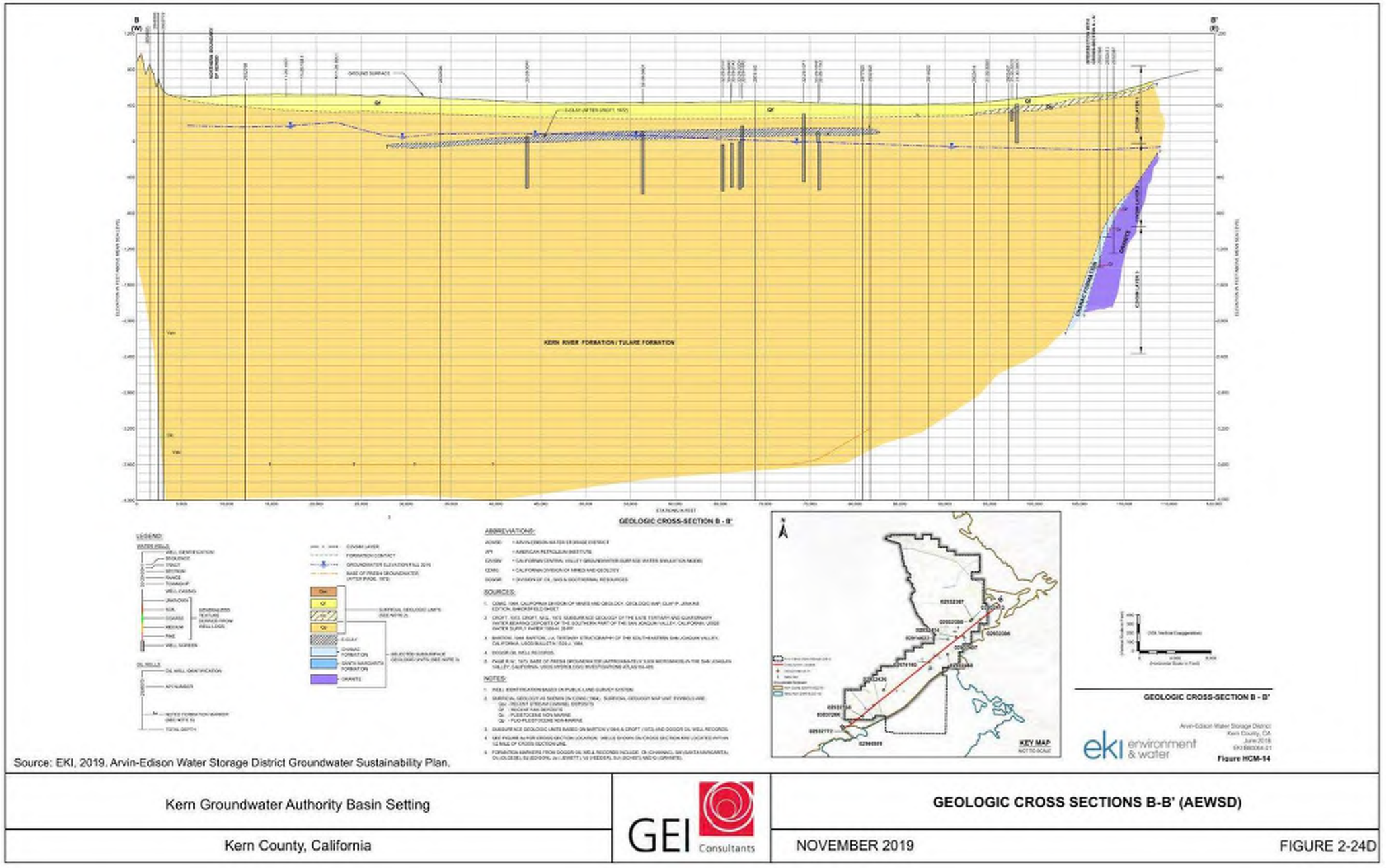


Figure 2-24c. Geologic Cross-Section A-A', Arvin-Edison Water Storage District



Source: EKI, 2019. Arvin-Edison Water Storage District Groundwater Sustainability Plan.

Kern Groundwater Authority Basin Setting	GEI Consultants	GEOLOGIC CROSS SECTIONS B-B' (AEWSD)
Kern County, California	NOVEMBER 2019	FIGURE 2-24D

Figure 2-24d. Geologic Cross-Section B-B', Arvin-Edison Water Storage District

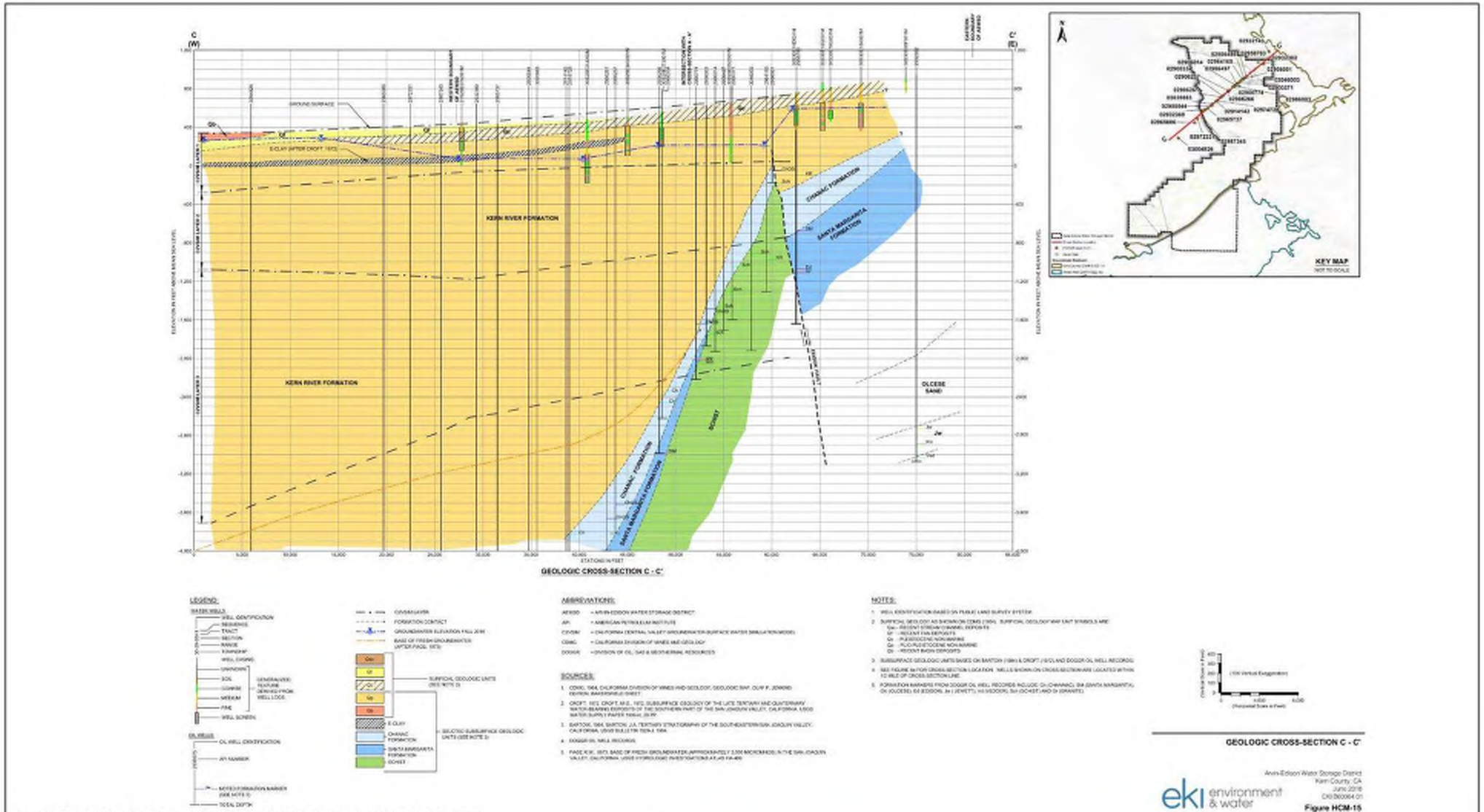


Figure 2-24e. Geologic Cross-Section C-C', Arvin-Edison Water Storage District

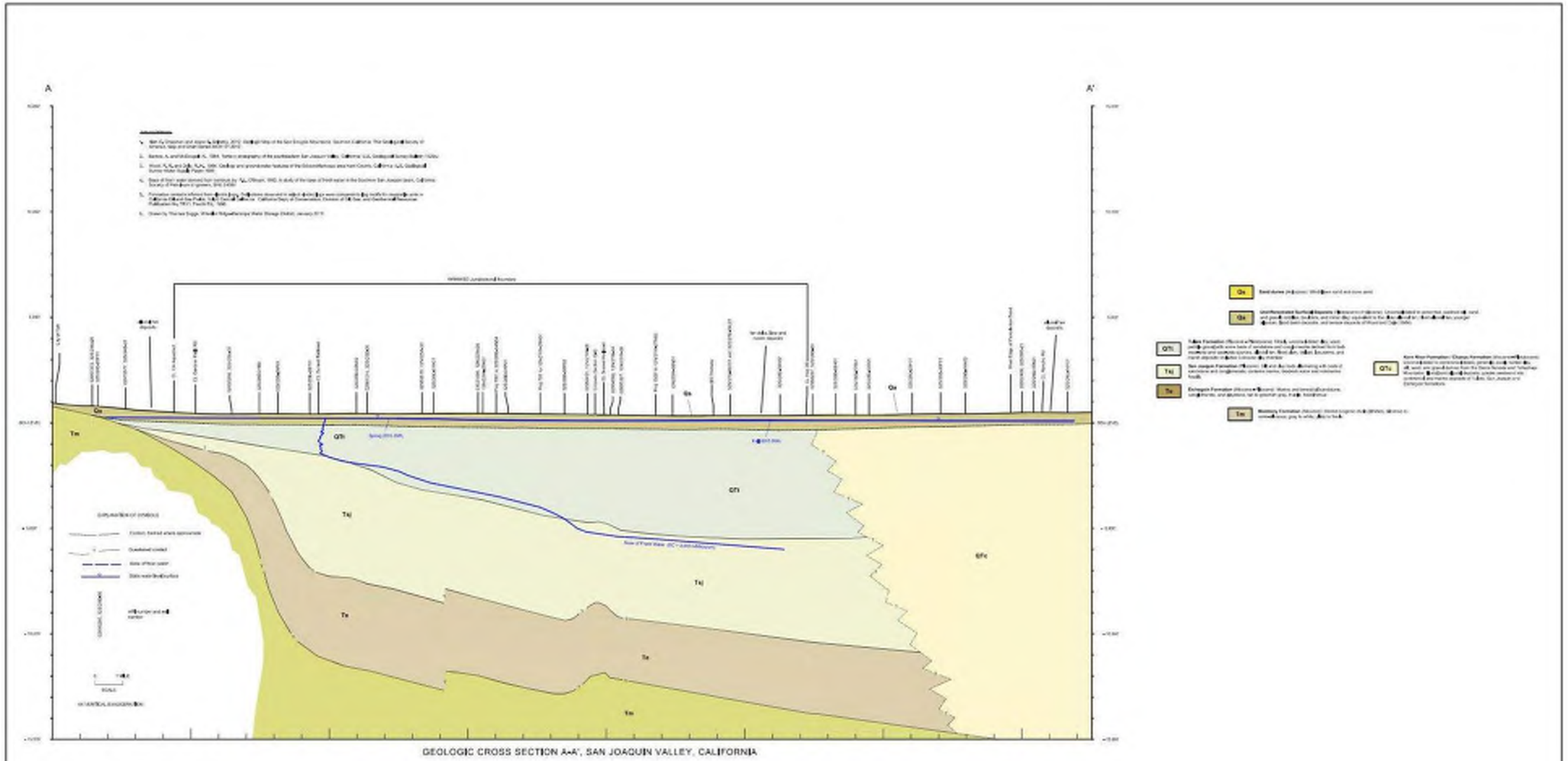
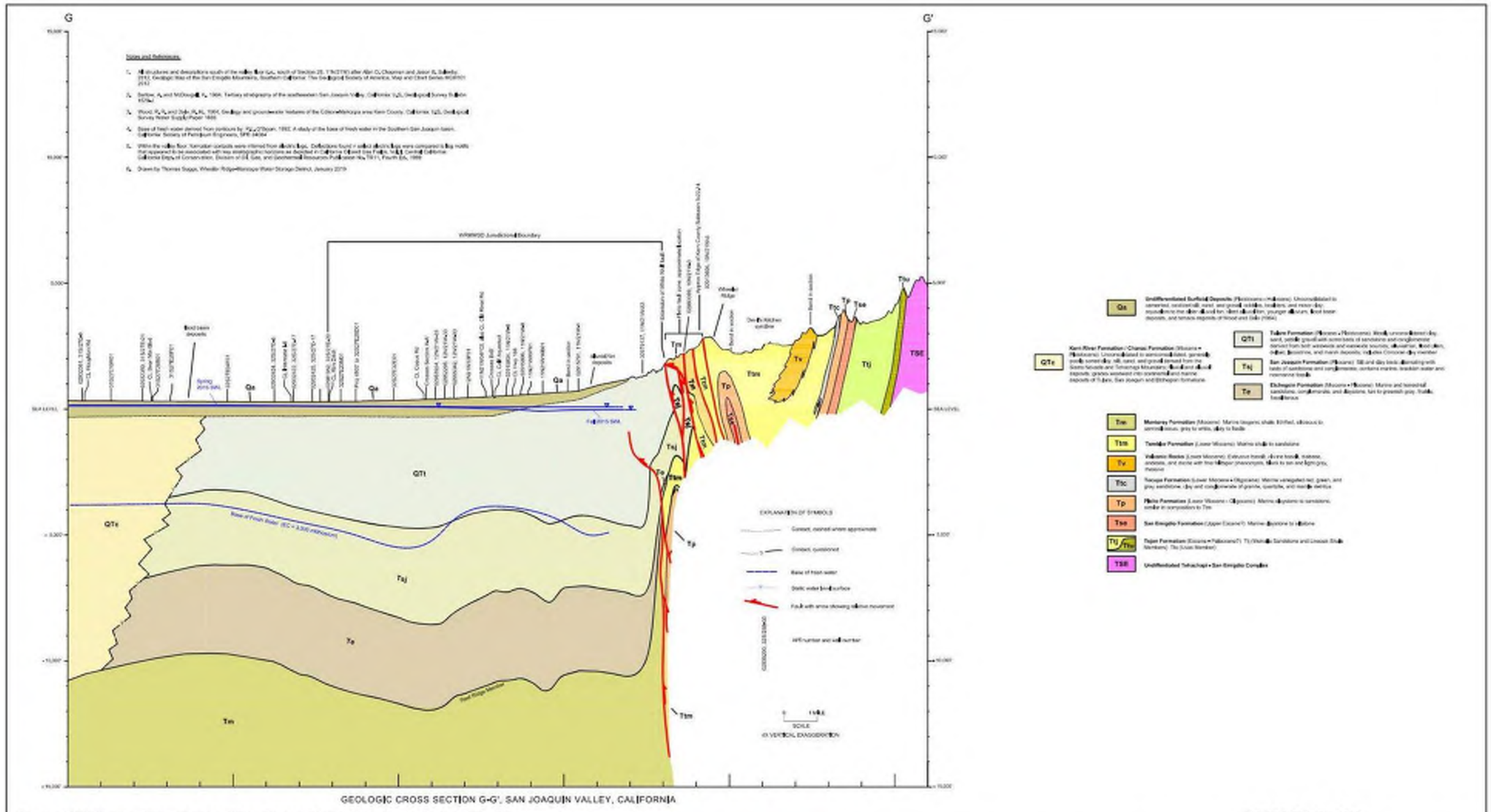


FIGURE 2-19F

Source: 2019 Wheeler Ridge Maricopa Water Storage District Groundwater Sustainability Plan.

Kern Groundwater Authority Basin Setting	GEI Consultants	GEOLOGIC CROSS SECTIONS A-A' (WRMWSD)
Kern County, California	NOVEMBER 2019	FIGURE 2-24F

Figure 2-24f. Geologic Cross-Section A-A', Wheeler Ridge-Maricopa Water Storage District



GEOLOGIC CROSS SECTION G-G', SAN JOAQUIN VALLEY, CALIFORNIA

Source: 2019 Wheeler Ridge Maricopa Water Storage District Groundwater Sustainability Plan.

FIGURE 2-19G

Kern Groundwater Authority Basin Setting	GEI Consultants	GEOLOGIC CROSS SECTIONS G-G' (WRMWSD)
Kern County, California	NOVEMBER 2019	FIGURE 2-24G

Figure 2-24g. Geologic Cross-Section G-G', Wheeler Ridge-Maricopa Water Storage District

This Page is Intentionally Blank

2.2.1.8.1 A-A' North of the River

A-A' north of the river illustrates the change in hydrogeology from west to east. The westside has a thin fresh water zone due to a shallow base of fresh water. The geology on the westside is dominated by marine deposits and the overlying Tulare formation consists of alluvial fan and debris flow facies primarily from sediments derived from the Coast Range marine deposits. To the east of the California Aqueduct, the Corcoran Clay of the Tulare includes diatomaceous clay and other fine-grained deposits associated with basin center facies. Section A-A' includes seismic form lines from the PGA (1991) investigation that show general structure of bedding that are consistent with mapped Buttonwillow and Semitropic folds and the structure of the base of the Tulare. In contrast, traditionally mapped Corcoran Clay layers which are available through the USGS and DWR (C2VSIM on Section A-A'), correlate clays that do now follow the general bedding forms observed in seismic lines. Future investigation may clarify the discrepancies between these interpretations.

The upper zone groundwater elevation is plotted on section A-A' which is generally considered to pertain to wells screened above the Corcoran Clay. Section A-A' displays wells screened in the upper zone above the Corcoran Clay which is the primary groundwater production zone to the west of Interstate 5 (I-5). Some groundwater production in the upper zone occurs east of I-5 with wells screened above the mapped Corcoran Clay and other wells screened across the Corcoran Clay. The upper zone likely extends further west and east; however, additional data were not available to continue the correlation.

The main regional groundwater surface is plotted across the basin. The groundwater is generally confined where wells are below the Corcoran Clay and semiconfined where wells are outside the extent of the Clay. As described in section 2.2.1.3, Pond-Poso Fault has been documented to affect groundwater flow. High resolution water level data across the fault, however, were not available for this cross section.

The central portion of the Subbasin (just west of the Pond-Poso Fault), has a much thicker aquifer zone with a deeper base of freshwater and thicker deposits of continental sediments (Kern River formation) derived from the Sierra Nevada where freshwater recharge into the Subbasin predominates.

Further to the east, wells have been drilled deeper (greater than 2000 feet) in order to extract fresh groundwater from the Santa Margarita formation and Olcese Sand. Although these aquifers are separate from the main alluvial aquifer system of the valley by Plio-Miocene Marine Deposits, some wells are screened across the continental deposits (Kern River formation), extending through marine and into the Santa Margarita formation and Olcese Sand.

2.2.1.8.2 B-B' North of the River

Section B-B' from northwest to southeast trends through a portion of the Subbasin with a deep base of freshwater. Seismic form lines confirm bedding gradually rise to the south onto the Bakersfield Arch beginning from just north of the City of Shafter southward toward the City of Bakersfield and the Kern River. The alluvium and Kern River formation become thicker toward the south where the Kern River has been a major source of the sediment input into the Subbasin.

2.2.1.8.3 South of the River Cross Sections

Cross sections developed for management area plans in the southern portion of the Subbasin are included herein (Figures 2-24c to 2-24g). These sections present the base of fresh water where it is deepest in the central southern area of the Subbasin southwest of the City of Arvin. They also present the White Wolf Fault and Edison Fault which alter groundwater flow. In general, water wells are screened in the upper 1000 feet of the subsurface across the southern portions of the Subbasin, in the Kern River Formation and Tulare Formation. In the southeastern portion of the Subbasin, faulting and folding has created a thinner column of Kern River Formation deposits to the east of Lamont. The top of the Chanac Formation may be as shallow as 900 feet below ground surface in T31S-R29E. Consequently, data on the base of fresh water were not readily available for plotting in the southeastern portion of the Subbasin.

Cross sections across the White Wolf Fault are provided in the *White Wolf Subbasin Technical Report* (EKI, 2016). Historical sections document change in groundwater elevations (generally a 50 feet decline) across the fault from south to north. Displacement of beds across the fault increases with depth. In general, groundwater aquifer thickness is not significantly affected by displacement across the fault. Additional information is available at the Basin Boundary Modification website: https://sgma.water.ca.gov/basinmod/basinrequest/preview/34.

2.2.1.9 Mapped Physical Characteristics

2.2.1.9.1 Topographic Information

Figure 2-25 presents a basin-wide topographic map of the Subbasin. The rim elevation of the Subbasin varies from approximately 600 feet msl along the White Wolf Fault on the south to over 2,000 feet in the foothills of the adjacent San Emigdio Mountains. On the east and west sides, the rim elevations vary between 1,000 and 2,000 feet msl. As such, the topography of the Subbasin slopes toward the center of the valley on three sides, and the 400-foot contour line generally defines a long and narrow valley floor, which slopes to the northwest. The lowest land surface elevations are approximately 210 feet msl and are located along the County line between Highway 43 and Interstate 5 (18 of 24 miles). Within the Subbasin, prominent topographic features include the Elk Hills, and the Buttonwillow and Semitropic ridges.

2.2.1.9.2 Surficial Geology (Including Location of Geologic Sections)

The surficial geology of the Subbasin has been documented in a variety of previous investigations and is presented on Figures 2-13, 2-17, and 2-18 (Bartow, 1991; Page, 1986; and CGS, 2010b) According to the California Geological Survey (2010b), the center of the basin consists mainly of Pleistocene to recent unconsolidated and semi-consolidated alluvial (Q of Figure 2-17), lake, playa, and terrace deposits. Older Pleistocene alluvium (Qao) is present in the eastern portion of the basin on top of Pliocene-Pleistocene deposits (QPc) of sandstone, shale and gravel deposits, including the Kern River Formation. The QPc unit includes the Tulare Formation and occurs as islands, surrounded by recent alluvium, within the center of the northern Subbasin along the western side and within the alluvium. Small remnants of older continental sediments are included along the southeastern flank of the Subbasin, including undivided

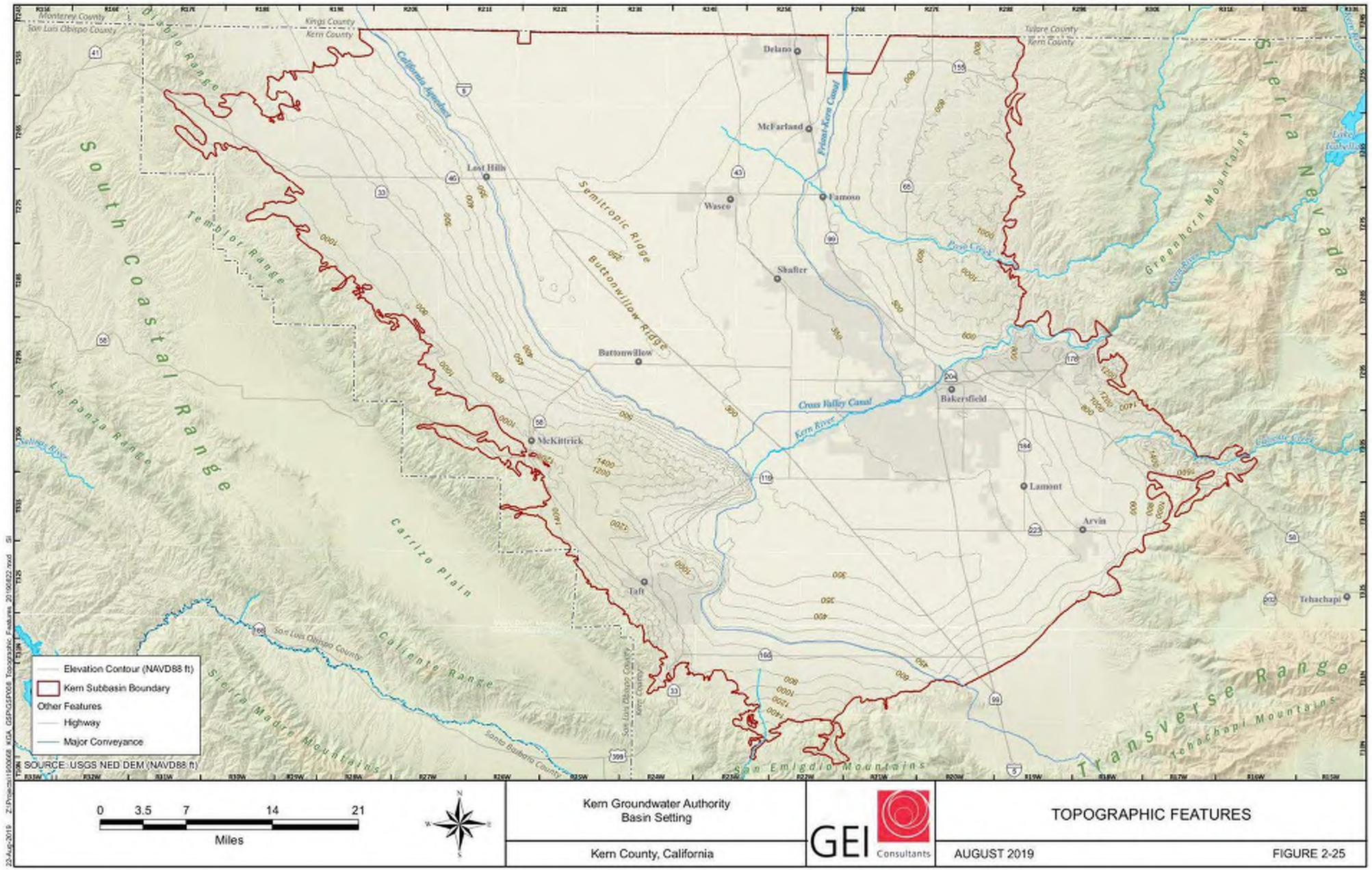


Figure 2-25. Topographic Features

This Page is Intentionally Blank

Tertiary-age sandstone, shale, conglomerate, breccia, and lake deposits (Tc) and Miocene-age sandstone, shale, conglomerate, and fanglomerate (Mc) plus smaller remnants of older marine sediments: Miocene-age sandstone, siltstone, shale, conglomerate, breccia (M). These remnant units would include the Santa Margarita Formation, Round Mountain Silt, and Olcese Sand.

Bartow (1991) provides a similar map (Figure 2-13) as the California Geological Survey map but refers to Quaternary alluvial and lacustrine sediments (Qs) on the valley floor and Tertiary sedimentary rocks (TS) along the flanks and for the islands of older rocks in the valley center. As discussed further below, the map shows the location of the Bakersfield Arch as well as three structural regions within the Subbasin.

Page's (1986) presentation of the surficial geology, as shown by Figure 2-17 better display the lakebed deposits. Recent river deposits (Qr) associated with the present-day Kern River, are shown as a long, narrow strip from the mouth of the Kern Canyon, and are comprised of gravel, sand, silt, and minor amounts of clay. The center of the valley floor is underlain by Recent flood basin (Qb) – clay, silt, and some sand; and by Pliocene to Recent lacustrine and marsh deposits (QTl) – clay, silt, and some sand with extensive subsurface clay layers (A, C, E/Corcoran). The former unit is associated with the original Kern River drainage and flood basin while the latter unit is associated with the historical Kern Lake Bed, Buena Vista Lake Bed, Goose Lake Beds, and the southern edge of the Tulare Lake Bed. The remainder of the valley is underlain by Miocene to recent continental deposits (QTc) – a heterogenous mixture of gravel, sand, silt, and clay with some layers of conglomerate, sandstone, siltstone, and claystone. Like the other maps, remnants of older continental deposits are shown along the rim of the Subbasin, primarily the southeastern side, including Oligocene to Miocene deposits (Tcmo) of gravel, conglomerate, sand, and clay; and Eocene to Miocene deposits (Tcme) of conglomerate, sandstone, fanglomerate, claystone, and breccia plus limited occurrences of undifferentiated marine deposits (Tm) of sand, clay, silt, sandstone, shale, mudstone, and siltstone of Eocene to Pliocene ages.

2.2.1.9.3 Soil Characteristics

Soils within the Subbasin have two general origins that are approximately delineated by the trough of the valley, which also mirror depositional patterns as mapped in surficial geology. The eastern alluvial fans were deposited primarily by runoff from the Sierra Nevada, Tehachapi, and Transverse mountain ranges. These soils are of igneous and metamorphic origin; are typically well drained, very low in salinity, and ideal quality for agriculture. The northwestern alluvial fans originated from Coast Range sedimentary rock formed on the sea bottom. This northwest region tends to have more areas with poorly drained soils of relatively marginal quality (Provost & Pritchard, et al., 2015). The Groundwater Quality Assessment Report (Provost & Pritchard, et al., 2015) describes five areas of different soil texture in the Subbasin: the clay rim area of fine grained texture near the historical lake beds, the foothills of medium texture, the Kern Fan region derive from river deposition, northern areas with some alluvium and other sources, and Wheeler Ridge/Arvin Edison with coarse soil. These five areas contain the different soil types described below.

Soils in the center of the Subbasin are generally categorized into three types according to texture. Fine-grained soils are found in the southwest, the historical lake beds, and northwest corners of

Subbasin. Coarse grained soils within the Poso Creek fan, Kern River fan, and Caliente creek fan. And the moderate infiltration of soils along the distal edges of the fans. The lake bed areas are composed of fine-grained soils of the historical Buena Vista and Kern lakebeds, and swamp and overflow lands, which continue north along the historical drainage paralleling the Goose Slough, Goose Lake, and southern edge of the Tulare Lake depositional environment. Medium to coarse grained soils are distributed in the Poso Creek and Kern River drainage beds as well as the proximal and medial portions of the Kern Fan, and the south boundary of the Subbasin.

Figure 2-26 and 2-27 present the soil distribution within the Subbasin as defined by U.S. Dept. of Agriculture (USDA), National Resources Conservation Service, Soil Survey Geographical Database (SSURGO) as obtained from the DWR SGMA Data Viewer website (2018). Figure 2-26 shows that six soil orders are present in the Subbasin, including Aridisols and Entisols throughout most of the Subbasin, with Inceptisols along the eastern highland, and much lesser amounts of Alfisoils, Mollisols, and Vertisols. According to the online Encyclopedia Britannica (EB, 2018), Ardisols are dry soils characterized by a low humus, light-colored surface horizon with a subsurface accumulation of soluble salts, silicate clays, and possibly a cemented layer of calcium carbonate, calcium sulfate (gypsum) or silica. Entisols are characterized by the absence of soil horizons due to recent deposition or active erosion under extreme wet or dry conditions (EB, 2018). Inceptisols exhibit a weak appearance of soil horizons overlying a weathering-resistant parent material. Alfisols are characterized by well-developed soil horizons enriched with aluminum- and iron-bearing (Al/Fe-) minerals but depleted of calcium carbonate (EB, 2018). Translocated clays typically form a layer with relatively high amounts of mineral nutrients (calcium, magnesium, sodium, and potassium). Mollisols are characterized by a thick, dark surface horizon of humus, which typically originates from native grass vegetation, and mineral nutrients are present in most horizons (EB, 2018). Humus and Al/Fe-bearing minerals do not migrate to subsurface layers. Vertisols are clay-rich soils (>30 percent) with significant cracking during the dry season due to the shrink-swell response of the clay minerals during the dry and wet seasons (EB, 2018). The shrink-swell action produces significant vertical mixing of the soil.

Figure 2-27 shows the distribution of hydrogeologic soil groups, which is based largely on four categories of infiltration rates: high, moderate, slow, and very slow. Group A soils have a high infiltration rate due to well drained sands or gravelly sands. Group B soils are moderately well drained due to moderately fine to coarse textures. These soils are present on the east, west, and south sides of the valley floor. Group C soils have a low infiltration rate due to their fine texture or because of a layer that impedes downward movement of water. These soils are present along the valley floor, along the eastern highlands, and at various locations along the northwestern side of the Subbasin. Group D soils have a very slow infiltration rate due to the presence of clay and are located primarily along the northern Subbasin boundary within the valley floor. More detailed soil survey data can be found in four USDA reports on various portions of the Subbasin: *Soil Survey of Kern County, California* (USDA, 1981, 1988, 2007, and 2009), including recent online updates.

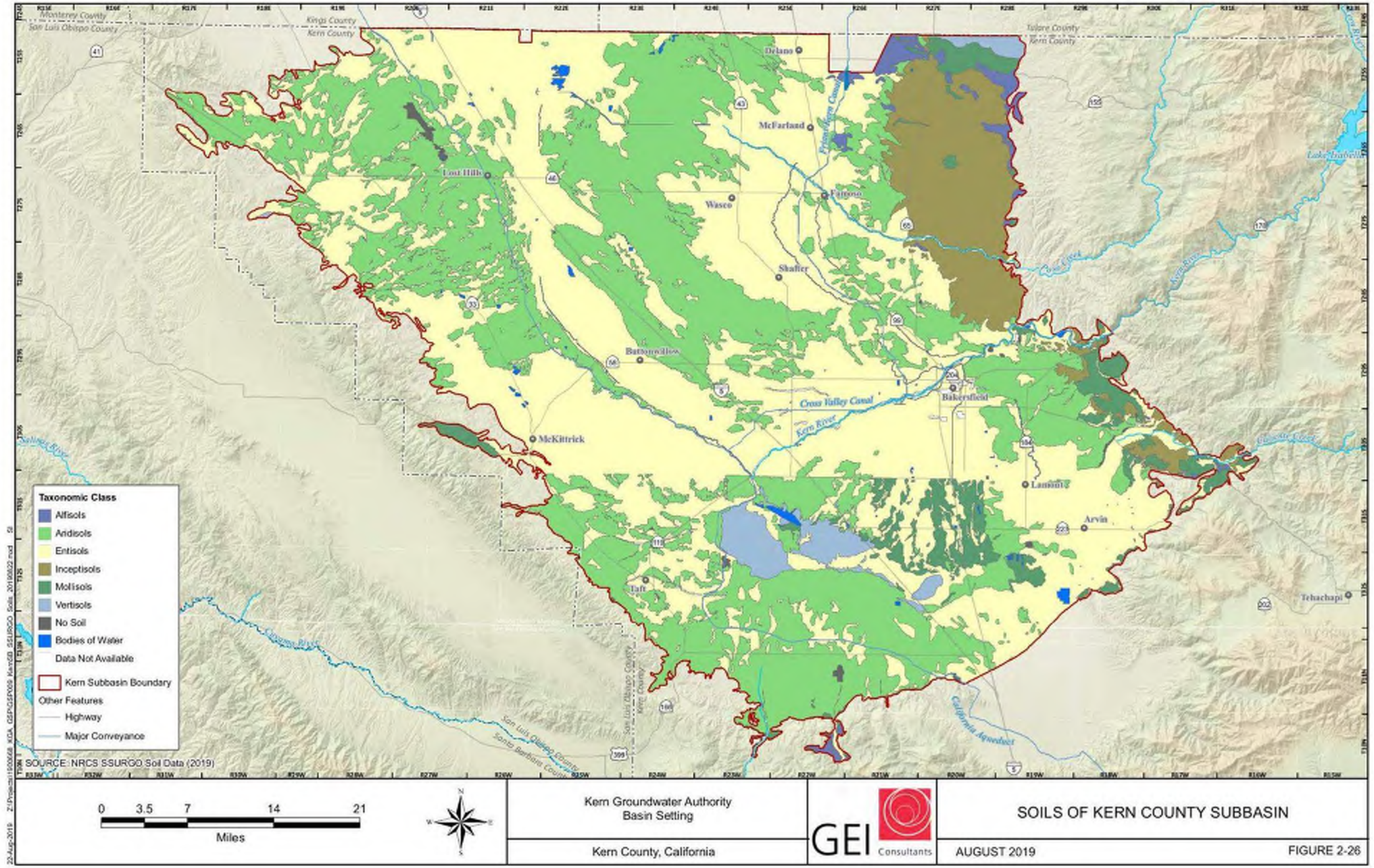


Figure 2-26. Soils of Kern County Subbasin

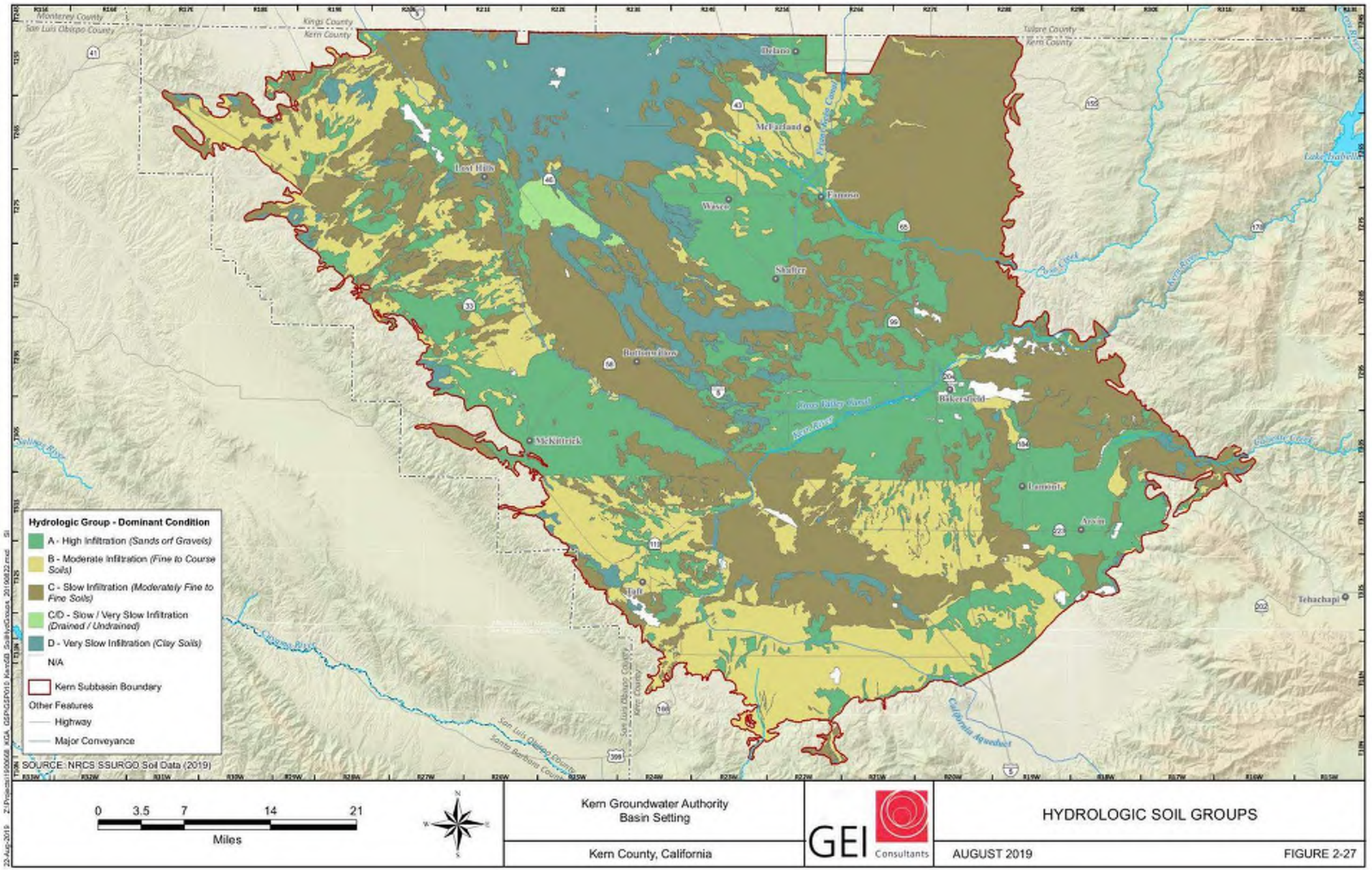


Figure 2-27. Hydrologic Soil Groups

2.2.1.9.4 Natural Recharge, Direct Recharge Areas, and Potential Recharge Areas

Direct recharge and potential recharge areas are differentiated in this section from natural recharge. Natural recharge occurs by groundwater underflow from adjacent sources, precipitation outgaining evapotranspiration in a Subbasin, or from natural surface waters flowing into the Subbasin. On the other hand, direct recharge is either planned or unplanned application of surface water by unlined conveyance, field application, managed recharge, and spreading operations. This section focuses mainly on direct recharge and potential recharge to the Subbasin, but briefly discusses natural recharge to the Subbasin. In-lieu recharge is not discussed in this section because it does not provide an actual input to the groundwater system for budgeting purposes, but only curtails or reduces the amount of groundwater that would have been pumped. In-lieu recharge is discussed in other sections of this GSP. This section may not include all localized recharge activities and facilities, but these local activities and facilities are further described within the individual management area plans.

Natural recharge to the Subbasin occurs mainly by underflow or surface recharge from the eastern and southern highlands (Sierra Nevada and Tehachapi Mountains). The surface water bodies as a source of recharge are discussed in the next section. In general, natural in-situ recharge by precipitation is absent in Subbasin, and may only occur in extreme wet years, because typically evapotranspiration outgains the amount of natural precipitation to the Subbasin (Provost and Pritchard et. al., 2015). The absence of natural recharge by in-situ precipitation in the Subbasin further illustrates the lack of recharge to the west side of the Subbasin where it is likely that very little if any freshwater underflow recharges the west side. In contrast, the east side is dominated by recharge from the Kern River and the Sierra Nevada.

Significant direct recharge to groundwater in the Subbasin occurs through managed recharge and water banking (storage) projects; as well as unmanaged recharge through natural waterways, unlined spill basins and regulating (balancing) reservoirs, percolation of applied water to crops that descend below the root zone, and unlined canals. Numerous sources of water are recharged by various projects, including local surface water (Kern River, Poso Creek, and other drainages) and imported water (State Water Project [SWP] and Central Valley Project [CVP]).

The major areas of direct recharge (facilities and drainages) are presented in Figure 2-28. Additional areas of unmanaged or managed recharge may include agricultural land where excess irrigation water percolates below the root zone, wastewater treatment spreading areas, and urban drainage spreading areas. Additional locations of natural recharge from surface water features may include springs, seeps, ephemeral/intermittent streams flowing into the Subbasin (Figure 2-29). The surface water features are described in more detail in the following section.

Since the late 1980s, large-scale groundwater recharge/banking operations have been constructed along the Kern River. Given the permeable nature of sediments within the Kern River Fan, most of the enhanced recharge projects involve surface spreading through ponds, low-lying fields, or basins. Some projects are dedicated to the replenishment of the groundwater basin, while other projects store surplus SWP and CVP water for subsequent extraction; and some banking projects do both. (Todd, 2017).

The Soil Agricultural Groundwater Banking Index (SAGBI), can further estimate groundwater recharge suitability to quantify recharge of deep percolated applied irrigation water and potential recharge from future managed recharge within the Subbasin. The California Soil Resource Lab at University of California Davis has developed an online application (https://casoilresource.lawr.ucdavis.edu/sagbi/) to present the SAGBI, which estimates groundwater recharge suitability based on five major factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. The application includes mapping coverage of the SAGBI and indicates a moderately good to excellent rating for the Poso Creek alluvial fan in the north central Subbasin, the Kern River alluvial fan in the central area, and in much of the southeastern to southwestern corners of the Subbasin. SAGBI ratings are moderately poor to very poor along the eastern margin, central western margin, as well as the center of the valley from the former Kern and Buena Vista lake beds, north along the Goose Neck Slough to the Tulare Lake Bed. While moderately good to good SAGBI is shown for much of the western margin, this area is underlain by marine sediments and is not likely to be a useful area for recharge. The SAGBI ratings generally agree with mapped soil data where higher rated SAGBI soil corresponds with moderate to high infiltration soils. Note that an abrupt east-west alignment of good versus poor SAGBI occurs in the southern central Subbasin and is likely due to the methods and results of historical soil surveys.

Groundwater discharge areas in the Subbasin are limited due to the depth of usable groundwater, typically greater than 100 feet throughout the Subbasin. Shallow, poor-quality groundwater (above the A-clay) does occur in the west central and southern areas. These shallow groundwater areas may support salt-tolerant vegetation. Effects of a shallow water table and evapotranspiration may discharge poor quality shallow groundwater from these areas to the surface. Historically, flowing wells were present throughout much of the valley floor (Mendenhall, 1916), including the Buena Vista and Kern lakes and the area to the north (>180 square mi), and from Buttonwillow north beyond the county line (>400 square mi). Over 100 flowing wells were identified in 1905 and reductions in flow were recognized in the following years. According to the USGS groundwater model (Faunt, 2009), the Kern River is a groundwater discharge area along a nominal 7-mile reach within Bakersfield, east of Highway 99; however, the City of Bakersfield measures flow at six weirs along the river across the valley and shows an overall loss of flow (seepage) from the Kern River.

2.2.1.9.5 Surface Water Bodies

Figure 2-29 presents the location of surface water bodies in the Subbasin according to the National Hydrography Dataset. These water bodies include the California Aqueduct (SWP) and federal Friant-Kern Canal, and other local canals that help convey Kern River water and imported surface water to beneficial users in the Subbasin. This dataset also includes the Kern River, Poso Creek, Caliente Creek, and other significant ephemeral streams, spring, and seeps, that are sources of recharge from the mountains on the east, southeast, and south sides of the Subbasin. The National Hydrography Dataset also includes wetlands delineations around the Kern Wildlife Refuge. The refuge is now sustained by imported surface water typically wheeled from the California Aqueduct and conveyed by the Goose Lake Canal to the refuge (USFS, 2005).

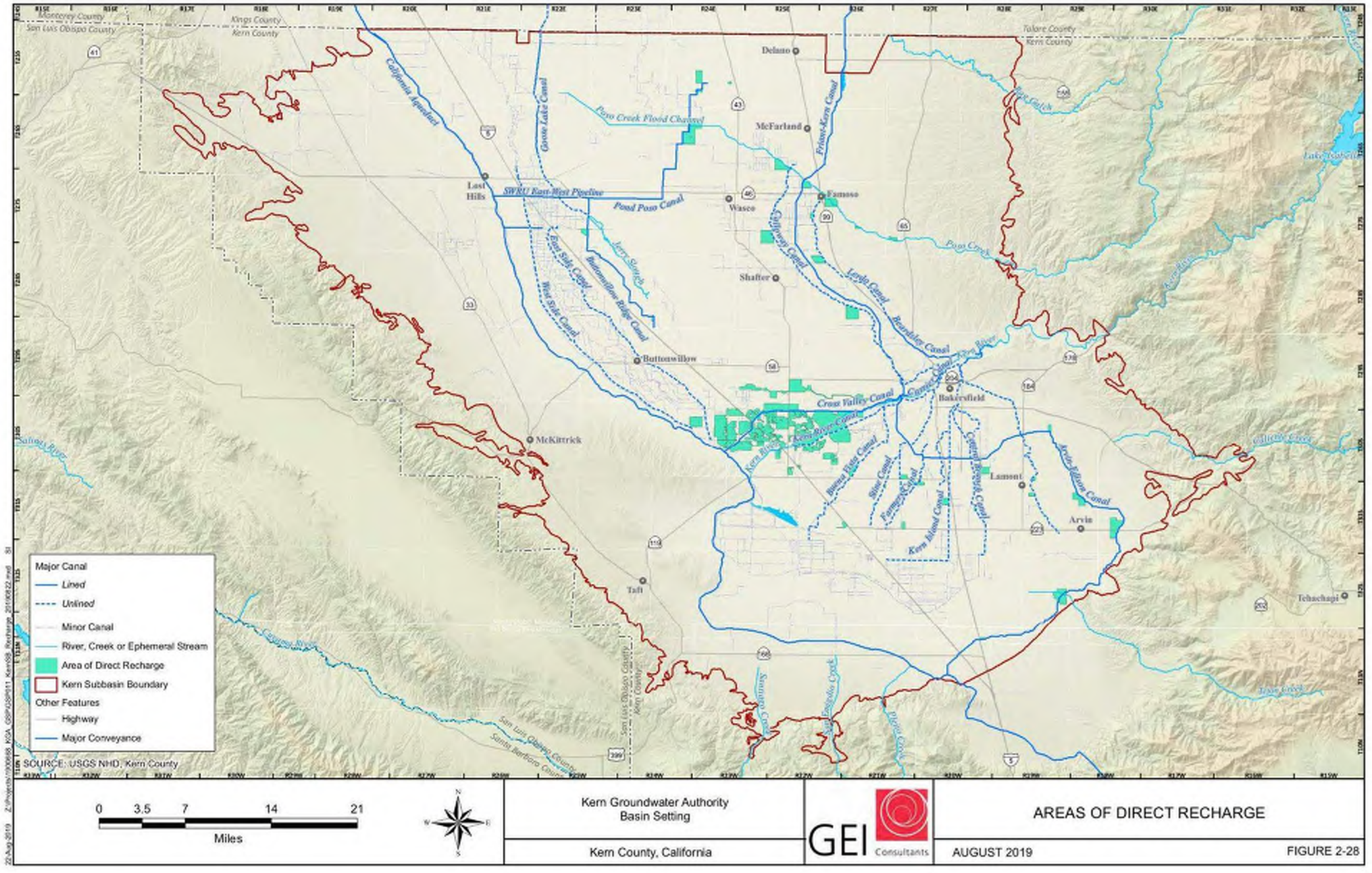
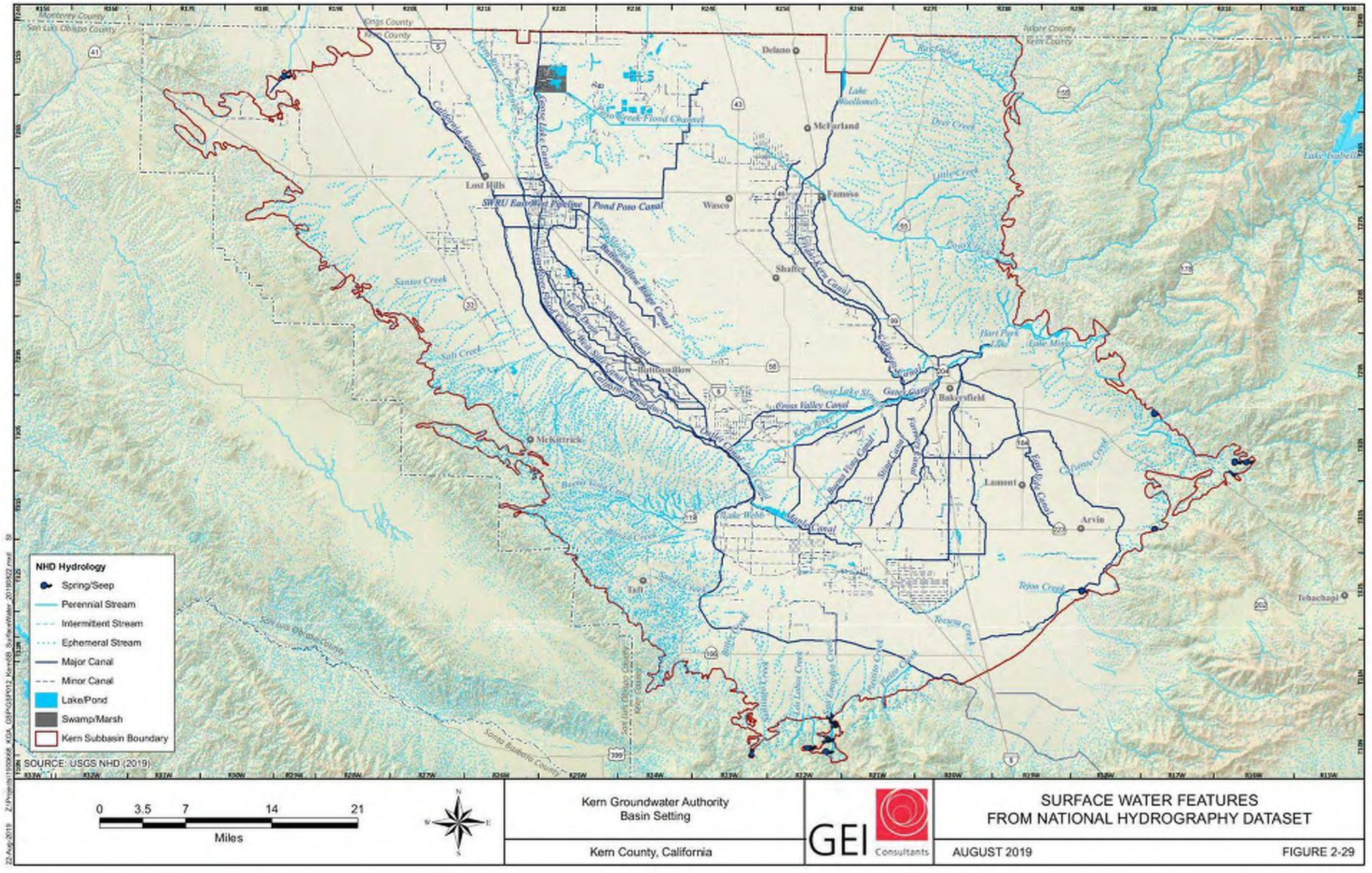


Figure 2-28. Areas of Direct Recharge


Monterey County
San Luis Obispo County
Kings County
Kern County
Tulare County
Kern County
Delano
McFarland
Famoso
Wasco
Shafter
Lost Hills
Bakersfield
Lamont
Arvin
Tehachapi
Taft
McKittrick
Buttonwillow
California Aqueduct
Pond Poso Canal
SWRU East/West Pipeline
Buena Vista Canal
Kern River
Kern River Flood Channel
Lake Woollomes
Lake Isabella
Santos Creek
Salt Creek
Caliente Creek
Tejon Creek
Tecuya Creek
Cottonwood Creek
Bitter Creek
Temblor Range
Sierra Nevada
Carrizo Plain
Elk Hills
Kern Front
Kern Island
Kern Lateral
Calloway Canal
Goose Lake Canal
Goose Lake Slough
Goose Valley Canal
Lerdo Canal
Lerdo Highline Canal
Kern Island Canal
Kern Island Canal
Kern Lateral Canal
Kern Water Bank Canal
Kern Water Bank Canal
Kern Water Bank

The most important source of naturally occurring surface water for the Subbasin is the Kern River, which has been regulated by the Isabella Dam and Reservoir since 1954. The dam and reservoir are operated by the U.S. Army Corps of Engineers and the distribution of water is administered by the Kern River Watermaster. The Kern River is approximately 164 miles long and is fed by rain and snowmelt from the Southern Sierra Nevada, including Mount Whitney. The last 35 to 40 miles of river crosses the Subbasin.

Local streams, many of which are ephemeral, provide additional local surface water during the wet season and during above normal and wet water years. A very small percentage of minor stream runoff is collected and used for irrigation; the majority of these irregularly occurring flows likely serve to recharge local groundwater basins (Kennedy and Jenks, 2011).

2.2.1.9.6 Source and Point of Delivery for Imported Water Supplies

Imported water is supplied by the Central Valley Project's (CVP) Friant-Kern Canal and California Department of Water Resources through the SWP. CVP water from the Friant Division is conveyed to users in the Subbasin through the Friant-Kern Canal, and SWP water is conveyed through the California Aqueduct together with CVP water from the Delta Division. Treated produced water is also used as an imported source of water to the groundwater Subbasin for beneficial use.

Central Valley Project – Friant Division

The CVP Friant-Kern Canal diverts water from Millerton Reservoir, created by Friant Dam on the San Joaquin River, and extends southward a distance of 152 miles through Fresno, Tulare and Kern counties to its terminus at the Kern River in Bakersfield. The capacity of Millerton Reservoir is about 520,000 AF, but 130,000 AF of this storage lies below the intake for the Friant-Kern Canal.

Water districts along the east side of the San Joaquin Valley entered into long-term water supply contracts with Reclamation, which provide for the delivery of three types of water; Class 1, Class 2, and Section 215.

Class 1 Water is the supply of water stored in or flowing through Millerton Lake which, subject to the contingencies described in the Contracts, will be available for delivery from Millerton Lake and the Friant-Kern and Madera Canals as a dependable water supply during each Contract Year.

Class 2 Water is the supply of water which can be made available subject to the contingencies described in the Contracts for delivery from Millerton Lake and the Friant-Kern and Madera Canals in addition to the supply of Class 1 Water. Because of its uncertainty as to availability and time of occurrence, such water will be undependable in character and will be furnished only if, as, and when it can be made available as determined by the Contracting Officer.

Section 215 Water is a temporary supply of water, other than Class 1 Water or Class 2 Water, made available to the Contractors in addition to water provided pursuant to water service contracts, including water made available that is not subject to acreage limitation pursuant to

Section 215 of the Reclamation Reform Act of October 12, 1982 (96 Stat. 1263), as amended. The historical allocation priorities for Section 215 Water are as follows:

- Long-term contractors
- Cross Valley contractors
- Other parties within the Friant Division service area with direct delivery capabilities
- CVP contractors outside of the Friant Division service area
- Other parties

Central Valley Project – Delta Division

In 1973, DWR completed the initial facilities of the SWP, including the main line of the California Aqueduct. Portions of the SWP were constructed for use in conjunction with the facilities of the CVP. As the state and federal projects developed, a group of water users planned the Cross-Valley Canal as a means of taking delivery of CVP water conveyed through the California Aqueduct. The Cross-Valley Canal was completed in 1975 and, in 1976, the water users entered into three-party contracts with DWR and Reclamation. Under these contracts, CVP water available to Reclamation in the Delta can be pumped by the SWP's Harvey O. Banks Pumping Plant into the California Aqueduct for delivery to the Tupman turnout where this water is diverted into the Cross-Valley Canal. This federal water, conveyance of which is subordinate to conveyance of SWP water, can then be delivered to water users in the Subbasin.

State Water Project

The Kern County Water Agency was formed in the 1960s to contract with the DWR for the importation of SWP water to Kern County. The California Aqueduct, the SWP's principal conveyance feature, transports water from the Delta along the west side of the San Joaquin Valley to the Subbasin. Individual water districts holding contracts with Kern County Water Agency have turnouts directly from the aqueduct into their service areas or receive water via the Cross-Valley Canal.

Two types of water are available from the SWP, including relatively firm Table A Water and surplus Article 21 Water. Table A Water takes its name from an exhibit to the contract between the DWR and the SWP contracting agencies that serves as the basis for allocating water among the agencies.

While the reliability of SWP water is less than was anticipated when the contracts were executed, a contract amendment, introduced in the Monterey Agreement of 1994, put agricultural and urban contractors on equal footing respecting the allocation of water supply during shortages. Prior to the amendment, agricultural contractors were burdened with a larger share of any shortages.

Article 21 Water, unlike Table A water, cannot be scheduled; rather, it must be taken at the time it is declared to be available and is analogous to Section 215 Water for the CVP-Friant contractors. The following conditions govern the availability of Article 21 Water:

- Available only when deliveries do not interfere with Table A allocations and SWP operations
- Available only when excess water is available in the Delta
- Available only when conveyance capacity is not being used for SWP purposes or scheduled SWP deliveries
- Cannot be stored within the SWP system. In other words, the contractors must be able to use the Article 21 water directly or store it in their own system

Due to these conditions, Article 21 Water is only available during the wet months of the year, typically December through March.

Produced Water

Water brought to the surface when oil is extracted is often referred to as "produced water." Produced water is groundwater that is commingled with hydrocarbons and located within the hydrocarbon bearing reservoir. Produced water is generated as oil is extracted for use. Often, produced water is returned to the original geological formation for enhanced oil recovery or disposal. Some produced water is suitable for beneficial use with treatment, though most is higher in salinity and must undergo extensive treatment and be blended with other water before use. New technology and the need to find new sources of water are driving the ability to process and treat produced water for beneficial use.

2.3 Groundwater Conditions

Annual groundwater elevation contour maps covering much of the Subbasin have historically been prepared by Kern County Water Agency in Water Supply Reports since before the 1990s until 2012. These maps provide seasonal high groundwater level conditions from spring water level data, and generally depict groundwater flow conditions over time consistent with flow directions observed in 2015. Groundwater conditions are also monitored through a number of local and joint district activities, as well as state mandated programs, such as CASGEM.

2.3.1 Groundwater Trends

Based on historical groundwater trends from USGS and the Kern County Water Agency (Page, 1986; and KCWA), groundwater flows into the Subbasin mostly from the uplands along the south and east margins of the Subbasin. Below is a generalized diagram depicting groundwater flow into the Subbasin (Figure 2-30). In the absence of pumping or significant barriers, groundwater naturally flows from high elevation points of recharge to lower elevation points with less recharge. In general, groundwater flow diverges to the north and south away from natural and managed recharge points along the Kern River. The river flows into Subbasin roughly along the axis of the Bakersfield Arch, which has a broad topographical rise that gradually dips to the north and south; thus, the rough alignment of the river effectively splits the Subbasin into northern and southern groundwater flow regimes. Groundwater to the south of the river flows toward discharge points at pumping wells within the south-central areas of the Subbasin, and groundwater to the north of the river migrates toward the northwest discharge points at pumping wells and continues north until it leaves the Subbasin as subsurface underflow.

Figure 2-30 presents the approximate location of the San Joaquin Valley (Buttonwillow) Syncline which likely affects the flow of westside groundwater from significantly impacting the main production zone of the Subbasin. In general, groundwater elevation trends near the river may be highly variable due to high volumes of managed groundwater recharge and extractions associated with groundwater banking projects. Groundwater elevation patterns further away from banking operations show more seasonal responses from pumping and recharge, and, an overall, long-term decline in groundwater level in the majority of the Subbasin.

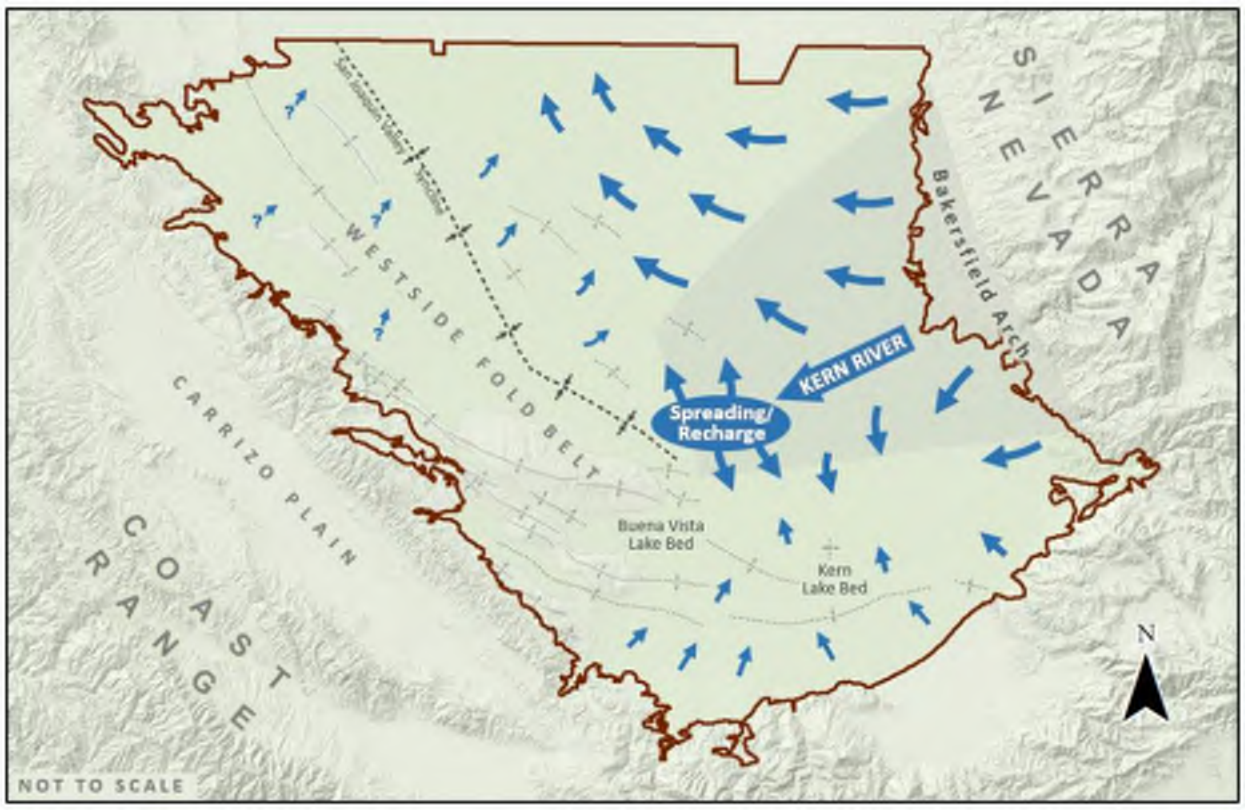


Figure 2-30. Generalized Diagram of Groundwater Flow in Kern County Subbasin

2.3.1.1 Elevation and Flow Directions

Groundwater elevation contour maps were prepared for Spring 2015 to provide relatively current groundwater flow trends across the Subbasin since the inception of SGMA. Contours were prepared for Spring 2015 (seasonal high) in the primary aquifer zone or "main production zone" which is generally confined below the E-clay or Corcoran and unconfined to semiconfined outside the extent of the E-clay (Figure 2-31). Contours for the "Upper Zone" by Schmidt and Associates (2018) are presented on Figure 2-32 for Spring 2015 data. They represent the upper unconfined to semiconfined zone (above the E-clay or equivalent) underlying the northwest-central part of the Subbasin. A Fall 2015 contour map was also developed to represent seasonal low groundwater conditions in the primary aquifer zone (Figure 2-33). At this time, there is insufficient data to contour a fall 2015 upper zone map. In addition, to production zones, depth contours developed by the Kern County Water Agency (2012) for the shallow unconfined zone (above the A-clay or equivalent) are presented on Figure 2-34.

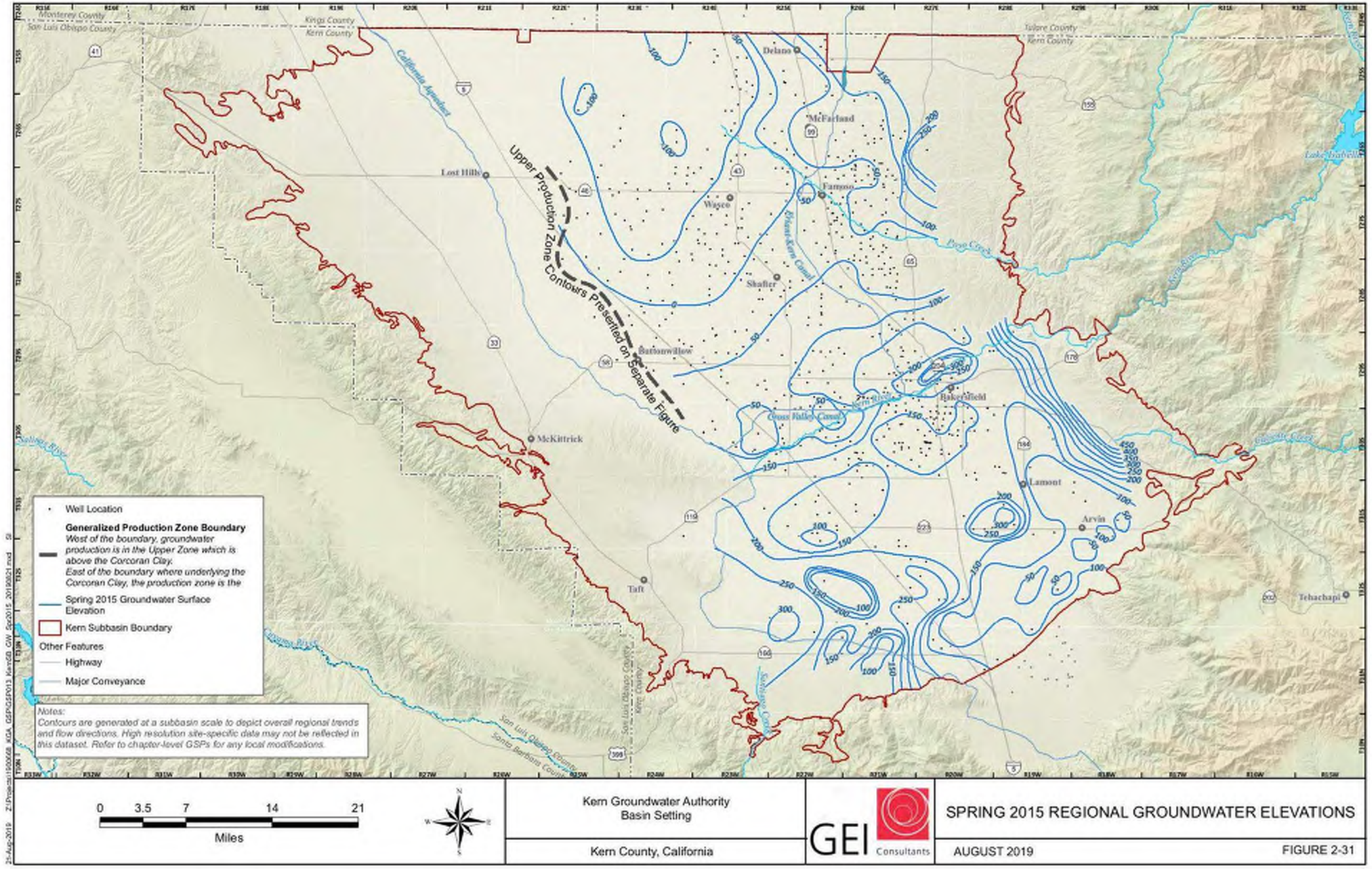


Figure 2-31. Spring 2015 Regional Groundwater Elevations

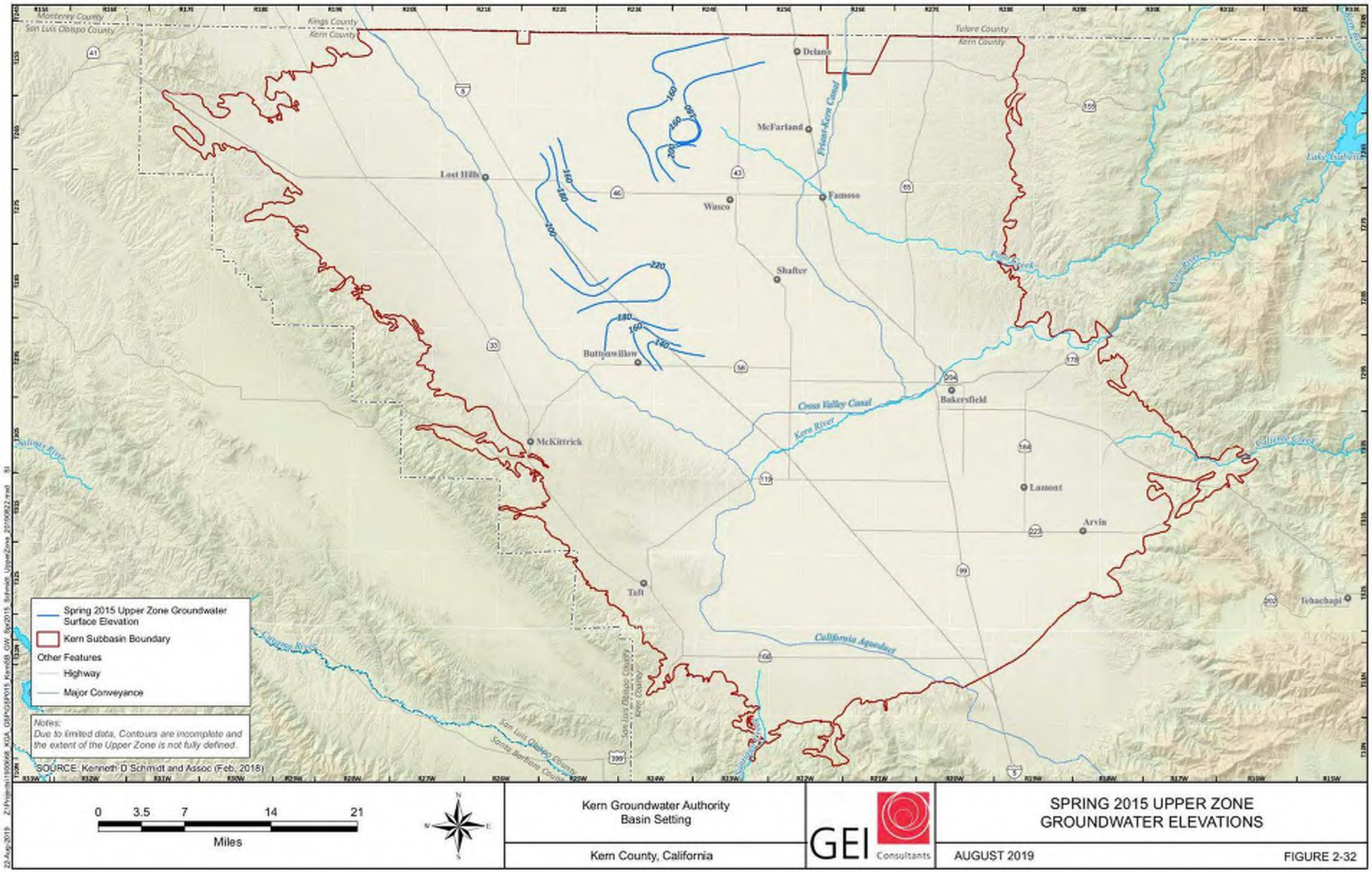


Figure 2-32. Spring 2015 Upper Zone Groundwater Elevations

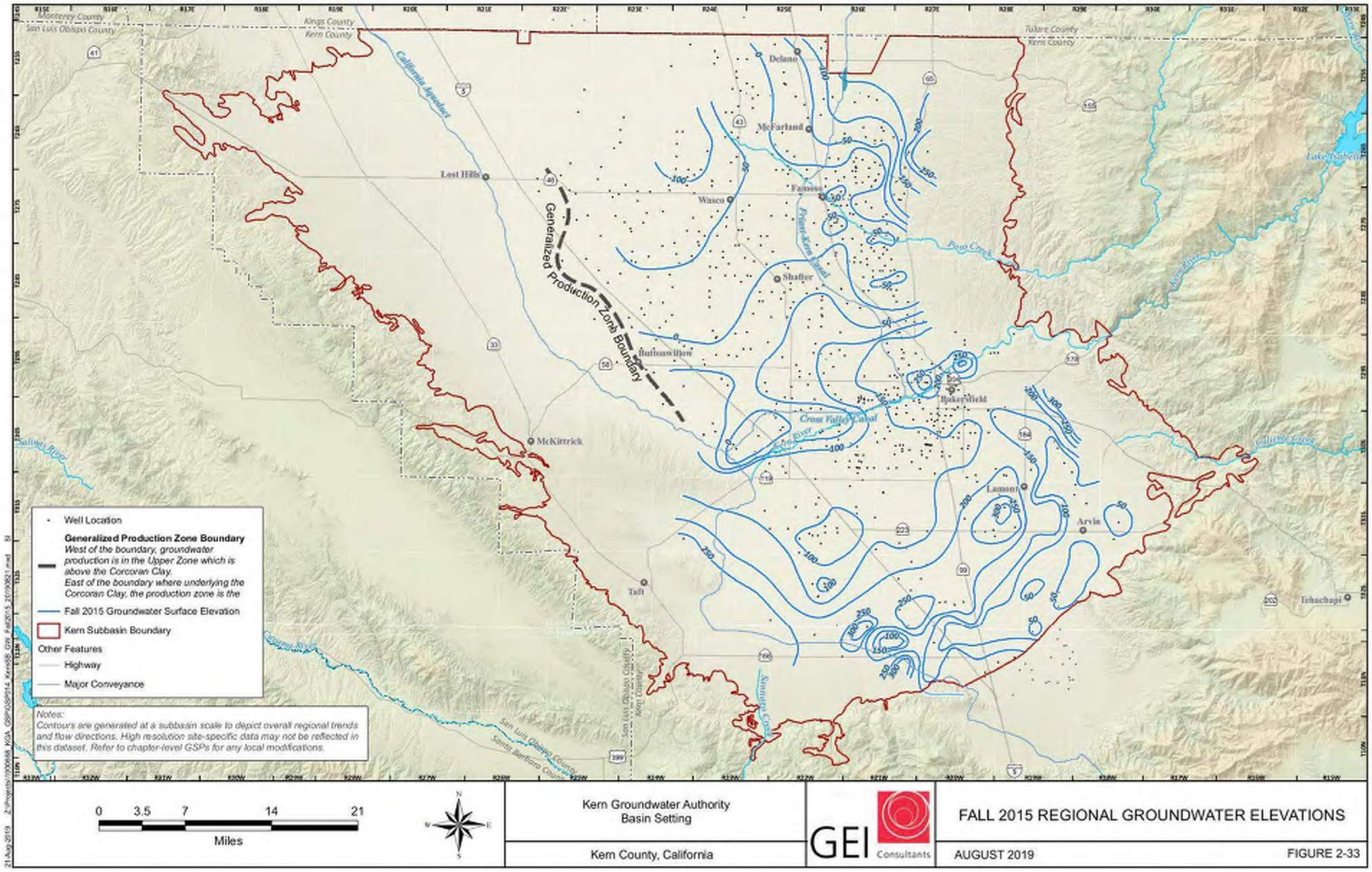


Figure 2-33. Fall 2015 Regional Groundwater Elevations

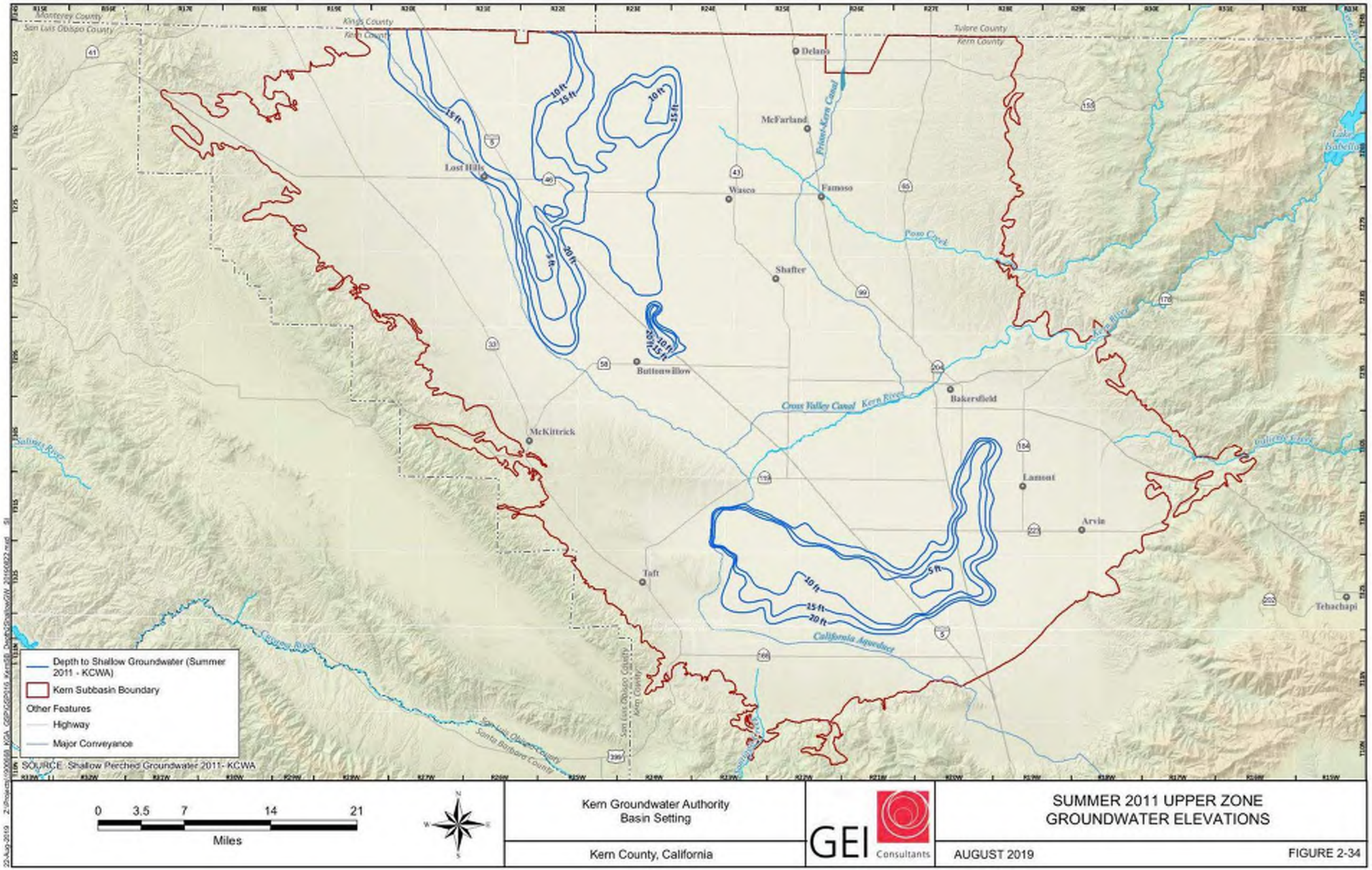


Figure 2-34. Summer 2011 Upper Zone Groundwater Elevations

These contours were developed from Summer 2011 and are generally representative of 2015 conditions. In general, shallow elevations are fairly constant over time.

2.3.1.1.1 Regional Contours

In general, groundwater flow directions reported are consistent with historical trends, with groundwater flowing from the uplands on the south, east, and west of the Subbasin toward the center of the Subbasin. Groundwater tends to diverge at the Kern River with flow to the south of the river toward pumping well discharge points, and flow to the northwest of the river toward pumping wells, and further north until it leaves the Subbasin. Based on 2015 groundwater elevations, the divergence to the North and to the South along the river is less notable due to the drought conditions which resulted in greater groundwater use with very little recharge during 2013 to 2015. Depressions in the groundwater potentiometric do occur south of the river; however, a general trend of flow toward the north and center "trough" of the Subbasin is apparent.

Groundwater elevations during Spring 2015 in the main production zone of the aquifer system ranged from less than minus 100 ft msl in the north-central part of the Subbasin to greater than 300 ft msl in the eastern and southeastern part of the Subbasin.

Groundwater elevation data for the Fall 2015 were limited in availability due to the high demand for pumping; therefore, the data range is incomplete, it may be affected by pumping, and it represents only a partial dataset; however, general groundwater flow trends are consistent with historical trends. Groundwater elevation data for the Fall 2015 in the main production zone of the aquifer system ranged from less than minus 150 ft msl (north-central Subbasin) to greater than 250 ft msl (south-southeast Subbasin). Contours in the upper unconfined zone of north-central Subbasin and shallow zone of Subbasin were not prepared for Fall 2015 due to a lack of sufficient data.

2.3.1.1.2 Upper Zone Contours

Groundwater elevations during Spring 2015 in the upper zone of the north central part of the Subbasin ranged from 220 ft msl to 160 ft msl. Within Townships 27S and the northern half of 28S, groundwater in the Upper Zone flows northeasterly. Within the southern half of Township 28S and 29S, groundwater flows southeasterly. Some of this flow may be affected by the Buttonwillow Syncline and Buttonwillow Ridge (anticline). As observed in Cross Section A-A' of North of the River (Figure 2-24a), beds from this groundwater aquifer system are deformed (folded).

2.3.1.1.3 Shallow Depth Contours

Groundwater depths in the shallow zone historically range from approximately 20 to 25 ft bgs to less than 5 ft bgs (ranging from 200 ft msl to 245 ft msl). Representative contour maps were chosen from the Kern County Water Agency's 2011 Water Supply Report (KCWA, 2012) (Figure 2-34), because more recent data from 2011 to 2015 are limited in extent; nonetheless, the recent data agree with DWR published maps of shallow perched groundwater in the San Joaquin Valley (DWR, 2009), and with the Kern County Water Agency's historical water supply reports.

Shallow groundwater is not significantly impacted by groundwater pumping in the production zone, as observed by the relatively consistent shallow groundwater depths and extents in historical water supply reports from the Kern County Water Agency and DWR across multiple water year types. The source of shallow groundwater as mapped by the Kern County Water Agency, is derived from the percolation of applied irrigation water, as well as historical natural percolation during large storm events. The extent of shallow groundwater, which is typically perched on shallow fine-grained sedimentary units and likely disconnected from the productive aquifer system, is relatively consistent with Page's (1986) extent of mapped surficial fine-grained flood deposits (Figure 2-17 and shallow clay units related to the "A" Clay of the Corcoran Clay (KCWA, 1976). During the mid to late 1980's, sufficient data were collected for the Kern County Water Agency's water supply report to show that, at times, the perched shallow groundwater units to the north of the river and to the south of the river have been joined at the northwest of the Kern River Fan, generally following the extent of flood plain deposits as mapped by Page (1986).

While shallow groundwater data is collected in certain regions of the Subbasin, the current data collection effort does not provide sufficient data to understand the interconnection between the lower production aquifer and the shallow purged groundwater system that existing in portions of the basin. This data gap will be addressed in projects and management actions identified in individual management area plans.

2.3.1.1.4 Horizontal Gradients

The following is a summary of general regional groundwater flow direction and general regional horizontal gradients based on the contour maps presented herein. For more detailed trends, refer to management area plans.

Groundwater in Spring 2015 for the main production zone (confined below the E-clay and semi-confined outside of the clay) in the east-northeast flows southwesterly at a gradient of 0.011 ft/ft. In the north-central area, groundwater flows northwesterly at a gradient of 0.002 ft/ft. In the central area of the Subbasin near the Kern River and banking activities, groundwater flows north to northwesterly at a gradient of 0.002 to 0.004 ft/ft. In the southeast, groundwater flows southwesterly at a gradient of 0.025 ft/ft. In the south, groundwater flows northwesterly to southeasterly at gradients of 0.004-0.012 ft/ft and 0.004 ft/ft respectively. In the southwest, groundwater flows northeasterly at a gradient of 0.001 ft/ft. Groundwater in the Bakersfield area flows away from the river from 0.005 to 0.011 ft/ft in a southeasterly to northwesterly gradient.

Groundwater in Fall 2015 for the main production zone (confined below the E-clay and semi-confined outside of the clay) in the east-northeast flows west to southwesterly at a gradient of 0.015 ft/ft. In the north-central area, groundwater flows northwesterly at a gradient of 0.002 ft/ft. In the central area of the Subbasin near the Kern River groundwater flows toward the banking activities northeasterly and southwesterly at gradients of 0.006 ft/ft and 0.003 ft/ft respectively. In the southeast, groundwater flows southwesterly at a gradient of 0.016 ft/ft. In the south, groundwater flows northwesterly to southeasterly at gradients of 0.007 ft/ft and 0.008 ft/ft respectively. In the southwest, groundwater flows northwesterly at a gradient of 0.005 ft/ft.

Groundwater in Spring 2015 for the upper unconfined zone (unconfined above the E-clay) in the north half of Township 28S and 27S flows northeasterly at a gradient of 0.002 ft/ft. In the south half of T28S and T29S, groundwater flows southeasterly at a gradient of 0.003 ft/ft. In the far north mapped area of the upper unconfined zone, groundwater flows at a gradient of 0.001 ft/ft northwesterly and 0.004 ft/ft westerly.

2.3.1.2 Hydrographs and Vertical Gradients

Hydrographs presenting change in groundwater elevation over time and vertical groundwater gradients for specific areas of the Subbasin are provided in the chapters herein for local management areas. In general, hydrographs presented in the management area plans indicate that groundwater elevations decline during below normal water years (as defined by the water year index), and groundwater elevations begin recovering during above normal water years. Additional information can be found Section 2.4, Water Budget Information.

2.3.2 Seawater Intrusion

The Subbasin is located in the Central Valley, more than 40 miles from the Pacific Ocean. Seawater intrusion will not affect the Subbasin.

2.3.3 Groundwater Quality

To characterize groundwater quality in the Subbasin, a literature review was conducted using USGS studies and other technical reports, as well as data extracted from GeoTracker and EnviroStor to identify contaminant plumes. The SWRCB's Human Right to Water portal was used to identify contaminants that are commonly violating drinking water standards and an evaluation of the groundwater water quality was conducted using data from local Water Districts and the State Drinking Water Information System (SDWIS), which collects sample results from all State regulated public water systems. This section of the report provides a brief introduction to the contaminants most commonly found in the Subbasin. A more focused evaluation of the groundwater is provided in the management area plans for each member agency that comprises the KGA.

Characterization of groundwater quality was conducted to comply with (California Code of Regulations – Title 23 – Waters; Subarticle 2 §354.16(d) – Groundwater Conditions: groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes. Constituents evaluated and the methodology used were consistent with guidance provided in:

- Assembly Bill 1249 (AB 1249) which states that "if the IRWM region has areas of nitrate, arsenic, perchlorate, or hexavalent chromium contamination, the (IRWM) Plan must include a description of location, extent, and impacts of the contamination; actions undertaken to address the contamination, and a description of any additional actions needed to address the contamination" (Water Code §10541.(e)(14)).

- Division of Drinking Water's (DDW) Human Right to Water (HR2W) portal, which identifies the contaminants that public water systems have received maximum contaminant level (MCL) violations. Commonly found contaminants were trended and occurrence data was evaluated.
- Water Quality Control Plan for Tulare Lake Basin (Basin Plan), dated May 2018, which is the State Board's implementation plan for Water Code §106.3. The amended Basin Plan requires permittees to "address the immediate needs of those drinking groundwater that exceeds the drinking water standard for nitrate."

Incorporating guidance from these sources was intended to incorporate the major constituents of concern and characterize groundwater in a manner that is consistent with current water quality focused programs. Of the regulated drinking water constituents considered, the most common water quality issues within the Subbasin are: nitrate, arsenic, boron, hexavalent chromium, dibromochloropropane (DBCP), 1,2,3-trichloropropane (TCP), total dissolved solids (TDS), sodium, and chloride. This water quality discussion is divided by constituent to explain the drinking water and agricultural standards and how these constituents' impact beneficial uses in the different regions of the Subbasin. Since the predominant land use in the Subbasin is for agricultural purposes, agricultural Water Quality Goals (as established by Ayers and Westcott) are referenced for evaluation of groundwater salinity (SWRCB, 2016a). The most applicable standard, Drinking Water Standard or agricultural goals will be used as a reference point when discussing each constituent.

Maps created to show constituent prevalence were developed using data extracted from the Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System. Only wells from the Public Water System dataset were used because they provide more consistent results since compliance monitoring frequency is regulated by DDW. To depict the highest contaminant values, the maximum concentrations were plotted, rather than average concentrations, from each public water system spanning a 10-year timeframe (2009-2019). These maps are intended to provide a general overview of constituent prevalence and concentrations. They should not be interpreted as indicating contamination throughout the region because constituent concentrations typically vary depending on well construction and local hydrogeologic conditions. More detailed analysis of water quality trends is discussed in the individual management area plans.

2.3.3.1 Arsenic

Arsenic has a primary drinking water MCL of 10 parts per billion (ppb) and an agricultural goal of 100 ppb. Reports published by the Department of Pesticide Regulation and USGS studies and the hydrogeology of the Subbasin indicate that the major source of arsenic in this Subbasin is naturally occurring from erosion of natural deposits. Throughout the southern San Joaquin Valley, arsenic-rich minerals such as arsenopyrite, a common constituent of shales and apatite, and phosphorites are the most common sources of arsenic leaching materials in the aquifer (Burton et al, 2012). In the Subbasin, these minerals are mostly found in lake bed deposits or the

Corcoran Clay. USGS reports that most of the highest arsenic detections are near the City of Delano and at the southwest extents of the Kern Fan, near the City of Bakersfield.

Since arsenic is mostly derived from natural geochemical processes, elevated concentrations are localized and appear to be associated with lake bed areas where there are thick clay deposits: Tulare Lake, Kern Lake, and Buena Vista Lake (Bulletin 118, DWR). In the Subbasin, consistently high concentrations generally concentrate in the center of the valley along the north margin of Buena Vista lake bed. Data trending indicates that its predominately found in wells constructed deeper than 1,000 feet below ground surface (bgs). Trending of the public water system wells in the Kern Fan indicates elevated arsenic is consistently found in wells constructed deeper than 650 feet bgs, and when groundwater elevations decline. A study conducted by USGS reports that arsenic is the trace element most frequently present at high concentrations in the Subbasin. Concentrations found in nearly 1,400 samples ranged from 10 to 30 ppb (Burton et al, 2012).

Severe drought conditions from 2012 through 2016 resulted in groundwater levels significantly declining throughout Kern County; subsequently, wells located in the Kern Fan are showing higher concentrations of arsenic from the deeper aquifers into the pumping zone due to the proportion of water from the deeper screened intervals increasing. Consequently, higher concentrations of arsenic have been observed in municipal wells. As groundwater levels temporarily recovered in 2017, there was a noticeable correlation to lower arsenic concentrations.

Findings from a study conducted by Negrini et. al (2008) explain that the thickest part of the coarsening-upward unit in the Kern Fan is in the same region as the wells with elevated arsenic concentrations. The study identified a large-scale sedimentary sequence (a specific geologic sequence) that was primarily prevalent in most of the wells in this study area. This sequence unit consists mostly of uniformly fine-grained silts and clays and the unit abruptly thickens basin-wide. The thickest part of this unit was found to have groundwater arsenic concentrations above 50 ppb. Depth interval containing sediments from this unit generally coincide with intervals having elevated arsenic concentrations. It was also found that at the same depth interval, arsenic is in an easily exchangeable state in the bulk sediment where oxidizing geochemical conditions dissolve the pyrite and release arsenic into the groundwater.

In addition to the lake bed areas, there is common arsenic detections associated with the Corcoran Clay. Mineral deposits transported by rivers into the San Joaquin Valley, from the Sierra Nevada and the coastal mountain ranges, became enriched with arsenic mineral deposits then adsorbed on the clay surfaces that were buried over time. When the oxygen deprived mineral deposits come into contact with oxygenated water, the result is dissolution of arsenic within the clay pore and into the groundwater. These deposits typically begin at depths greater than 180 feet bgs. Occurrence of arsenic in groundwater and any associations to the Corcoran Clay are addressed at the management area plans water quality sections.

2.3.3.2 Nitrate

Nitrate as nitrogen has an acute drinking water MCL of 10 parts per million (ppm); there is no agricultural goal. Sources of nitrate contamination in groundwater are runoff and leaching from fertilizer use; leaching from septic systems and sewage; confined animal facilities; and very small concentrations from erosion of natural deposits. Typically wells in the San Joaquin Valley have higher nitrate concentrations in the shallower zones. However, higher nitrate concentrations can also occur in deep wells, depending on source concentrations, lithology, and well construction. Dubrovsky et al (2010) considers background nitrate concentrations above 1 ppm to indicate human activity.

Although the agricultural industry is believed to be a primary contributor to nitrate contamination of the groundwater basins in the Central Valley, based on mass loading calculations, irrigation practices in this Subbasin have been improved to reduce nitrate leaching into groundwater. In a study conducted for the Kern River Watershed Coalition Authority (KRWCA, 2013), it is acknowledged that nitrate leaching from agricultural irrigation is not like other basins to the north because irrigation practices are more efficient here, which reduced nitrate leaching into the groundwater. This assessment is supported by a comparison of the Nitrate Hazard Index results from 1990 and 2012, which shows a significant reduction in nitrate risk to groundwater.

KRWCA is leading the Irrigated Lands Regulatory Program (ILRP) for the Subbasin and have provided results from the initial groundwater sampling that took place in fall of 2018 (KRWCA, 2019). Their groundwater trend monitoring program requires nitrate sampling of first encounter groundwater during spring and fall each year. Trends are not ascertained yet since fall of 2018 was the first year of monitoring and these are the only results that are publicly available. Of the 26 representative wells sampled (14 domestic and 12 irrigation), nitrate results ranged from 1.1 to 21 parts per million (ppm) with a median value of 9.9 ppm. Nine of the wells sampled exceed 10 ppm: of these, seven wells are domestic and two are used for irrigation. Nitrate concentrations of these wells is included in Figure 2-35, although they are not specifically labeled as first encounter groundwater wells.

In addition to studies evaluating agricultural impacts of nitrate contamination, studies investigating the correlation of other potential nitrate sources were also reviewed. Dubrovsky et al (2010) finds that domestic wells located in agricultural areas are not only influenced by irrigation practices and/or livestock as a potential nitrate source, but also from septic systems. A USGS study (Burton et al, 2012) was conducted in the Southeast San Joaquin Valley and the Kern County Subbasin. This study used statistical analysis of land uses, well construction data, water quality parameters and number of septic systems around each study well to determine that land uses fairly represent nitrate sources impacting the well. Some of the data obtained for the Burton et. al, (2012) study were from the State Water Board's GAMA Domestic Well Project, where wells were sampled in 2006 (Shelton, 2006). The Project analyzed 29 of the 181 domestic study wells in the Kaweah Subbasin study area, for stable isotopes of nitrogen and oxygen. Wells with higher nitrate concentrations (median of 5 ppm and mean of 11 ppm) were targeted for this study. Testing showed that 28 of the 29 impacted wells have nitrate characteristics consistent

with a dairy manure or septic system source. Septic systems elevate groundwater nitrate concentrations since they only remove half of the nitrogen in the wastewater, leaving the remaining half to percolate to groundwater (McCalasand, 2019). One of the 29 wells showed an isotopic composition indicative of a synthetic fertilizer. While the isotopic composition of nitrate varies with land use, it is consistent between nitrate source (soil, fertilizer, manure, septic or community wastewater). Private well sampling for stable isotopes of nitrate was not conducted in the Kern County Subbasin.

Kern County Environmental Health Department (EHD) updated their program and ordinance with the development of the County's Local Agency Management Program (LAMP) to comply with the State Water Board's policy on septic systems (SWRCB, 2012). This was adopted to allow local agencies to continue use of septic systems, while protecting water quality and public health. An analysis was conducted to estimate baseline septic systems in Kern County. Four basic elements used in their analysis were parcel development status; general soil/septic systems suitability mapping; hydrologic areas; and groundwater basins. Since it was assumed that incorporated areas have municipal sewer systems that either serve or are available to these parcels, only non-sewerage unincorporated areas of the County were included in the analysis. This study revealed that approximately 30 percent of developed parcels within the Subbasin rely on septic systems. KGA is working with Kern County to document the location of these septic systems. A partial list of system recently inspected was provided and is shown in Figure 2-35.

Prior to the State's policy, EHD has been collecting water quality data on newly drilled wells to gain an understanding of groundwater quality. Initial assessment showed about eight percent of the wells tested are above the nitrate MCL; data from 1998 through 2019 are included in Figure 2-35. While there is currently a data gap, it is anticipated that continued work with Kern County and through the implementation of their LAMP that the domestic well water quality data and location of septic systems will be available to KGA. Although not all septic system location data is available at the time of this evaluation, it is noted areas with septic systems and domestic wells, generally show elevated nitrate concentrations.

Studies conducted by UC Davis, Center for Watershed Sciences have evaluated nitrate sources in the Tulare Lake Basin and documented that on a regional scale, groundwater nitrogen loading from sewer collection system leaks and septic systems is negligible compared to fertilizers. However, when looking at a local level, septic systems can be a significant source of nitrate contamination to domestic wells in peri-urban areas surrounding cities, or in areas of relatively high rural household density (Viers et. al, 2012). Findings also indicate that disadvantaged communities with water quality issues are in these same areas. Septic systems are considered low-hanging fruit (Dzurella et al, 2012), but is an important issue to address due to its impact to localized drinking water sources.

This Page is Intentionally Blank

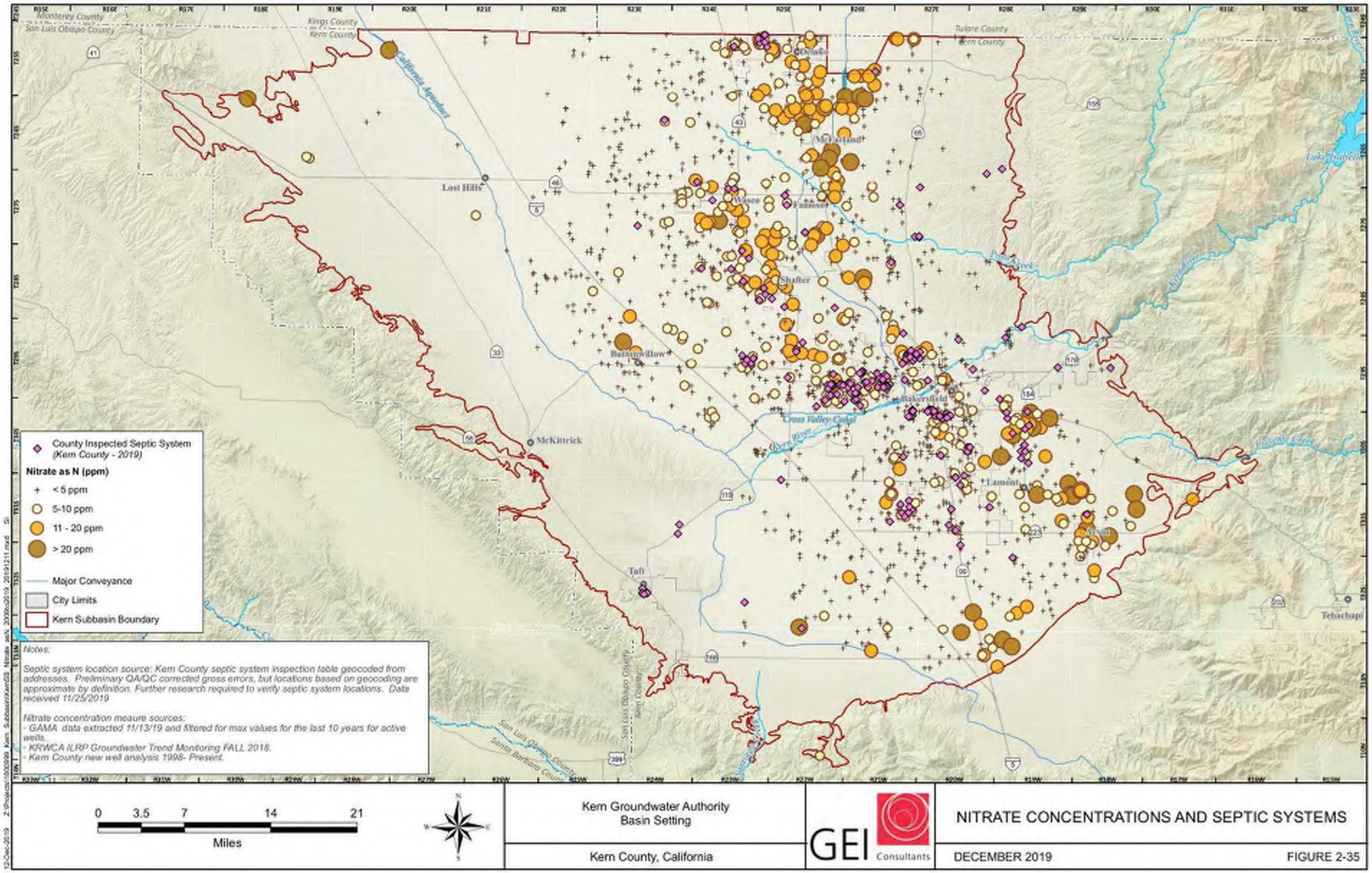


Figure 2-35. Nitrate Concentrations and Septic Systems

This Page is Intentionally Blank

Data gaps often identified in these studies include lack of localized data such as location of septic systems, proximity of domestic wells to septic systems, and water quality of unregulated domestic wells. Reports such as Viers et al, (2012) and the initial assessment for the LAMP report have acknowledged these data gaps. To better assess nitrate sources, future monitoring programs should be geared towards better data collection methods to conduct a more comprehensive evaluation on septic system impacts to groundwater. Additionally, nitrate issues need to be evaluated on a local level rather than regional approach, especially when looking at the impacts to human health and consumption of water from unregulated domestic wells.

2.3.3.3 Boron

There is no federal or state MCL for boron. However, California does have a Notification Level of 1,000 ppb, and there is an agricultural goal of 700 ppb. The agricultural goal is set to protect various agricultural uses of water, including irrigation of various types of crops and stock watering. These levels are used as a baseline to compare against and are not intended to represent an acceptable maximum value for the Subbasin. Since most of the land use in the Subbasin is irrigated lands, the agricultural goal for boron is used as a reference point, rather than the drinking water Notification Level. The most prevalent sources of boron in drinking water are from leaching of rocks and soils, wastewater, and fertilizer/pesticides applications.

According to the USGS Scientific Investigations Report 2011-5218 (Burton et al, 2012) boron is most commonly found in the southern part of the Subbasin near the Tehachapi Mountains. Even though the USGS study for boron was limited to the southern part of the Subbasin, it was concluded that elevated concentrations of boron may be naturally occurring. Boron is potentially associated with sediments in the aquifer derived from marine deposits that are naturally high in boron from the Coast Ranges and San Emigdio Mountains. Saline waters have also been found to contain relatively high concentrations of boron, groundwater that underlies the freshwater aquifer could contribute high boron concentrations in deep wells.

2.3.3.4 Hexavalent Chromium

There is no federal MCL for hexavalent chromium. In July 2014, California adopted a primary MCL of 10 ppb, which was invalidated as of September 2017. While DDW is repeating the regulatory process for adopting a new MCL, the federal MCL of 50 ppb for total chromium applies. There is no agricultural goal for hexavalent chromium.

Hexavalent chromium can come from anthropogenic and natural sources. Anthropogenic sources include discharges of dye and paint pigments, wood preservatives, chrome-plating liquid wastes, and leaching from hazardous waste sites into the environment. Naturally occurring chromium is a metal found in ore deposits containing other elements, mostly as chrome-iron ore. Chromium is also prevalent in soil and plants: the phenomenon of releasing chromium into groundwater is believed to be similar geochemical processes to arsenic. Generally, natural chromium in the environment occurs as trivalent chromium (Cr3) then is oxidized to a hexavalent state (Cr6+). This typically occurs in oxidizing conditions such as alkaline pH range (between 8 and 14 units)

or in the presence of manganese dioxide; in these conditions, naturally occurring hexavalent chromium is likely to exist.

The presence of manganese oxide minerals within ultramafic and serpentinite derived soils and/or sediments can trigger the oxidation of chromium, leading to the presence of naturally occurring hexavalent chromium in the aquifers (SWRCB, 2017; Groundwater Information Sheet 2017). While studies have not been conducted on the types of soils and sediments in the Subbasin where hexavalent chromium is present, the relatively low concentrations (typically in the range of 5 – 13 ppb) indicate the source is naturally occurring (GAMA). Additionally, GeoTracker and EnviroStor databases were searched for open contamination cleanup sites and do not identify any point source contamination in the Subbasin.

2.3.3.5 Synthetic Organic Chemicals

Synthetic organic chemicals predominately found in the Subbasin are dibromo-3-chloropropane (DBCP) and 1,2,3-trichloropropane (TCP). Both chemicals have very low drinking water MCLs. There are no agricultural goals. DBCP has a primary MCL of 0.2 ppb; sources of contamination are a banned nematicide that is still present in soils and groundwater due to runoff or leaching from former use on soybeans, cotton, vineyards, tomatoes, and tree fruit. Since its use was banned in 1977, groundwater contaminant concentrations in municipal wells have shown either steady or decreasing trends. In 2008 the Department of Public Health (transferred to State Water Board as DDW in July 2014) estimated the median half-life of DBCP in the Central Valley is 20 years. This is consistent with the public well data that has been evaluated for this Subbasin.

TCP has a primary MCL of 5 parts per trillion (ppt), which became effective in January 2018 and requires all active drinking water sources are tested at least quarterly during 2018. Since the MCL is set at the detection limit, any well with a detection is identified as exceeding the standard. According to the Water Boards Q1 Report, there is a clear correlation between the location of the of drinking water sources contaminated with TCP and agricultural activities (State Water Resources Control Board, TCP Sampling in Q1 2018).

In the past, TCP was present as an impurity in certain soil fumigants (1,3-D soil fumigants) used to kill nematodes. TCP also has some limited industrial uses. Throughout the Central Valley, most of the TCP found in groundwater was introduced through agricultural application of soil fumigants sold under the trade names of D-D and Telone. In the mid-1970s, Telone was reformulated and the name changed to Telone II. D-D was discontinued in 1984. Telone II remains on the market today but no longer contains TCP. Because TCP was an impurity in these soil fumigants, the potential groundwater contamination was not disclosed to distributors or users, by the product manufacturers. Application rates were not tracked, making it difficult to determine where groundwater contamination is likely to occur. TCP is a highly stable compound, meaning that it is resistant to degradation and has a half-life of hundreds of years (Samin et. al. 2012).

Many large public water systems (serving more than 10,000 population) began sampling their wells for TCP using a low-level analytical method around 2003, as a requirement of the Unregulated Chemical Monitoring Rule. From this data, DDW determined that the most

impacted counties are Kern, Fresno, Tulare, Merced, and Los Angeles. Since a primary MCL was adopted, all water systems were required to test their wells quarterly beginning January 2018. Occurrence data from the State Water Board's DDW shows 94 of California's public water systems have 562 TCP impacted wells (DDW, June 2016). In Kern County, 18 water systems have 124 impacted wells, or approximately 52 percent of their total wells (State Water Board, June 2016).

Figure 2-36 provides a graphical representation of TCP concentrations for the public water system wells within the Subbasin (data extracted on April 29, 2019). To simplify the figure, only the maximum concentrations from January 2018 to April 2019 are shown. Results from the initial compliance monitoring indicates that increased testing requirements directly increased the prevalence of TCP impacted wells in the Subbasin.

the maximum concentrations from January 2018 to April 2019 are shown. Results from the initial compliance monitoring indicates that increased testing requirements directly increased the prevalence of TCP impacted wells in the Subbasin.

2.3.3.6 Total Dissolved Solids (TDS), Sodium and Chloride

Based on drinking water standards, the recommended secondary maximum contaminant level (SMCL) of total dissolved solids is 500 parts per million with an upper limit of 1,000 ppm and chloride is 250 ppm with an upper limit of 500 ppm. There is no drinking water standard for sodium; however, Water Quality Goals for Agriculture, published by the Food and Agriculture Organization of the United Nations in 1985, has set agricultural goals for TDS, sodium, and chloride at 450 ppm, 69 ppm, and 106 ppm, respectively. The criteria identified are protective of various agricultural uses of water, including irrigation of various types of crops and stock watering. These levels are used as a baseline to compare against and are not intended to represent an acceptable maximum value for the Subbasin. Since a majority of the land use in the Subbasin is irrigated lands, the agricultural goals for TDS, sodium, and chloride are used for this portion of the water quality evaluation.

The Burton et. al (2012) report states that in general the higher concentrations of TDS may be affected by sediments from the Tehachapi and San Emigdio Mountains and the Coast Ranges which contain marine deposits. Report findings showed positive correlations between agricultural land use and TDS levels but concluded that higher concentrations of TDS in the Subbasin may primarily be from natural sources as well as human activities. The same findings were true for chloride concentrations.

In a preliminary groundwater salinity mapping study conducted by USGS Scientific Investigations (Report 2018-5082, Metzger and Landon, 2018), groundwater salinity related to the distribution of 31 oil fields and adjacent aquifers was mapped across major oil-producing areas of central and southern California. The objective of this mapping study was to define groundwater with TDS concentrations less than 10,000 ppm using data from petroleum and groundwater wells, and to document data gaps. The study concluded that there is no hydrogeological connection between oil wells and water wells in the mapped regions. This conclusion is based on salinity mapping and well construction: the top perforation of the oil

wells is deeper than the bottom perforation of water wells, except for oil fields in the north eastern part of Kern County. Well perforations in the north eastern part showed little to no vertical separation. Additionally, the study found that the west side of the San Joaquin Valley (in in Kern County) generally has the highest TDS levels at the shallowest depths.

Salinity defined in the chapters of this report are sometimes general, referring to TDS levels, or may be more specific to address the ions of concern based on predominant land uses. TDS is comprised of several dissolved minerals (calcium, phosphates, nitrates, sodium, potassium, and chloride), most of which have minimal impact on beneficial uses of the groundwater. Throughout the Subbasin, sources of salinity identified include a combination of naturally occurring marine deposits; infiltration from produced water disposal ponds; perched water subject to evaporative pumping; or agricultural drainage ponds.

Sodium and chloride ions contribute to TDS and in this region are more important to evaluate due to its impact to the agricultural industry. Both sodium and chloride show similar trends in the wells evaluated; therefore, some sections of the water quality evaluation collectively refer to these ions as salinity. There is slightly more focus on sodium since it is an important measurement to crop yield.

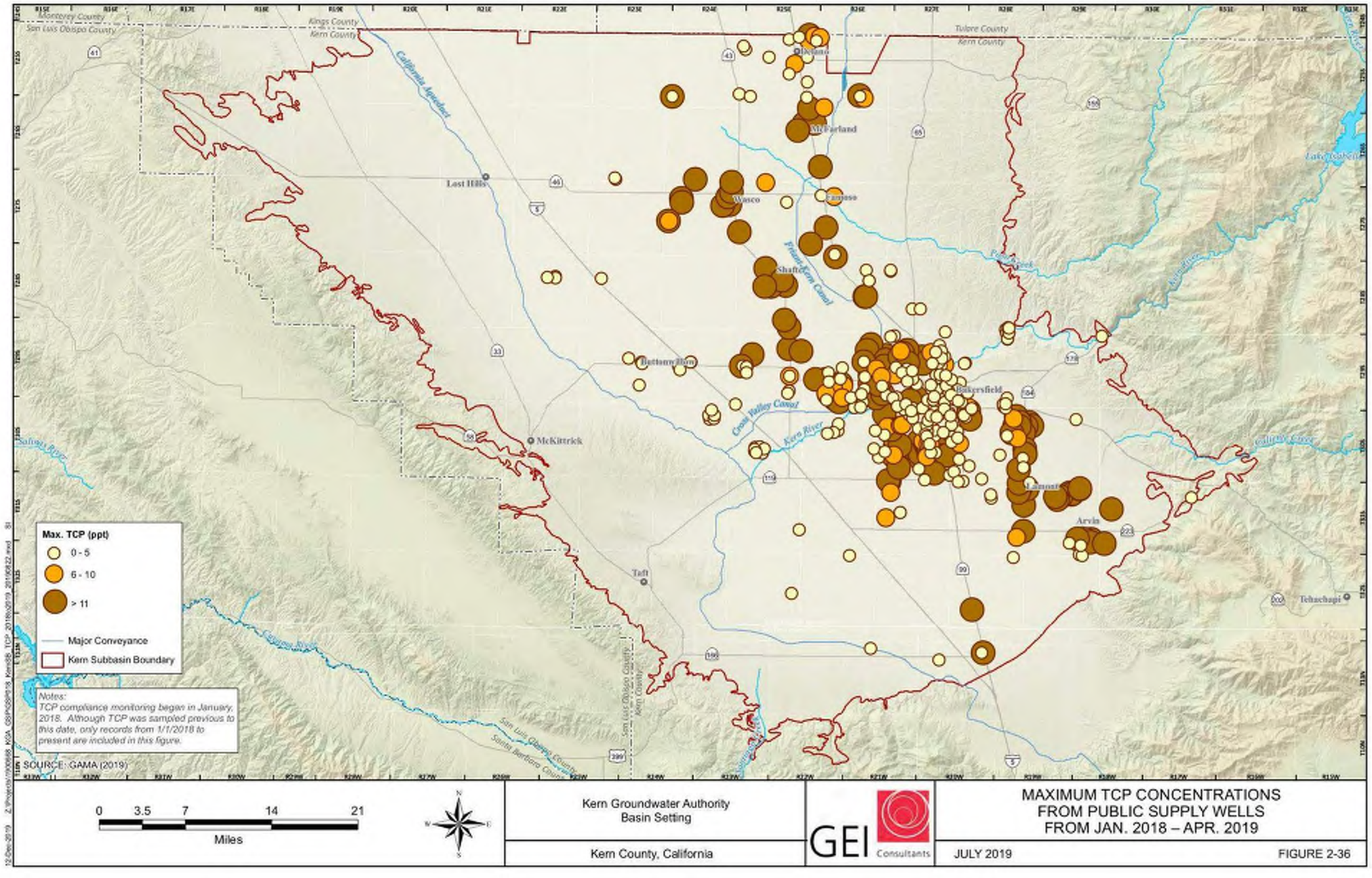


Figure 2-36. Maximum TCP Concentrations from Public Supply Wells from Jan. 2018- Apr. 2019

This Page is Intentionally Blank

2.3.3.7 Groundwater Contaminant Sites

An evaluation of documented groundwater contaminant sites in the Subbasin were identified through the GAMA Groundwater Information System. GAMA contains information from other programs and databases, such as SWRCB – GeoTracker and Department of Toxic Substances (DTSC) – EnviroStor databases. The data included in this basin setting is in response to the emergency regulations § 354.16(d), that requests within the GSP, "a description and map of the location of known groundwater contamination sites and plumes." However, it is not the intent of this section to evaluate or confirm whether any of these sites as listed by regulatory agencies are impacting groundwater with beneficial use. Furthermore, this GSP cannot guarantee the accuracy of the data acquired from these regulatory sources. This section presents cases as were listed from the regulatory databases that may document potentially impacted groundwater sites. Programs listed below were reviewed from GAMA. There are two figures to graphically represent the distribution of sites; Figure 2-37 shows permitted facilities and Figure 2-38 shows clean-up sites.

- Waste Discharge Requirements (WDR)
- Underground Storage Tank (UST)
- Leaking Underground Storage Tank (LUST)
- Cleanup Program Sites
- DTSC Hazardous Waste Sites
- Department of Pesticide Regulation
- Underground Injection Control (UIC) Wells
- Oil and Gas Sites
- Irrigated Lands Regulatory Program Sites
- Confined Animal Site

2.3.3.7.1 Permitted Facilities with Waste Discharge Requirements Orders

While GeoTracker does not include water quality data for WDRs a list of sites and their general location is accessible through the State Board's California Integrated Water Quality System (CIWQS). The general location of Confined Animal Facilities is also available through this database. Figure 2-37 is a graphical representation of the known WDRs and Confined Animal Sites in the Subbasin. A total of 264 sites were identified; however, 43 sites are not included in this figure because latitude/longitude coordinates were not available to confirm that the site are within the Subbasin. The intent of mapping the location of the sites is to provide an idea of where the WDRs and Confined Animal Sites are located throughout the Subbasin.

Irrigated Lands Regulatory Program (ILRP) is permitted as a third-party WDR, like the WDR permit for Confined Animal Sites. However, site specific information is not publicly available because there are too many enrolled parcels under the Order. The Kern River Watershed

Coalition Authority reports on the program. Relevant reports were reviewed and incorporated into the water quality discussion.

2.3.3.7.2 Underground Injection Control Permitted Wells

UIC permitted wells are not included in the list of groundwater contaminant sites because the UIC program's objective is to confine injected fluid to the approved injection zone so that injected fluid does not migrate to a zone where it could degrade valuable groundwater or hydrocarbon resources. Wells permitted under the State's Class II UIC program are presented on Figure 2-39. The UIC program's objective is to confine injected fluid to the approved injection zone so that injected fluid does not migrate to a zone where it could degrade valuable groundwater or hydrocarbon resources (DOGGR, April 2019). This program requires that any injection well have at least two cemented strings of casing across any underground source of drinking water located above a proposed injection zone, an annual Mechanical Integrity Test (MIT) and an annual step-rate test to ensure that groundwater is protected.

Data acquired from the regulatory sources listed above are included in Table 2-5 (Envirostor and Geotracker Databases) only if they applied to the following criteria in the order listed below:

1. potential media of concern defined as "groundwater," "other groundwater," or "drinking groundwater,"
2. potential contaminant of concern defined, or "unknown,"
3. the site/case reported as "not closed", and had one of the following statuses:
    - active cleanup
    - active land use restrictions
    - open remediation
    - open site assessment
    - open – eligible for closure
    - inactive-action required
    - other evaluation
    - under review
    - open-inactive
    - inactive-permitted
    - inactive-unpermitted

There is a total of 77 sites identified within the Subbasin. Figure 2-38 and Table 2-5, with cross referenced Map IDs, present the locations and details of known impacted groundwater or potentially impacted groundwater within the Subbasin. Table 2-5 provides the Site/Facility Name, Site Regulatory Identification and Status, associated site address and latitude/longitude, CalEnviroScreen Score (if applicable), as well as any identified constituents of concern impacting the groundwater at these sites.

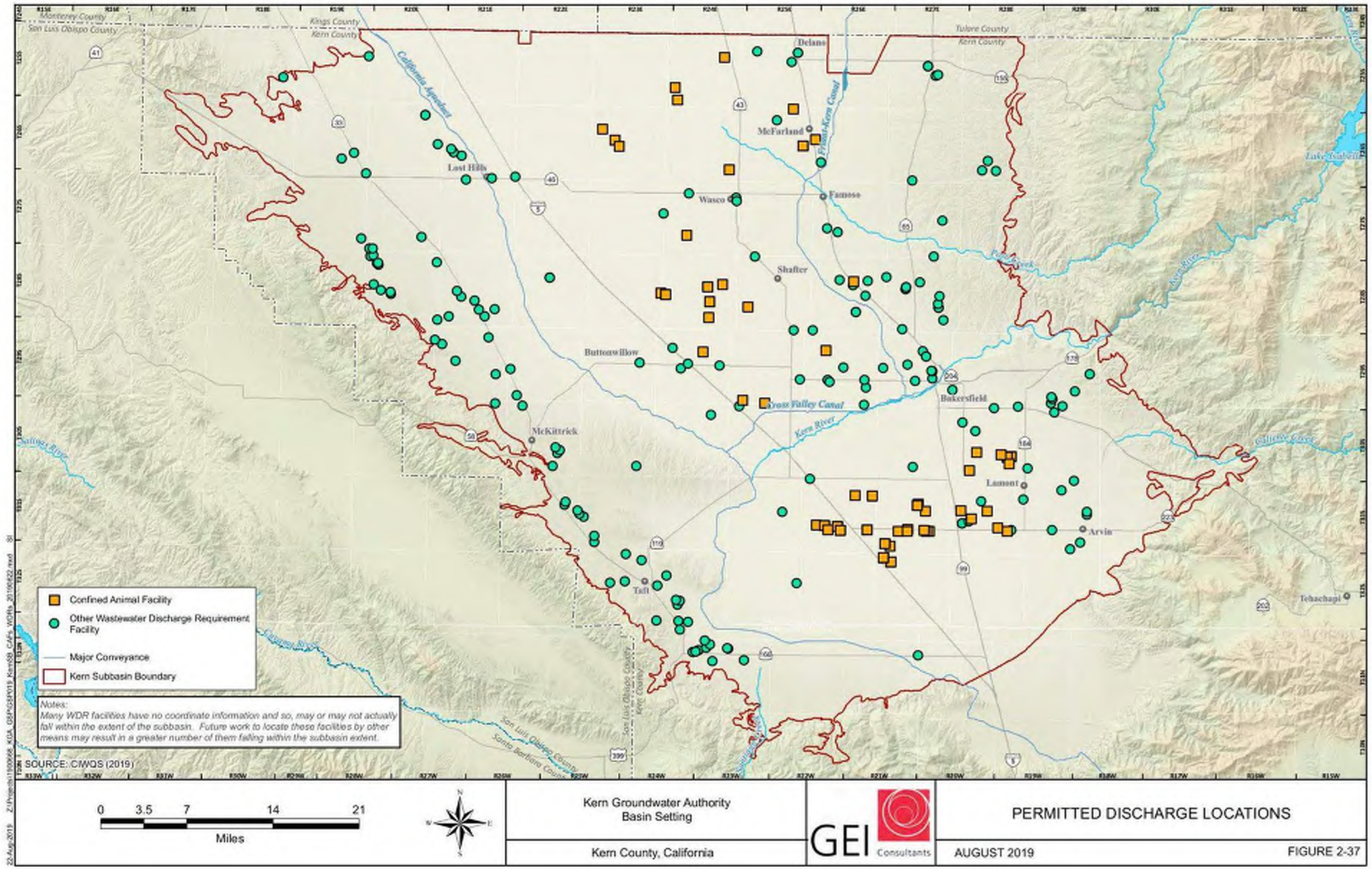


Figure 2-37. Permitted Discharge Locations

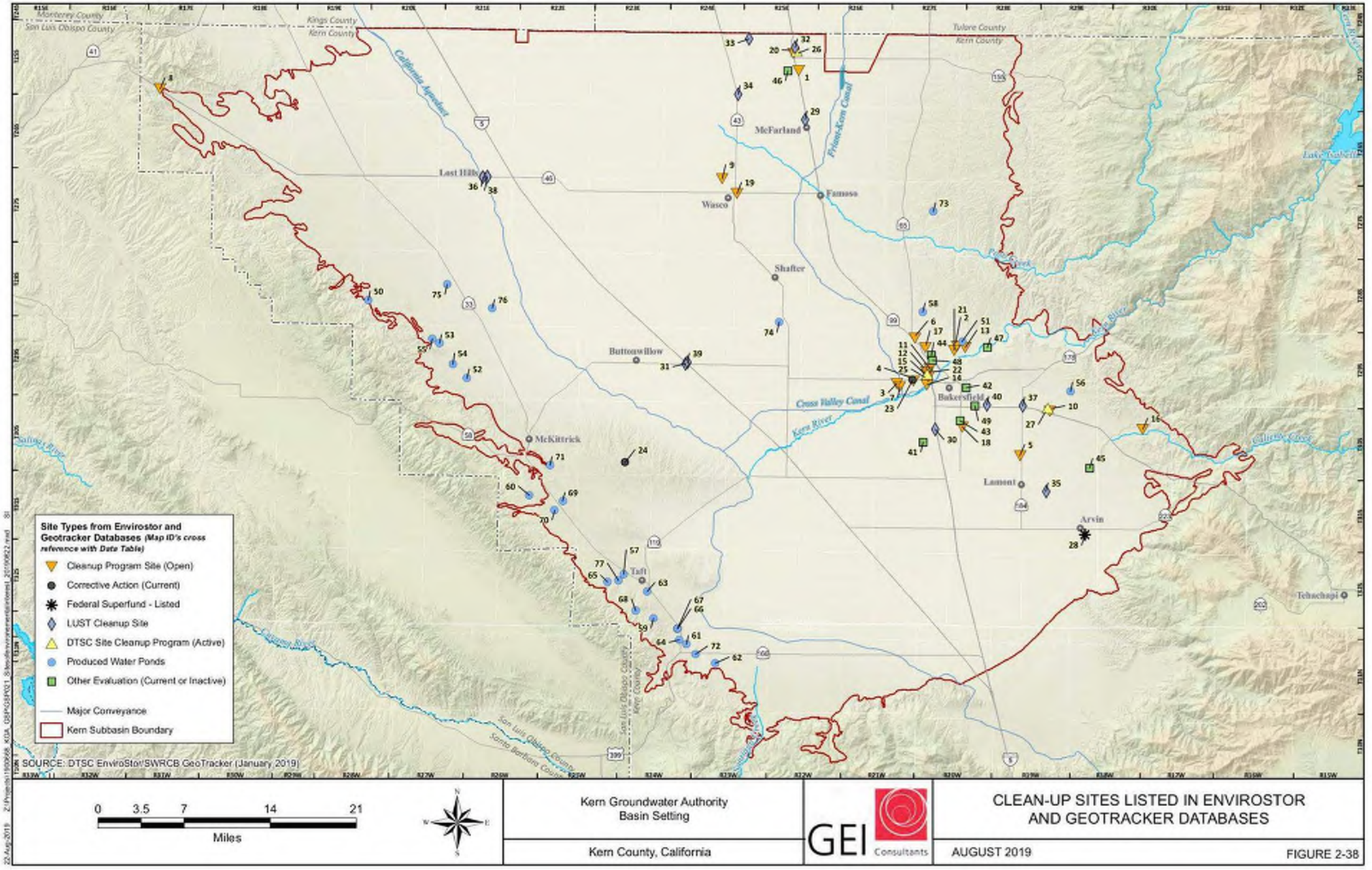


Figure 2-38. Clean-up Sites Listed in Envirostor and GeoTracker Databases

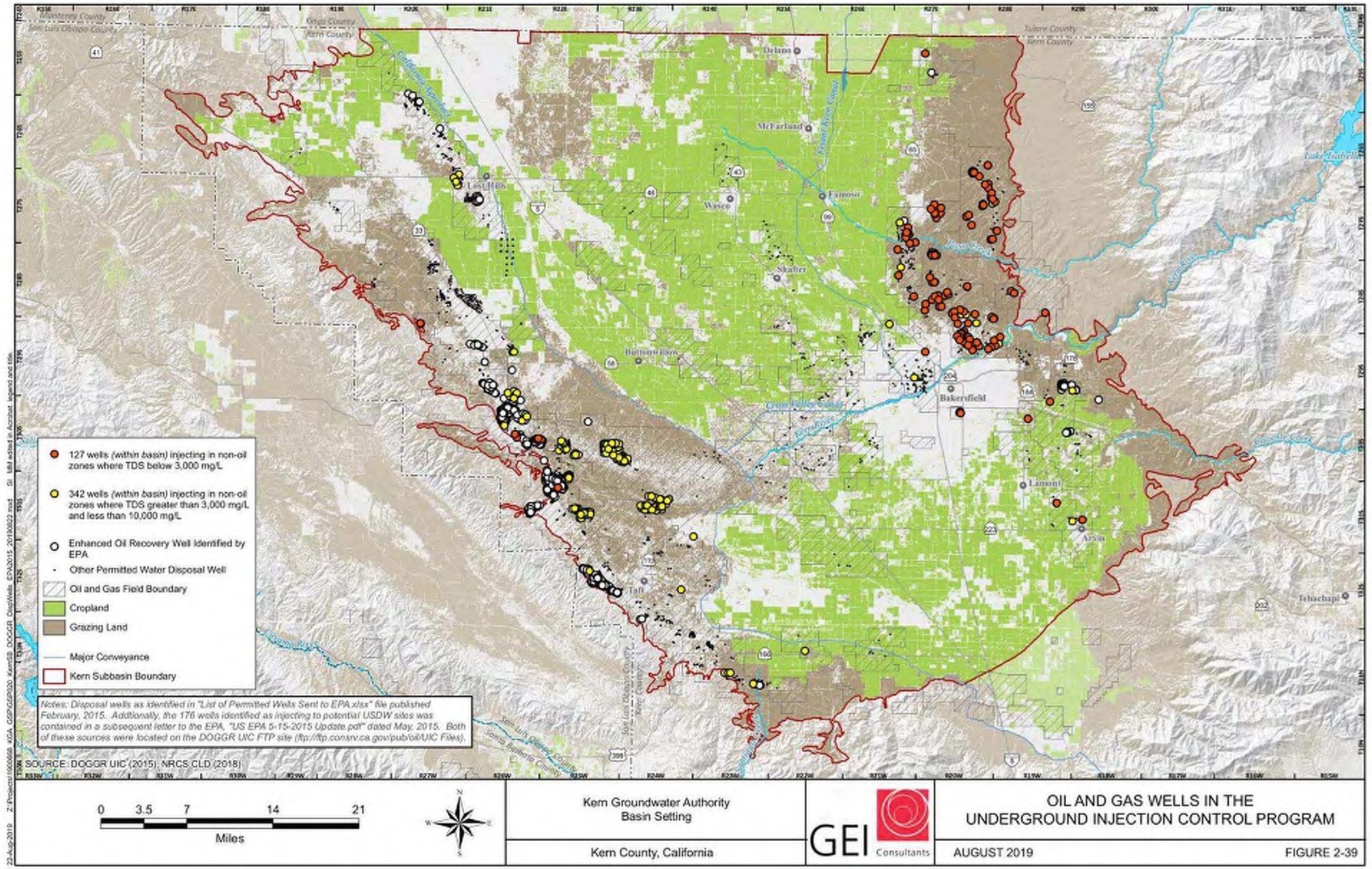


Figure 2-39. Oil and Gas Wells in the Underground Injection Control Program

Table 2-5. GeoTracker EnviroStor Sites with Potential Groundwater Media

Table 2-5
GeoTracker and Envirostor Sites with Potential Groundwater Media
Kern Groundwater Authority
Kern County, California
(Updated January 2015)

New Map ID	Site / Facility Name	ENVIROSTOR/ Geotracker ID	Source	Program Type	Status	Address	City	Zip	CALEnviroscreen Score	X Coord	Y Coord	Constituents of Concern
1	CROP PRODUCTION SERVICES (CPS) DELANO	SL285724257	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	930 WOOLOMES AVE	DELANO	93215-9553	---	-119.2422	35.7466	VOCs and Pesticides, NITRATE, OTHER CHLORINATED HYDROCARBONS, OTHER SOLVENT OR NON-PETROLEUM HYDROCARBON
2	CHEVRON USA (AKA: CHEVRON REFINERY & WAIT TANK YD)	SL205064267	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	2525 NORTH MANOR STREET	BAKERSFIELD	93308	---	-119.0087	35.4238	BENZENE, CRUDE OIL, LEAD, OTHER PETROLEUM
3	PG&E KERN POWER PLANT (FORMER COFFEE RD. OVERPASS)	SLT5FP024290	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	2401 COFFEE ROAD	BAKERSFIELD	93308-5748	---	-119.044919	35.37920074	BENZENE, CRUDE OIL, OTHER PETROLEUM
4	BAKERSFIELD REFINERY	SL205334279	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	6451 ROSEDALE HIGHWAY	BAKERSFIELD	93308	---	-119.071219	35.38198244	BTEX, TPH, MTBE / TBA / OTHER FUEL OXYGENATES, OTHER SOLVENT OR NON-PETROLEUM HYDROCARBON
5	KERN OIL & REFINING	SL372524510	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	7724 E PANAMA LANE	BAKERSFIELD	93307-9210	---	-118.9189	35.2954	BTEX, TPH, MTBE / TBA / OTHER FUEL OXYGENATES, PAHs
6	BAKERSFIELD AIRPORT BUSINESS PARK (CHEVRON LAND/DJ)	SL0602981532	Geotracker	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	UNICORN RD. AT HWY 99/E5	BAKERSFIELD	93308	---	-119.0698	35.4328	CRUDE OIL
7	SUNLAND REFINING CORPORATION	SL205224272	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	2152 COFFEE ROAD	BAKERSFIELD	93308-5746	---	-119.0911102	35.37558916	CRUDE OIL, GASOLINE, MTBE / TBA / OTHER FUEL OXYGENATES
8	CHEVRON - ANTELOPE PUMP STATION	SL0602980189	Geotracker	CLEANUP PROGRAM SITE	OPEN - ASSESSMENT & INTERIM REMEDIAL ACTION	STATE ROUTE 46	LOST HILLS	93249	---	-120.364723	35.71351	CRUDE OIL, WASTE OIL / MOTOR / HYDRAULIC / LUBRICATING
9	WASCO AIRPORT	SLT5FQ444336	Geotracker	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	PALM AVE & MCCOMBS	WASCO	93280	---	-119.3505	35.6184	DDD / DDE / DDT, OTHER INSECTICIDES / PESTICIDE / FUMIGANTS / HERBICIDES
10	J. R. SIMPLOT - EDISON	SLT5FS324650	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	430 PEPPER DR.	EDISON	93220	---	-118.8746	35.3485	DIBROMOCHLOROPROPANE (DBCP), FERTILIZER, PESTICIDES/HERBICIDES
11	SAN JOAQUIN REFINING CO - FRUITVALE REFINERY	SL205714283	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	STANDARD STREET	BAKERSFIELD	93308	---	-119.048	35.3972	DIESEL
12	BAKERSFIELD REFINERY - AREA 3	T10000001848	Geotracker	CLEANUP PROGRAM SITE	OPEN - VERIFICATION MONITORING	3663 GIBSON STREET	BAKERSFIELD	93308	---	-119.0527654	35.39338088	DIESEL, GASOLINE
13	WEST COAST OIL REFINERY, BAKERSFIELD	SL0602970387	Geotracker	CLEANUP PROGRAM SITE	OPEN - INACTIVE	1157 CHINA GRADE LOOP	BAKERSFIELD	93308	---	-118.9975	35.4225	DIESEL, GASOLINE, LEAD
14	APEX BULK COMMODITIES	T10000011271	Geotracker	CLEANUP PROGRAM SITE	OPEN - ASSESSMENT & INTERIM REMEDIAL ACTION	2111 BRICYN LANE	BAKERSFIELD	93308	---	-119.05178	35.37789	DIESEL, OTHER PETROLEUM
15	SAN JOAQUIN DRUM	SLT5FR034417	Geotracker	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	3930 GILMORE AVE	BAKERSFIELD	93308-6214	---	-119.05165	35.39017952	METALS/HEAVY METALS, PESTICIDES/HERBICIDES, VOLATILE ORGANIC COMPOUNDS
16	J. R. SIMPLOT - SENA (AKA: SENA FERTILIZER)	SLT5FS304448	Geotracker	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	NONE	EDISON	93220	---	-118.7406	35.3276	NITRATE, OTHER INSECTICIDES / PESTICIDE / FUMIGANTS / HERBICIDES
17	WESTERN FARM SERVICE INC-1630 NORRIS ROAD BAKERSFIELD	SL186304005	Geotracker	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1630 NORRIS RD	BAKERSFIELD	93308-2234	---	-119.0541923	35.4230027	OTHER CHLORINATED HYDROCARBONS
18	GARRETT CROPDUSTERS	SLT5FQ334305	Geotracker	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	2910 S UNION AVE	BAKERSFIELD	93307-4154	---	-119.0003209	35.32892143	OTHER INSECTICIDES / PESTICIDE / FUMIGANTS / HERBICIDES
19	SIMPLOT WASCO	SLT5FS184436	Geotracker	CLEANUP PROGRAM SITE	OPEN - REMEDIATION	541 HWY 46	WASCO	93280-1433	---	-119.3289256	35.60078769	OTHER INSECTICIDES / PESTICIDE / FUMIGANTS / HERBICIDES
20	WIP - DELANO, PCE	SL0602943992	Geotracker	CLEANUP PROGRAM SITE	OPEN - INACTIVE		DELANO	93215	---	-119.2496	35.7672	PCE
21	WITCO REFINERY (OILDALE)	SLT5FQ474339	Geotracker	CLEANUP PROGRAM SITE	OPEN - SITE ASSESSMENT	1134 MANOR STREET	BAKERSFIELD	93308-2553	---	-119.0129	35.415	PETROLEUM/FUELS/OILS
22	SABRE REFINERY	SLT5FQ334326	Geotracker	CLEANUP PROGRAM SITE	OPEN - INACTIVE	W. BAKERSFIELD-ROSEDALE AREA	BAKERSFIELD	93308	---	-119.05	35.3576	TOTAL PETROLEUM HYDROCARBONS (TPH)
23	BIG WEST OF CALIFORNIA LLC	80001738	EnviroStor	CORRECTIVE ACTION (CURRENT)	REFER: RWQCB	6451 ROSEDALE HWY	BAKERSFIELD	93308	81-85%	-119.072547	35.383247	BTEX, MTBE
24	OCCIDENTAL OF ELK HILLS INC	80001254	EnviroStor	CORRECTIVE ACTION (CURRENT)	ACTIVE - LAND USE RESTRICTIONS, POST CLOSURE RCRA PERMIT	28590 HIGHWAY 119	TUPMAN	93276	76-80%	-119.484792	35.281959	Metals, Petroleum, PCBS, Radioactive Isotopes, Volatile Organics
25	ASSURED TRANSPORTATION SITE	15420001	EnviroStor	DTSC SITE CLEANUP PROGRAM (ACTIVE)	ACTIVE	3226 GIBSON ST	BAKERSFIELD	93308	81-85%	-119.051671	35.3594494	Halogenated Organic Compounds, Tetrachloroethylene (PCE)
26	DELANO PCE PLUME	60001327	EnviroStor	DTSC SITE CLEANUP PROGRAM (ACTIVE)	ACTIVE	MAIN STREET AND 10TH AVENUE	DELANO	93215	66-70%	-119.2456698	35.76910534	Tetrachloroethylene (PCE)
27	J R SIMPLOT, EDISON	15070030	EnviroStor	DTSC SITE CLEANUP PROGRAM (ACTIVE)	ACTIVE - LAND USE RESTRICTIONS	430 PEPPER DRIVE	EDISON	93220	81-85%	-118.8776	35.35147831	Organochlorine pesticides (8081 OCPS), Volatile Organics (8260B VOCs)
28	BROWN AND BRYANT, INC., ARVIN FACILITY	15280011	EnviroStor	FEDERAL SUPERFUND - LISTED	ACTIVE	600 S DERBY ST	ARVIN	93203	81-85%	-118.8231038	35.20314691	DINOSEB and Volatile Organics (8260B VOCs)

Table 2-5
GeoTracker and EnviroStor Sites with Potential Groundwater Media
Kern Groundwater Authority
Kern County, California
(Updated January 2019)

New Map ID	Site / Facility Name	ENVIROSTOR/ Geotracker ID	Source	Program Type	Status	Address	City	Zip	CALEnviroscreen Score	X Coord	Y Coord	Constituents of Concern
29	EASTLAKE MINI MART	T0602912732	Geotracker	LUST CLEANUP SITE	OPEN - ELIGIBLE FOR CLOSURE	201 ELMO HWY	MCFARLAND	93250	---	-119.2325588	35.6886169	Gasoline
30	HOWARDS MINI MARKET	T10000000635	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	3360 PLANZ ROAD	BAKERSFIELD	93309	---	-119.0332612	35.325438	Diesel, Gasoline
31	JEFFRIES BROS. OASIS	T10000003369	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	35750 HWY 58	BUTTONWILLOW	93206	---	-119.39992	35.39946	Benzene, Diesel, Ethylbenzene, Gasoline, MTBE / TBA / Other Fuel Oxygenates, Naphthalene, Toluene, Xylene
32	LUGRECCO PROPERTY	T0602925877	Geotracker	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	1330 HIGH STREET	DELANO	93215	---	-119.247728	35.772859	Gasoline
33	NORTH KERN STATE PRISON	T0602900672	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	2737 CECIL AVE W	DELANO	93216	---	-119.3145731	35.7831358	Gasoline
34	POND MERCANTILE	T0602920113	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	25315 POND RD.	POND	93280	---	-119.3282703	35.71777716	Gasoline
35	RIBER MARKET	T0602900267	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	11228 EDISON RD S	LAMONT	93241	---	-118.8792731	35.25343586	gasoline
36	ROBERTSONS MARKET	T0602923377	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	29124 HWY 46 (FORMERLY 62160 HWY 46)	LOST HILLS	93249	---	-119.6964148	35.6152236	Diesel, Gasoline
37	SAMCO FOOD STORE NO. 3	T10000009045	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	8103 EAST BRUNDAGE LANE	BAKERSFIELD		---	-118.91375	35.35405	Diesel, Gasoline
38	TAYLOR AUTOMATED FUELS	T0602900529	Geotracker	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	61700 HWY 46, HWY CORNER OF HWY 46 AND LOST HILLS RD	LOST HILLS	93249	---	-119.6900572	35.61036925	Gasoline
39	TRAVEL CENTERS OF AMERICA	T10000010004	Geotracker	LUST CLEANUP SITE	OPEN - SITE ASSESSMENT	27768 LAGOON DRIVE	BUTTONWILLOW	93206	---	-119.39723	35.40124	Benzene, Diesel, Gasoline, MTBE / TBA / Other Fuel Oxygenates, Naphthalene, Toluene, Xylene
40	WHOLESALE FUELS, INC.	T10000007773	Geotracker	LUST CLEANUP SITE	OPEN - REMEDIATION	2200 EAST BRUNDAGE LANE	BAKERSFIELD	93307	---	-118.96504	35.35471	Benzene, Ethylbenzene, Gasoline, MTBE / TBA / Other Fuel Oxygenates, Naphthalene, Toluene, Xylene
41	BAKERSFIELD DISCOVERY PROJECT	60001630	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	INACTIVE - ACTION REQUIRED	PACHECO ROAD AND STINE ROAD	BAKERSFIELD	93311	66-70%	-119.058751	35.310912	Tetrachloroethylene (PCE), Trichloroethylene (TCE)
42	BAKERSFIELD PLATING WORKS	15340012	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	REFER: OTHER AGENCY	527 EAST 19TH	BAKERSFIELD	93305	81-85%	-118.9954948	35.37450554	Metals (cadmium, Chromium (VI), Copper, Lead, Nickel)
43	BC CHEMICALS	15280041	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	REFER: RWQCB	1511 SOUTH UNION AVENUE	BAKERSFIELD	93307	91-95%	-119.0036106	35.33508464	Arsenic
44	CALTRANS SERVICE YARD	60001605	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	INACTIVE - NEEDS OTHER EVALUATION (CURRENT OR INACTIVE)	1200 OLIVE DRIVE	OILDALE	93308	86-90%	-119.046228	35.413042	PCE, TCE
45	EASTLAND FLYING SERVICE	15070006	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	INACTIVE - NEEDS OTHER EVALUATION (CURRENT OR INACTIVE)	16849 MT. VIEW ROAD	LAMONT	93241	76-80%	-118.816845	35.28164	Carbaryl, 8141A OPPS, Toxaphene
46	KERN COUNTY DUMP	15490017	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	REFER: RWQCB	SE OF XING OF STRADLEY & WOOLOMES AVES	DELANO	93215	96-100%	-119.25779	35.74626	Tetrachloroethylene, trichloroethylene, Dichlorodifluoromethane, 1,1 Dichloroethane
47	KERN COUNTY GUN CLUB	15860001	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	REFER: OTHER AGENCY	2818 CHINA GRADE LOOP	BAKERSFIELD	93308	76-80%	-118.965412	35.422405	Lead, Other Organic Solids, Polynuclear aromatic hydrocarbons
48	RAIN FOR RENT	60001771	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	INACTIVE - NEEDS OTHER EVALUATION (CURRENT OR INACTIVE)	3404 STATE STREET	OILDALE	93308	96-100%	-119.044881	35.406524	Unknown
49	SPARKLE/BRUNDAGE CLEANERS	60002071	EnviroStor	OTHER EVALUATION (CURRENT OR INACTIVE)	BACKLOG	3517 W. BRUNDAGE ROAD	BAKERSFIELD	93304	96-100%	-118.9824817	35.3539159	Tetrachloroethylene, trichloroethylene
50	CARNEROS CREEK, THETA	T10009422184	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	CARNEROS CREEK OIL FIELD	LOST HILLS		---	-119.85852	35.46844	Crude Oil
51	CHEVRON USA INC-KERN RIVER-SAN JOAQUIN	T10000007105	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	KERN RIVER OIL FIELD	MALTHA		---	-119.601769	35.428919	Crude Oil
52	CYMRIC OIL FIELD, BOWLES LEASE	T10000006948	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	SW OF LOKEN RD / LOST HILLS RD	MCKITTRICK	93251	---	-119.71424	35.37855	Crude Oil
53	CYMRIC OIL FIELD, LEER-RICHARDSON LEASE	T10000007036	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	CYMRIC OIL FIELD	MCKITTRICK		---	-119.754775	35.418844	Crude Oil
54	CYMRIC OIL FIELD, OVERLAND ANDERSON LEASE	T10000007035	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	NE TAFT (S20, T29S, R21E, MDB&M)	MCKITTRICK	93251	---	-119.73454	35.3944	Crude Oil
55	CYMRIC OIL FIELD, USL LEASE	T10000007037	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	CYMRIC OIL FIELD	MCKITTRICK		---	-119.765	35.42378	Crude Oil
56	EDISON OIL FIELD, RACETRACK LEASE	T10000007136	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	EDISON OIL FIELD	EDISON		---	-118.84515	35.37127	Other Inorganic / Salt, TDS, Crude Oil
57	J&K, MIDWAY-SUNSET OIL FIELD, JADE KERN PROJECT LEASE	T10000000764	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	KRISTIN STREET NE 1/4, SEC 25 T32S R23E MDB&M	TAFT	93268	---	-119.48427	35.16988	Crude Oil
58	KERN FRONT NO. 2	T10000007097	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	KERN FRONT OIL FIELD	SACO		---	-119.05882	35.46374	Crude Oil

Table 2-5
GeoTracker and EnviroStor Sites with Potential Groundwater Media
Kern Groundwater Authority
Kern County, California
(Updated January 2019)

New Map ID	Site / Facility Name	ENVIROSTOR/ Geotracker ID	Source	Program Type	Status	Address	City	Zip	CALEnviroscreen Score	X Coord	Y Coord	Constituents of Concern
59	MIDWAY-SUNSET OIL FIELD, BERRY & EWING LEASE	T10000007297	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	MIDWAY-SUNSET OIL FIELD	MARICOPA		---	-119.44121	35.09573	Crude Oil
60	MIDWAY-SUNSET OIL FIELD, C. E. HOUCHIN ET AL LEASE	T10000006771	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	SEC 9, T31S, R22E, MDB&M	FELLOWS	93224	---	-119.62194	35.24141	Crude Oil
61	MIDWAY-SUNSET OIL FIELD, FULTON LEASE	T10000007030	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	NORTHEAST OF MARICOPA (S3, T11N, R24W, SB B&M)	MARIPOSA	93252	---	-119.39335	35.08872	Crude Oil
62	MIDWAY-SUNSET OIL FIELD, HAVENSTRITE LEASE	T10000006759	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	MIDWAY-SUNSET OIL FIELD	MARICOPA		---	-119.35188	35.0463	Crude Oil
63	MIDWAY-SUNSET OIL FIELD, JAMESON TRUST LEASE	T10000006947	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	7026 DARNOCH WAY	WEST HILLS	91307	---	-118.45068	35.13032	Crude Oil
64	MIDWAY-SUNSET OIL FIELD, JAMESON TRUST LEASE	L10002548641	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	MIDWAY-SUNSET OIL FIELD	MARICOPA		---	-119.40374	35.0736	Crude Oil
65	MIDWAY-SUNSET OIL FIELD, LOCKWOOD LEASE	T10000007029	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	WEST OF TAFT	TAFT	93268	---	-119.5077454	35.14047576	Crude Oil
66	MIDWAY-SUNSET OIL FIELD, MOCO 35 LEASE (PLASTIC-LINED POND 3)	T10000007039	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	NORTH OF MARICOPA (S35, T12N, R24W, MDB&M)	MARICOPA	93252	---	-119.4057919	35.08717928	Crude Oil
67	MIDWAY-SUNSET OIL FIELD, MOCO 35 LEASE (PONDS 1&2, SAND PIT5)	T10000007031	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	NORTH OF MARICOPA (S35, T12N, R24W, MDB&M)	MARIPOSA	93252	---	-119.4065	35.08679	Crude Oil
68	MIDWAY-SUNSET OIL FIELD, NATIONAL USL LEASE	T10000007032	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	TWO MILES SOUTHWEST OF TAFT (S35, T32S, R23E, MDB&M)	TAFT	93268	---	-119.46687	35.10715	Crude Oil
69	MIDWAY-SUNSET OIL FIELD, SHALE 14 LEASE	T10000007033	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	1.5 MILES SOUTHEAST OF DERBY ACRES (S14, T31S, R22E)	DERBY ACRES	93224	---	-119.57365	35.23502	Crude Oil
70	MIDWAY-SUNSET OIL FIELD, W & S LEASE	T10000007034	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	2 MILES SOUTHEAST OF DERBY ACRES (S14, T31S, R22E)	DERBY ACRES	93224	---	-119.5852	35.22457	Crude Oil
71	MIDWAY-SUNSET OIL FIELD, WEBBER LEASE	T10000006776	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	LOD ENERGY - NE ¼ SECTION 34, T30S, R22E, MDB&M	FELLOWS	93224	---	-119.59296	35.27708	Crude Oil
72	MIDWAY-SUNSET, HOYT LEASE	T10000006779	Geotracker	PRODUCED WATER PONDS	UNDER REVIEW	MIDWAY-SUNSET OIL FIELD	MARICOPA		---	-119.37886	35.05688	Crude Oil
73	POSO CREEK, POSO	T10000007301	Geotracker	PRODUCED WATER PONDS	INACTIVE - UNPERMITTED	LINN OPERATING INC - NW OF BRONZE HILL RD. & WHITE CROWN DR.	MCFARLAND	93250	---	-119.0452	35.58195	Crude Oil
74	RIO BRAVO OIL FIELD, KERNCO LEASE	T10000006733	Geotracker	PRODUCED WATER PONDS	OPEN - INACTIVE	NW OF 7TH STANDARD RD / TRANSPORT LN S1/2 OF THE NE1/4 OF SECTION 34, T28S, R25E, MDB&M	SHAFTER	93263	---	-119.2656	35.44852	Crude Oil
75	S. BELRIDGE OIL FIELD, HILL LEASE	SL0602935481	Geotracker	PRODUCED WATER PONDS	INACTIVE - PERMITTED	SEC 19, T28S, R21E, MDB&M	SOUTH BELRIDGE OIL FIELD		---	-119.7453854	35.4882473	Other inorganic, Salt
76	SOUTH BELRIDGE OIL FIELD, SOUTH WASTEWATER DISPOSAL FACILITY	SL0602980665	Geotracker	PRODUCED WATER PONDS	INACTIVE - PERMITTED	SOUTH BELRIDGE OIL FIELD	SHERR CITY		---	-119.6796305	35.46215366	Other inorganic / salt
77	VAUGHN-MIDWAY-SUNSET OIL FIELD, USL 15	T10000006813	Geotracker	PRODUCED WATER PONDS	OPEN - SITE ASSESSMENT	NORTHWEST IF MDDR RD / THOMAS ST	TAFT	93268	---	-119.49199	35.14731	Crude Oil

Source: DTSC EnviroStor; https://www.envirostor.dtsc.ca.gov/public/ and SWRCB Geotracker: http://geotracker.waterboards.ca.gov/

2.3.4 Land Subsidence

Prior to COVID, the Kern Subbasin had been meeting with the DWR-California Aqueduct Subsidence Project (CASP) team to share KGA findings related to non-SGMA related sources of subsidence (e.g., oil field, geotechnical etc.) on the Aqueduct. These studies had been shared with the DWR SGMA Team on a separate occasion. Knowing that DWR SGMA Team and DWR CASP do not directly communicate on a staff level, the Subbasin recently held two additional meetings (July 8th and June 3rd) to bring new DWR CASP staff up to speed on the findings of KGA subsidence work conducted between 2020 and 2022. At the July 8th meeting, the CASP team expressed that they are still analyzing data for their 2022 Precise Survey Report on the California Aqueduct and as such, they were unable to provide any concrete findings or direction on potential subsidence rates for comparison to the KGA studies.

The Kern Subbasin presented an Aqueduct "white paper" (Attachment G3) to the CASP that details the proposed methodology for evaluating future subsidence rates, and the need to set interim (i.e., through 2025) MO/MTs per the direction of DWR SGMA Team. The Subbasin and DWR CASP also explored mutually beneficial studies that could be implemented between 2022 and 2025 that would address identified data gaps for both the Subbasin and DWR CASP. The CASP team indicated that they understood the white paper approach and were also evaluating non-SGMA related sources of subsidence. As an initial step, DWR CASP had held a meeting with California Department of Conservation Geologic Energy Management Division (CalGEM) to discuss how to account for those activities in their evaluations. The CASP team stated that they believe themselves to be similar to the GSAs as an infrastructure owner, and thus a participant of SGMA not a regulator.

As the Kern Subbasin moves forward, we believe significant data gaps pertaining to the various causes and rates of subsidence in the Subbasin still exist and, that if addressed, will lead to better defined management objectives for the Aqueduct and other critical infrastructure and help focus planned and future monitoring resources where they will be most effective. We also believe that working jointly and in close consultation with the CASP team would multiply the respective expertise and resources of both parties to the benefit of all those dependent on the Aqueduct.

Inelastic (irrecoverable) land subsidence (subsidence) is an undesirable result and the DWR of the Subbasin Groundwater Sustainability Plans (GSP) placed subsidence as one of the deficiencies to be further described and addressed. In response, the Subbasin has developed coordinated definitions for Subsidence Undesirable Results and Critical Infrastructure as follows:

Undesirable Results – Land Subsidence:

An undesirable result for land subsidence is defined as the point at which the amount of inelastic subsidence, if caused by Subbasin groundwater extractions, creates a significant and unreasonable impact to surface land uses or Subbasin critical infrastructure.

Critical Infrastructure – Land Subsidence:

The KCS has adopted two classifications for critical infrastructure: Regional Critical Infrastructure and Management Area Critical Infrastructure.

Regional Critical Infrastructure is defined as infrastructure located within the Subbasin that serves multiple areas of the Subbasin and whose loss of significant functionality due to inelastic subsidence, if caused by Subbasin groundwater extractions, would have significant impacts to beneficial users. The Subbasin has collectively determined that the only infrastructure that meets the definition for Regional Critical Infrastructure are the California Aqueduct and the Friant-Kern Canal.

Management Area Critical Infrastructure is defined as infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area. Each Subbasin Management Area has identified their respective Management Area Critical Infrastructure in their Management Area Plan or individual GSP.

Inelastic land subsidence has the potential to alter the land surface in ways that could increase flood risk in low lying areas; and damage well casing, canals, and other linear infrastructure. This section summarizes land subsidence data collected within the Subbasin and discusses documented impacts and potential impacts of land subsidence in or near the Subbasin.

Historically, it was commonly believed that the principal cause of subsidence in the Subbasin was groundwater extraction for agriculture and municipal use. However, recent separate subsidence studies conducted by the Westside District Water Authority (WDWA) and the KCS have found that the underlying causes of subsidence in the Subbasin are more complex and likely include several interrelated contributing factors. Chief among these are groundwater extraction for beneficial use, oilfield activities, geotechnical conditions related to the disparate types of soil native to the Subbasin, and natural settlement of critical infrastructure. None of the subsidence modes besides groundwater extraction for agricultural and other Management Area uses are within the control of Subbasin GSAs.

2.3.4.1 Processes Leading to Land Subsidence

Inelastic compaction or land subsidence occurs in the fine-grained beds of the aquifer system. Clays and silts, although not very permeable, are typically highly porous. In many of these fine-grained layers, pore spaces are supported by water at the time of deposition. This water is essentially groundwater storage to the Subbasin, although the majority of it is a component of inelastic storage, and therefore, it is not reusable. During over-pumping conditions, groundwater is pumped from pore spaces between grains of sand and gravel. Once the aquifer system is pumped beyond the sustainable yield, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The subsequent release of water and water pressure from the clay and silt beds result in compaction (the beds become thinner) as clay particles supported by water in pore spaces rearrange and collapse. Groundwater cannot re-enter the clay structure after the collapse. This condition represents a permanent loss of the water storage volume in the clay layers. The effects of compaction are also seen as a lowering of the land surface, otherwise known as land subsidence

The WDWA recently completed the WDWA Subsidence Review (2020) and found that oilfield activities have also contributed to subsidence. Oilfields on the west side of the Subbasin extract oil and produced water from some of the same aquifers used for beneficial use elsewhere in the Subbasin. The WDWA determined that oilfield pumping has resulted in impacts to regional critical infrastructure such as the California Aqueduct between Mileposts 195 to approximately Milepost 215. The Subbasin has identified other areas that are likely experiencing oilfield-induced subsidence. These areas will be the subject of future studies.

2.3.4.2 Lawrence Berkeley National Laboratory Subsidence Study

The Lawrence Berkeley National Laboratory (LBL) Subsidence Study was undertaken in order to determine the baseline rate of subsidence in the Kern County Subbasin for the study period (2015-2021). Study data was also compared to the March 2021 Differential Interferometric Synthetic Aperture Radar (DInSAR) Study conducted by Earth Consultants International (ECI) on behalf of the KGA and other GSAs in the Kern Subbasin. This study determined that the data from the ECI study was in reasonable scientific agreement with the LBL Data.

For comparison, and to understand yearly variations, the cumulative line-of-sight displacement and the yearly displacement rates were determined for a roughly seven-year interval extending from early 2015 until late 2021. These values will be used in a follow-on study to better assess the vulnerability of critical infrastructure within the subbasin. These include, but are not limited to, gravity-driven surface water delivery systems, of which the primary regional conveyance structures are the California Aqueduct (Aqueduct) and the Friant-Kernel Canal (FKC). Due to varying processes within the sub-basin, which include groundwater pumping for agricultural, industrial, and oil and gas extraction, the basin will be further sub-divided into eastern, western, southern, and central regions as shown in Figure 2-40 and the maximum, minimum, and mean subsidence will be computed for each area.

The west region of the Subbasin is distinguished by extensive areas of open range land and oil field operations interspersed with cultivated lands. Much of the Westside has no significant current or planned groundwater use because of naturally poor water quality due to the presence of marine sediments and saline connate water. As such, surface water deliveries from the State Water Project via the Aqueduct are a primary source of water for agriculture. Significant volumes of oil field produced water are generated in the west region. Produced water is a by-product of oil production common to almost all oil fields in the KCS. Produced water is exempt from SGMA, and therefore outside of the control of the KGA or other GSAs in the Subbasin.

The southern region is characterized by a mixture of land uses including agriculture, urban development and oil field operations. SGMA related groundwater extractions include industrial, municipal and agriculture. The southern region also receives surface water delivered by the Aqueduct. The eastern region is bounded by the FKC on the west and the foothills of the Sierra-Nevada Range on the east. It encompasses both agriculture use and oil field activities. Groundwater quality is generally good in this area and is utilized for various SGMA related purposes (e.g., municipal, agriculture, industry). Deliveries of surface water via the FKC is a primary source of water for agriculture, although not all growers have access to FKC water.

The central region of the Subbasin is characterized by widespread agricultural activity, interspersed with municipal and industrial uses. Scattered oilfield operations are also present. The central region is particularly susceptible to land subsidence caused by groundwater extraction. This is due to the presence of extensive and layers of clay (e.g. Corcoran Clay) and other fine grained sediments in the subsurface. The sources of water include groundwater, and surface water deliveries from the Aqueduct and FKC.

The summarized results of the LBL study for the period 2015 to 2021 are provided in the Table 2-6.

Table 2-6. Summary of Results of the LBL Study for the Period 2015 to 2021

Region	Description	Subsidence Rate (inches/year)
Entire Region	Mean yearly rate	-0.440
	Minimum yearly rate	+0.046
	Maximum yearly rate	-1.111
Central Region	Mean yearly rate	-0.654
	Minimum yearly rate	+0.064
	Maximum yearly rate	-1.791
Southern Region	Mean yearly rate	-0.361
	Minimum yearly rate	+0.265
	Maximum yearly rate	-0.838
Eastern Region	Mean yearly rate	-0.356
	Minimum yearly rate	+0.281
	Maximum yearly rate	-0.811
Western Region	Mean yearly rate	-0.365
	Minimum yearly	+0.265
	Maximum yearly rate	-0.984

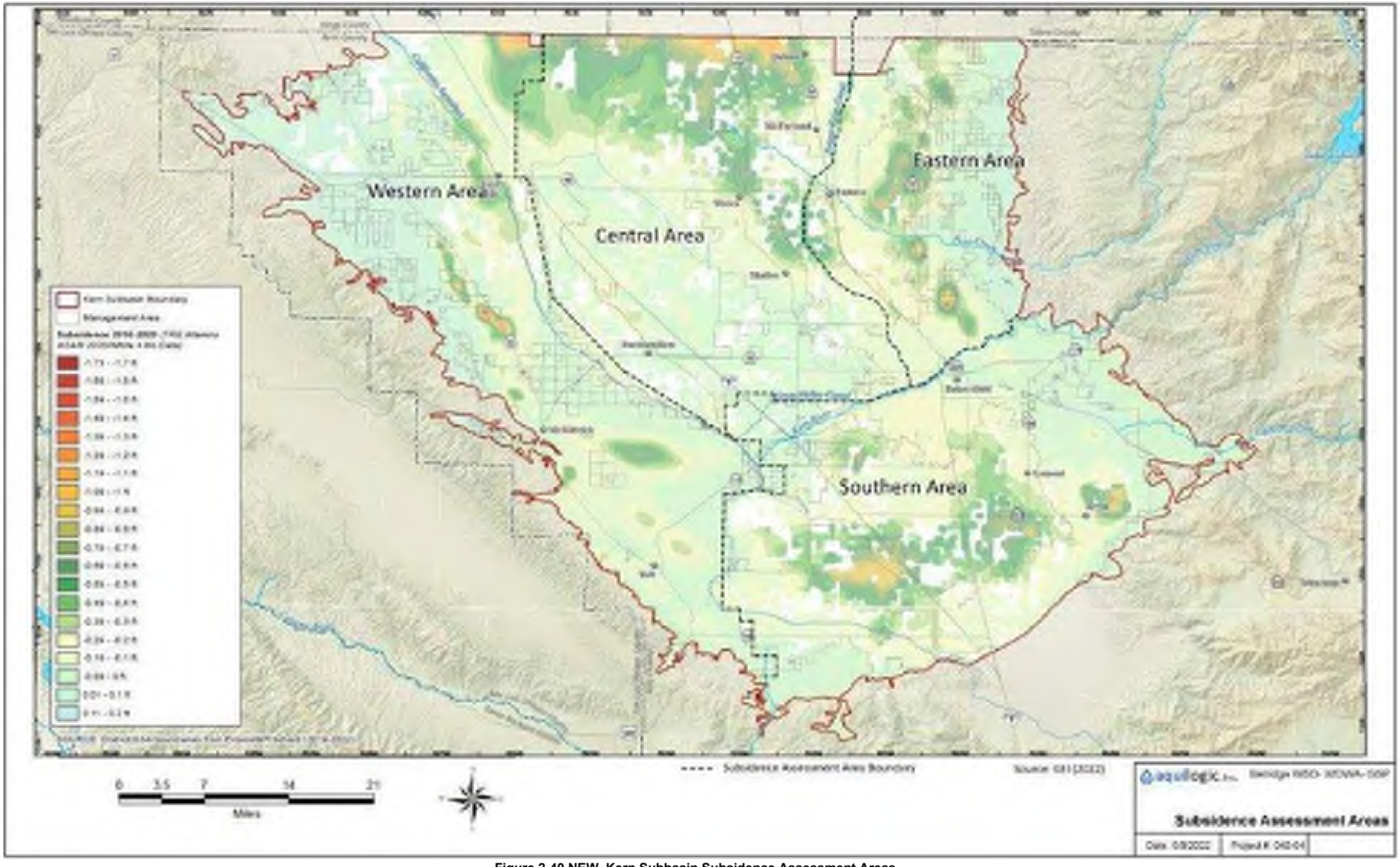


Figure 2-40 NEW. Kern Subbasin Subsidence Assessment Areas

This Page is Intentionally Blank

2.3.4.3 Regional Critical Infrastructure

Some types of large-scale linear infrastructure such as concrete-lined canals, can be susceptible to the regional subsidence caused by groundwater withdrawal. When subsidence rates are not equal across a region, differential compaction can occur. This differential compaction or subsidence may result in the formation of new low-lying areas for which canal designs have not taken into account. Newly formed low-lying areas are what impact large-scale linear infrastructure such as canals; often reducing freeboard and capacity. Examples of infrastructure that have been impacted by subsidence in the Southern San Joaquin Valley include the Friant-Kern Canal and California Aqueduct. The LBL study concluded that given the current rates of subsidence on buried infrastructure, like pipelines, would not experience significant adverse effects provided "hinge line" factors (i.e., stream crossings, faults, and changes in elevation etc.) were minimal. Figures 2-41 and 2-42 show Subbasin infrastructure and recent JPL InSAR data for October 2020 through 2021. Figure 2-43 shows the Identified Regional Critical Infrastructure within the Kern Subasin.

Friant-Kern Canal Subsidence impacts have been well documented to the north of the Subbasin in an approximate 18 mile stretch from Milepost 102.7 through 121.5, centered around Deer Creek (FWA, 2019). Subsidence was roughly 12 feet of the original design elevation, including 3 feet of subsidence from 2016 to 2019. Due to land subsidence the canal's water delivery capability has been reduced by nearly 40 percent of its original capacity, Class 2 contractors have suffered nearly 60 percent reduced capacity (FWA, 2019). Within the Subbasin, the FKC has experienced a few inches of subsidence near Poso Creek (Mileposts 127 to 137).

A recent InSAR study conducted by the Subbasin determined that subsidence was historically overestimated by previous JPL InSAR studies in the Subbasin. The exact cause of subsidence near the Friant-Kern Canal in the Subbasin is therefore the subject of ongoing study. As a first step, recently acquired grant funding will be utilized to install new extensometers to improve the quality and quantity of data necessary to establish future sustainable management criteria in close consultation with the DWR, Friant Water Authority, and other key stakeholders.

California Aqueduct

The March 2019, *California Aqueduct Subsidence Study: Supplemental Report* prepared by the Department of Water Resources California Aqueduct Subsidence Project (DWR-CASP) provided much substantive data on the Aqueduct that will be useful for ongoing and future planning by the various GSAs) within the Subbasin. The report also identified several Aqueduct pools within the Subbasin as areas of concern because of diminished operational capacity due to subsidence. Perhaps the most prominent of these areas are located between Aqueduct milepost (MP) 195 and 215, and MP 267 and 271. Historically, it was commonly believed that the principal cause of subsidence in the Subbasin and Central Valley at large was groundwater extraction for agriculture and municipal use. However, recent separate subsidence studies conducted by the Westside Districts Water Authority (WDWA) and the KCS have found that the underlying causes of subsidence in the KCS are more complex and likely include several interrelated factors. Chief among these are groundwater extraction for beneficial use, oilfield

activities and geotechnical conditions related to the disparate types of soil native to the KCS, and natural settlement of the 60 year old Aqueduct.

Two segments of the Aqueduct were raised in 1989 and 1996 in Kern County. The first between MP 194.94 and 197.05 (T25S-R20E) in 1989, and the second between MP 206.10 and 207.94 (T27S-R21E). In general, this northwest portion of the basin is far from the main groundwater production in the central part of the Subbasin. A recent study conducted by the WDWA determined that subsidence between Mileposts 195 and Milepost 215 is attributed to oilfield extraction activities and not agricultural pumping. A separate Subbasin-wide InSAR study determined that previous JPL InSAR studies likely overestimated the rate of subsidence in the Subbasin. These data were shared with DWR and DWR-CASP. Future studies by the Subbasin along the Aqueduct are planned.

At the time of the submittals on January 31, 2020, the Subbasin GSPs expressed that significant data gaps existed with regard to the differing causes of subsidence that may be unique to each of the five subsidence areas of interest identified in the Subbasin. This lack of representative data precluded setting meaningful data-based sustainable management requirements until additional data was obtained. In the intervening 18 months since submittal of the Subbasin GSPs in 2020, the Subbasin has made progress in acquiring the data necessary to set sustainable management criteria. This work includes (some completed and other ongoing) the two aforementioned WDWA and Subbasin studies, retaining the Lawrence Berkeley National Laboratory (LBNL) to perform a baseline subsidence and infrastructure status assessment of the Aqueduct and other critical infrastructure in the Subbasin, preparing a revised basin study and the planned installation of additional subsidence monitoring sites in consultation with the DWR-CASP and the Friant Water Authority (FWA).

Based on the data from the WDWA and Subbasin investigations, it is apparent that key data gaps pertaining to the various causes and rates of subsidence in the Subbasin still remain and that further study is needed to better define realistic management objectives for the Subbasin. To this end, in addition to the LBNL study, the KCS will install extensometers, near the Friant-Kern Canal, and work in close consultation with DWR-CASP and Friant Water Authority to update and interpret new InSAR and oilfield data. In addition, the Subbasin is in the process of preparing an updated basin study. The Subbasin has also committed to working cooperatively with the DWR- CASP and the FWA in the planning and installation of other geodetic-based monitoring technology in the Subbasin. The goal of the ongoing studies is to: 1.) more fully quantify the individual causes of subsidence, and 2.) establish data-based subsidence MOs/MTs for Subbasin critical infrastructure and individual management area critical infrastructure as appropriate.

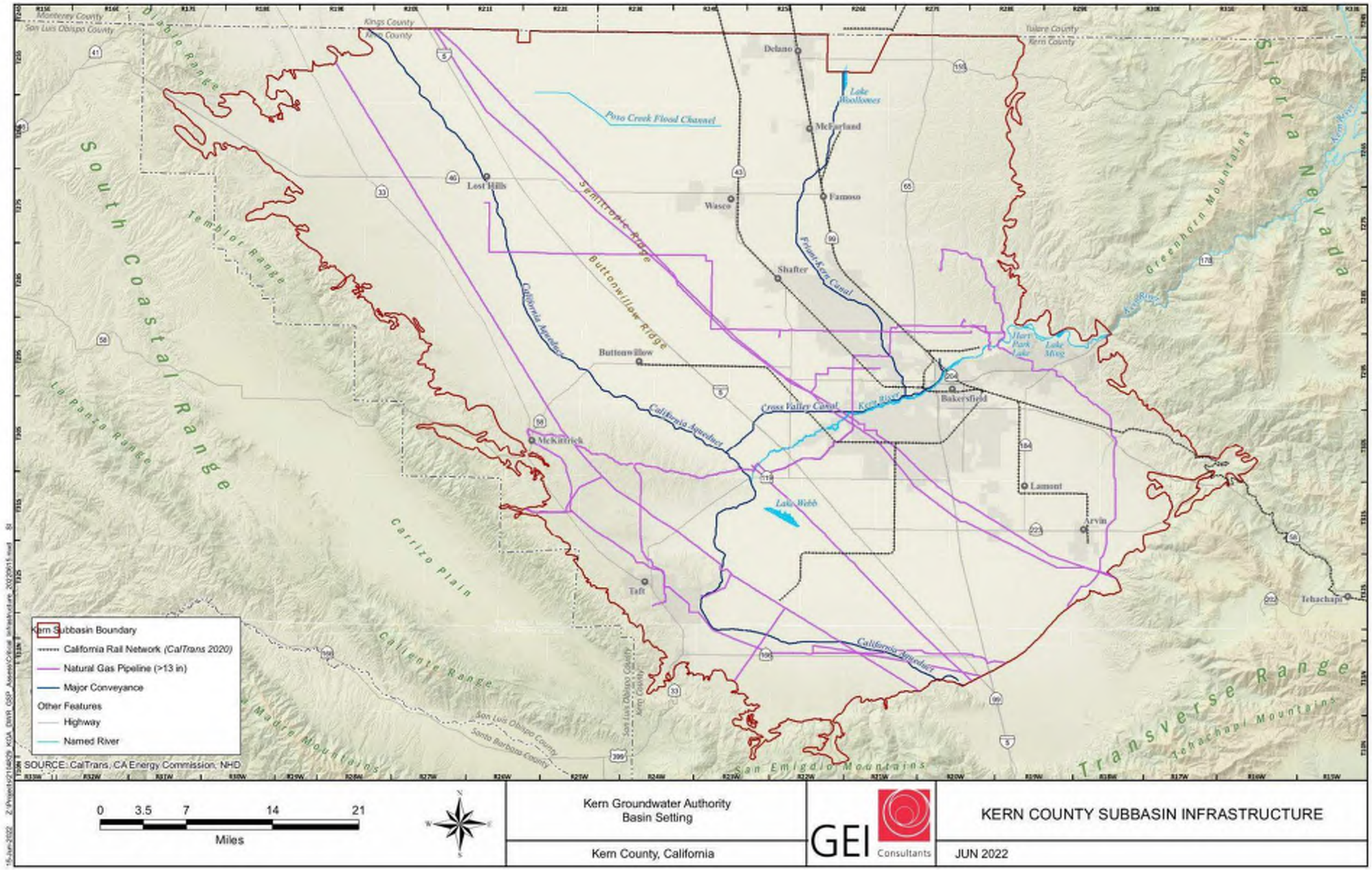


Figure 2-42 NEW. Potentially Impacted Regional Critical Infrastructure.

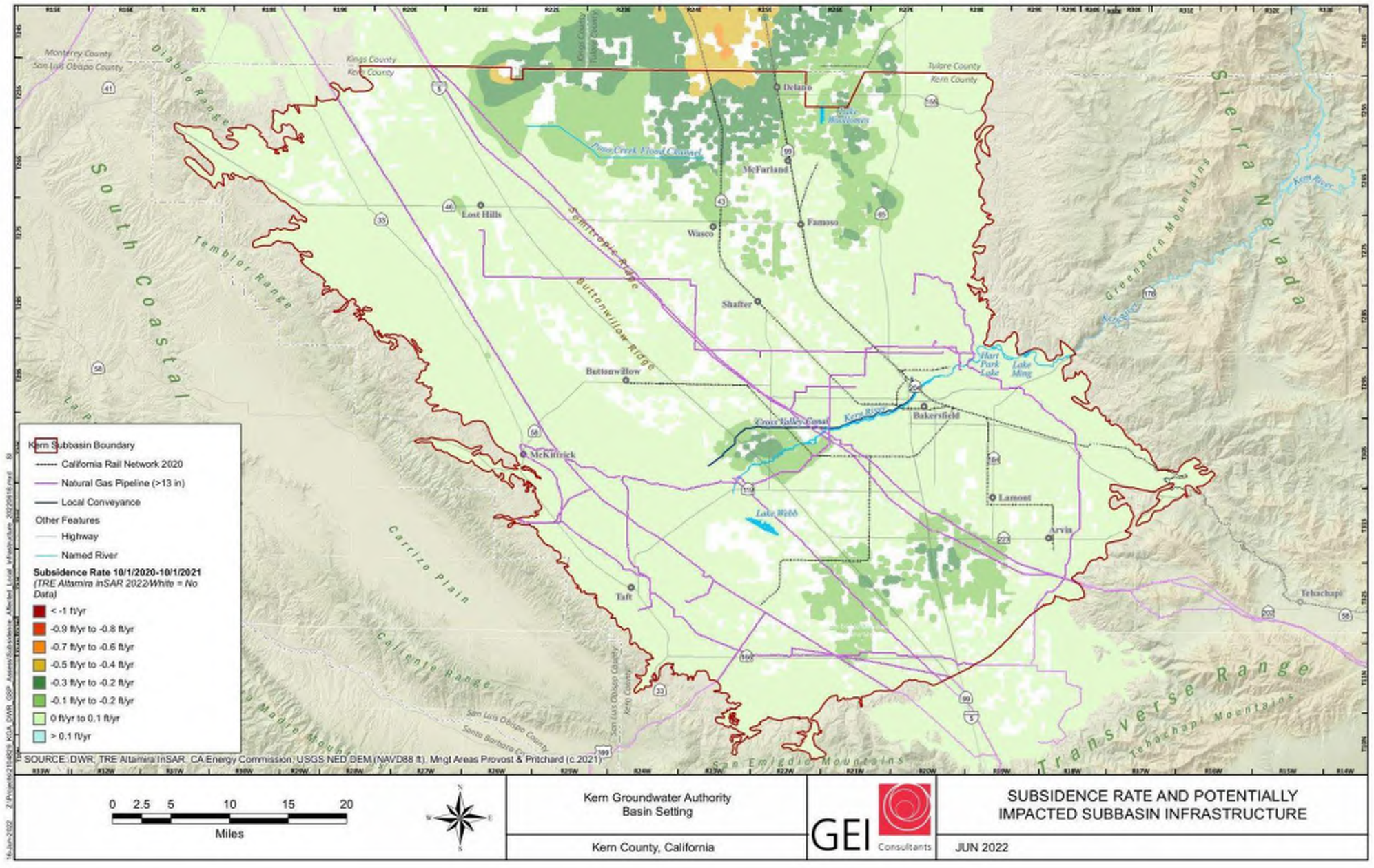


Figure 2-43 NEW. Potentially Impacted Regional Critical Infrastructure with Subsidence Rate.

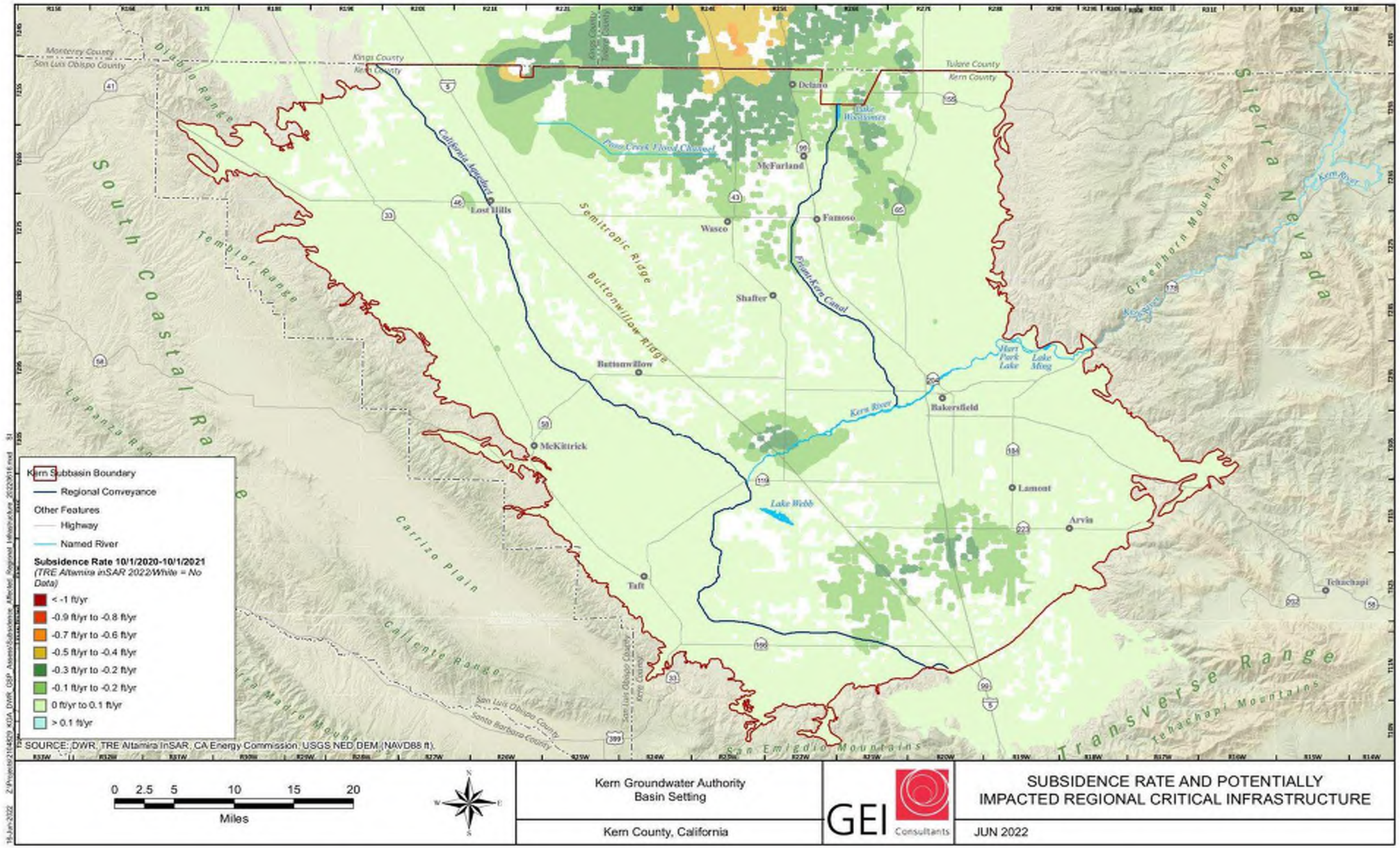


Figure 2-44 NEW. Identified Regional Critical Infrastructure with Subsidence Rate.

This Page is Intentionally Blank

Recognizing the wide variability in geologic, geotechnical and extraction activities present in the Subbasin, the Subbasin has developed two separate but coordinated methodologies for determining MOs and MTs for Aqueduct and the Friant-Kern Canal. The metric common to each of the methodologies is the amount of concrete liner freeboard in an area of interest and its relationship to operational capacity of the infrastructure. These methodologies, along with the aforementioned ongoing studies, will serve as the foundation for the development of future MOs and MTs in consultation with the DWR-CASP and the FWA.

2.3.4.4 Fault Movement

Within the Subbasin, Pond-Poso Fault movement has been detected during dry years. Although the impact to infrastructure is unknown, Holzer (1980) observed fault movement along the Pond-Poso Fault from February 1977 to March 1979. This fault movement was observed during seasons of water level decline, and Holzer concluded that 9 inches of offset had occurred along the Pond-Poso Fault System since the 1950's. In addition, Holzer (1980) observed that fault offset of groundwater levels was greater during dry years when the lowest seasonal water level low occurred.

2.3.4.5 Impacts to Well Casing

Just north of Subbasin, near Los Banos-Kettleman City, Wilson (1968) documented well casing failures attributed to land subsidence. Wilson reported that during 1950-1961 wells that were screened primarily below the Corcoran Clay experienced screen failures associated with compaction or land subsidence.

2.3.4.6 Degraded Water Quality

Degradation of water quality due to land subsidence has been studied in the San Joaquin Basin to the north of the Subbasin. Smith et. al. (2018), hypothesizes that poor water quality in clays may be released to the aquifer system during over pumping and compaction of clays. Specifically, data north of the Subbasin in the San Joaquin Valley may indicate that areas with a thicker Corcoran Clay extent have seen an increase in arsenic concentrations as subsidence rates have increased due to over pumping (Smith et. al., 2018).

2.3.4.7 Land Subsidence Monitoring

Historical documentation of subsidence has relied on various types of data, including ground surveys, declining groundwater levels, and borehole extensometers. Recent subsidence studies have relied on ground surveys, borehole extensometers, continuous GPS stations, and remote sensing (InSAR) to collect data.

Each method has advantages and drawbacks. An extensometer measures a discrete subsurface interval, or typically the interval of the ground surface to the total depth of the extensometer. On the other hand, CGPS and InSAR monitor overall change in ground surface relative to a datum such as sea level, regardless of the depth interval. Moreover, InSAR provides information over a

wide area, and when processed carefully, is extremely accurate, especially when coordinated with land-based CGPS.

2.3.4.8 Remote Sensing

Within the Central Valley, and in particular the Subbasin, researchers have utilized remote sensing techniques such as satellite-based Interferometric Synthetic Aperture Radar (InSAR) and aircraft-based L-band SAR or Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR). These surveys have been led by the National Aeronautics and Space Administration (NASA) and Jet Propulsion Laboratory (JPL), as well as other international researchers. The benefit of remote sensing is that large areas of land can be surveyed with no invasive actions or land surface access complications. DWR has commissioned studies (TRE Altamira, 2019) to evaluate the accuracy of remote sensing and identify additional processing and calibration methods for accuracy.

The following is a summary of recent remote sensing findings with respect to the TRE Altamira report:

- InSAR data with nearby UNAVCO CGPS have been processed and calibrated for northern Kern County Subbasin to the north of Visalia using the TRE Altamira-patented method SqueeSAR.
- InSAR calibration by TRE Altamira reports accuracy to 20 mm (0.07 feet) at 95% confidence interval.
- The calibration points include UNAVCO CGPS points (subsidence results as great as 8 inches over the time period of 2015 to 2018).
- Other points in the SOPAC network including Corcoran and Lemoore stations were not included in calibration; however, Ojha et al (2019) demonstrated that LEMA Lemoore and CRCN Corcoran (high subsidence areas) (at least 50 inches of subsidence between 2015 to 2018) may correlate well with InSAR.

Filling data gaps in the San Joaquin Valley with high subsidence areas lacking calibration monitoring points such as CGPS may be beneficial for future remote sensing work and calibration.

2.3.4.9 Historical Subsidence Results

Within the Subbasin, subsidence has been documented from leveling by the National Geodetic Survey at up to 12 feet from 1926 to 1970 (Ireland et al., 1984). USGS estimates that about 75 percent of the subsidence occurred in the 1950s and 1960s, corresponding to extensive groundwater development (Galloway, et al., 1999). Water levels during this period were continuing to fall to historic lows each year, for the first time, which were associated with larger amounts of subsidence (Todd, 2017).

Subsidence was also measured by USGS borehole extensometers in the west Subbasin from 1978 to 1983 (26S/23E-16H2 and 16H3) and to the south of Bakersfield from 1963 to 1978 in

Extensometer 32S-28E-20Q1). These two extensometers have since been abandoned; however, a couple new extensometers have been installed in the Subbasin.

2.3.4.10 Recent Subsidence Results

A comprehensive Differential InSAR study conducted by Earth Consultants International (ECI) (2021) (Attachment E1) on behalf of the Subbasin determined that previous InSAR studies by others may be overestimating subsidence rates by a significant factor (45 to 50 percent) within the Subbasin. It is believed that this discrepancy is the result of the short time intervals related to the acquisition of available InSAR data in the previous studies. To mitigate this condition ECI recommended that future Subbasin InSAR studies include a minimum time interval of five years' worth of InSAR data to enhance data resolution and accuracy. The vertical resolution of the Subbasin study was approximately 2.4 millimeters per year (mm/yr) and was ground-truthed with land-based GPS data. Examples of data from the ECI study versus previous studies is provided here.

- Friant-Kern Cana Mileposts 120-130 (AOI-1). Previous InSAR monitoring had detected up to five inches per year of subsidence in areas surrounding this segment of the Friant-Kern Canal. The ECI study found the rate of annual subsidence to average between two and three inches.
- Aqueduct Mileposts 196 to 215 (AOI-2). A separate study by the WDWA in 2019 and early 2020 identified Lost Hills Oilfield activities as the contributing cause of identified subsidence. The ECI study found that subsidence along this segment displays the characteristics of oil field activities, and that the area is isolated by areas of generally lower subsidence, suggesting that agricultural groundwater extraction is minimal in this area.
- Friant-Kern Canal Mileposts 130 to 137 (AOI-3). The ECI study estimated annual subsidence rates at around two to three inches. This rate is similar to that for AOI 1.
- Aqueduct Mileposts 267 to 271 (AOI-4). The ECI study estimated annual subsidence in this area to be approximately one to two inches. Previous studies reported subsidence as being between two and four inches.
- North Boundary of Subbasin (AOI-5). A review of the subsidence rate for 2015-2016 presented in the JPL/NASA data indicates this area experienced between five and eight inches of subsidence. Data from the ECI study found the average rate of subsidence for the period between April 2015 and September 2020 was much lower at approximately two to four inches.

More recent DWR data now seems to correlate with the ECI data, and LBL InSAR data was concluded to be in reasonable agreement with the ECI data. The KGA and its members recognize InSAR is a valuable tool, in conjunction with ground-based geodetic technology, for assessing subsidence in relation to Subbasin identified critical infrastructure. To ensure the best suite of technologies and methodology are brought to bear on subsidence affecting Subbasin critical

infrastructure, the Subbasin will reassess both the methodology for determining the current interim MOs/MTs and the infrastructure specific MO/MT levels in 2025.

2.3.4.11 Annual Rate of Subsidence

The following tabulated summary data includes cumulative inches of subsidence within Subbasin, and a calculated approximate annual rate for the time period for the data collection period. As discussed above the InSAR data in this Table 2-7 may be overestimating subsidence by a significant factor (approximately 45% to 50% over estimation).

Table 2-7 Land Subsidence Data

Subbasin Area	Date Range	Cumulative Subsidence (inches)	Calculated Annual Rate of Subsidence (inches/year)	Source
Historical Range in the Subbasin	1926 - 1970	12 - 96	~ 0.3 - 2.2	Ireland, 1984. Topographic Maps and Leveling Data.
North Central Subbasin	1978 - 1983	-0.04 – 1.5	-0.001 – 0.03	Extensometer 26S/23E-16H2 and -H3, USGS
South of Bakersfield	1963 – 1977	23.3	~0.14	Extensometer 32S-28E-20Q1, USGS
North and West Subbasin	2005 - 2017	0.1 – 11.7 0.2	~0 – 1.3	CGPS PBO. (BVPP, P544, P545, P563, P564, P565).
South Central Subbasin	2006-2016	9.8 - 11.5	~1.1	CGPS (BKR1/BKR2, ARM1)
West Subbasin and South of Bakersfield	Jan. 2007 – Mar. 2011	6.0	~1.4	LSCE, 2014. Compiled from InSAR.
North Central Subbasin	Dec. 2013 – Mar. 2018	3.2	~0.8	SWSD Extensometer 25S22E35B001M
Central Subbasin	July 1994 - June 2018	-3 (negative value indicates uplift)	Not Presented Here.	Kern Fan Extensometer 30S/25E-16L According to AECOM (2016), data from extensometer show “little response to changes in water level changes during recharge or recovery operations.”
Southwest Subbasin along California Aqueduct	Apr. 2014 – Jan. 2015	0.5 - 5	~0.7 – 6.7	UAVSAR. InSAR Canadian Radarsat-2 (Farr et al., 2015)
North Central Subbasin	May 2015 – Sep. 2016	~1 - 12	~1.3 – 9.2	InSAR ESA Sentinel-1A (Farr et al., 2016)
Southwest Subbasin along California Aqueduct	Apr. 2014 – Jun. 2016	0 - 16	~0 – 7.4	UAVSAR (Farr et al., 2016)

2.3.4.12 Map of Subsidence Locations

Historic JPL InSAR data (Figures 2-44 to 2-48) is provided for context and comparison to Figures 2-49 and 2-50 which shows the recent subsidence rate in the Kern Subbasin from

California Groundwater Live website. Analysis of historic JPL InSAR data by ECI as part of their 2021 InSAR Study concluded that the JPL data may be over estimating subsidence rates by 40 to 50% in areas with seasonal groundwater withdrawals. A subsequent study conducted by the Lawrence Berkeley Laboratory (LBL) concluded that their subsidence rate for various ports of the Kern Subbasin were in reasonable agreement with the ECI data. The data in Figure 2-49 and 2-50 provides more current InSAR data reported by DWR on the California Groundwater Live website which appears to comport with ECI and LBL findings.

2.3.4.13 Data Gaps in Subsidence Understanding

Based on the data gathered through recent investigations, it is apparent that key data gaps pertaining to the various causes and rates of subsidence in the Subbasin still remain and that further study is needed to better define realistic management objectives for the Subbasin. To this end, in addition to the LBNL study, the Subbasin will install extensometers, near the FKC, and work in close consultation with DWR-CASP and Friant Water Authority to update and interpret new InSAR data. In addition, the Subbasin is in the process of preparing an updated basin study. The Subbasin has also committed to working cooperatively with the DWR- CASP and the FWA in the planning and installation of other geodetic-based monitoring technology in the Subbasin. The goal of the ongoing studies is to: 1.) more fully quantify the individual causes of subsidence, and 2.) establish data-based subsidence MOs/MTs for Subbasin critical infrastructure and individual management area critical infrastructure as appropriate.

There are data gaps in land subsidence that will be considered for future data collection. These data gaps include subsidence monitoring along points of critical infrastructure such as the Friant Kern Canal and California Aqueduct.

As described herein, there are a valuable dataset of CGPS monitoring points with which to pair water level monitoring data; however, InSAR data show that many of the CGPS points are not in zones of high subsidence, nor adjacent to critical infrastructure. Therefore, CGPS points alone are useful as quality control points, but they are likely not situated in areas of high subsidence or near critical infrastructure to facilitate decision making on sustainable management criteria.

InSAR is a dataset that may be able to fill the gaps between CGPS points. Continued InSAR data collection over appropriate time intervals as recommended by ECI and LBL can fill the temporal data gap in the record. Correlations between CGPS and InSAR could confirm InSAR results in high subsidence areas near Subbasin, as they have been demonstrated in low subsidence and other areas (Tre Altamira, 2019; and Ojha et al, 2019, ECI 2021).

As the water level monitoring network is established in the Subbasin, collocated temporal water level data with CGPS data can be collected to evaluate the relationship between active subsidence and residual subsidence with respect to water level change over time. The understanding of residual subsidence will better inform sustainable management criteria for setting thresholds.

2.3.4.13.1 Work in Progress

At the June 17, 2022, meeting with DWR, the Kern Subbasin presented the findings of two important subsidence studies conducted subsequent to the January 2020 submission of the Subbasin groundwater sustainability plans (GSP). Both subsidence studies indicate that groundwater extractions under the purview of SGMA are not the sole cause of historical subsidence. The studies also identified that significant additional data is required to fully understand the dynamics of subsidence, its impacts on critical infrastructure including the California Aqueduct and the Friant-Kern Canal, and whether such impacts can be influenced by groundwater management as altered by future projects and management actions.

Based on the presentation of data, the Kern Subbasin Groundwater Sustainability Agencies (GSAs) expressed concern with setting SMCs where significant data gaps exist. The Kern Subbasin GSAs understand that DWR has addressed the issue of data gaps in the Monitoring Networks and Identification of Data Gaps Best Management Practice warning that "Data must be of sufficient quality to enable scientifically defensible decision." (Monitoring Networks and Identification of Data Gaps Best Management Practice, page 27.)

DWR SGMA staff understood the data provided by the Kern subbasin and appreciated the challenge of setting sustainable management criteria in the face of data gaps. However, DWR stated substantial compliance with the requirements of the Sustainable Groundwater Management Act (SGMA) requires the development of interim SMCs for subsidence and DWR SGMA staff stated that the setting of the SMC can include caveats. Therefore, the Kern subbasin will proceed with the development of interim sustainable management criteria for subsidence with the following caveats which may not be inclusive.

- The sustainable management criteria can be interim, and will be updated in the 2025 GSP update;
- Due to the complexity of the Kern Subbasin, setting of an interim SMC for subsidence, does not require GSAs take responsibility, manage, regulate or otherwise be liable for impacts resulting from actions outside the authority of the GSA or outside the GSA's ability to manage sustainability under SGMA; and
- That the Kern Subbasin GSAs are not responsible for addressing subsidence caused by activities outside of the jurisdiction of SGMA i.e., extractions from exempt aquifers, or caused by activities other than extraction of water on behalf of the beneficial users under the purview of SGMA.

The SMCs for subsidence described in the remainder of this white paper were developed with consideration of these caveats.

2.3.4.13.2 CA Aqueduct

As the Kern subbasin moves forward, we believe significant data gaps pertaining to the various causes and rates of subsidence in the KCS still exist and, that if addressed, will lead to better defined management objectives for the Aqueduct and help focus planned and future monitoring

resources where they will be most effective. We also believe that working jointly and in close consultation with the DWR-CASP team would multiply the respective expertise and resources of both parties to the benefit of all those dependent on the Aqueduct. The Kern subbasin has been meeting with the CASP team since 2019 to move forward this concept of joint cooperation to develop data-based management objectives and future sustainable management criteria. As such, the Kern Subbasin and DWR CASP have agreed, as proponents for the sustainable management of the Aqueduct, to continue to work collaboratively to assess the causes and potential solutions to subsidence on the Aqueduct.

2.3.4.13.3 Friant-Kern Canal

Kern Subbasin is in contact with the FWA and will continue to work with FWA on filling data gaps as well as coordinate on a monitoring network. The FWA (in conjunction with the Bureau of Reclamation) is developing a proposed a system-wide Friant-Kern Canal Capacity Correction Program (Program). Both entities have already begun the correction phase of the Middle Reach, which experienced significant capacity loss (over 60%) as a result of regional subsidence. The proposed Program includes identifying impacts to water supplies from the loss of flow capacity in the Lower Reach. Several Kern Subbasin representatives are involved in the Program and will continue to monitor the Program with respect to SGMA compliance and implementation.

2.3.5 Interconnected Surface Water Systems

Interconnected surface water systems are surface waters that are hydraulically connected by a continuous saturated zone to an underlying aquifer 23-CCR § 351(o). Within the Subbasin, there are no interconnected natural surface water systems in monitored areas associated with the pumping zone of the regional aquifer system.

The following are naturally occurring surface water bodies within the Subbasin:

- Kern River: Flows within the Subbasin (located within the Olcese and Kern River GSAs) are a function of hydrologic conditions in the Kern River watershed and regulation by Isabella Dam and Reservoir; and
- Poso Creek and other minor streams: Streamflow is unregulated and is ephemeral within the Subbasin, principally occurring during “wet” months of “wet” years.

Other surface water bodies, such as the Buena Vista Aquatic Recreation Area lakes, are situated in former basins of natural surface water bodies but are now dependent on managed water deliveries.

Since the advent of groundwater pumping in the Subbasin and subsequent impoundment and regulation of flow of the Kern River, groundwater levels near the river are no longer connected with the riverbed by a continuous saturated zone. Water quality data suggest that some portion of the recharge to the principal water-bearing aquifer underlying the far eastern portion of the Subbasin (the Olcese Sand Aquifer) may come from percolation of Kern River surface water via seepage through the Kern Gorge Fault and/or through the overlying shallow alluvium. However, such recharge occurs independent of groundwater production in the principal aquifer, and there is

no known pumping from the shallow alluvium zone itself. Thus, there is no interconnected surface water under the influence of groundwater pumping in the principal aquifer in this area and no impacts to interconnected surface water have been observed.

The observation that there are now no interconnected surface water systems in the Subbasin is reflected in the aquifer characterization found in locally developed groundwater models. For example, groundwater levels in the Kern Delta Water District Superposition Model are indicated to be disconnected from the Kern River and other simulated streams (Todd, 2017). See the Kern River GSA GSP, which addresses in more detail the lack of interconnected surface water around the Kern River bed, as the area in around the Kern River bed is located within the jurisdiction of the Kern River GSA. The information below, as required by GSP regulations, is provided for completeness of the KGA GSP basin setting, however, for a more detailed discussion of interconnected surface water systems related to the Kern River, see the Olcese and Kern River GSAs GSPs, as the Kern River is outside of the jurisdictional area of the KGA.

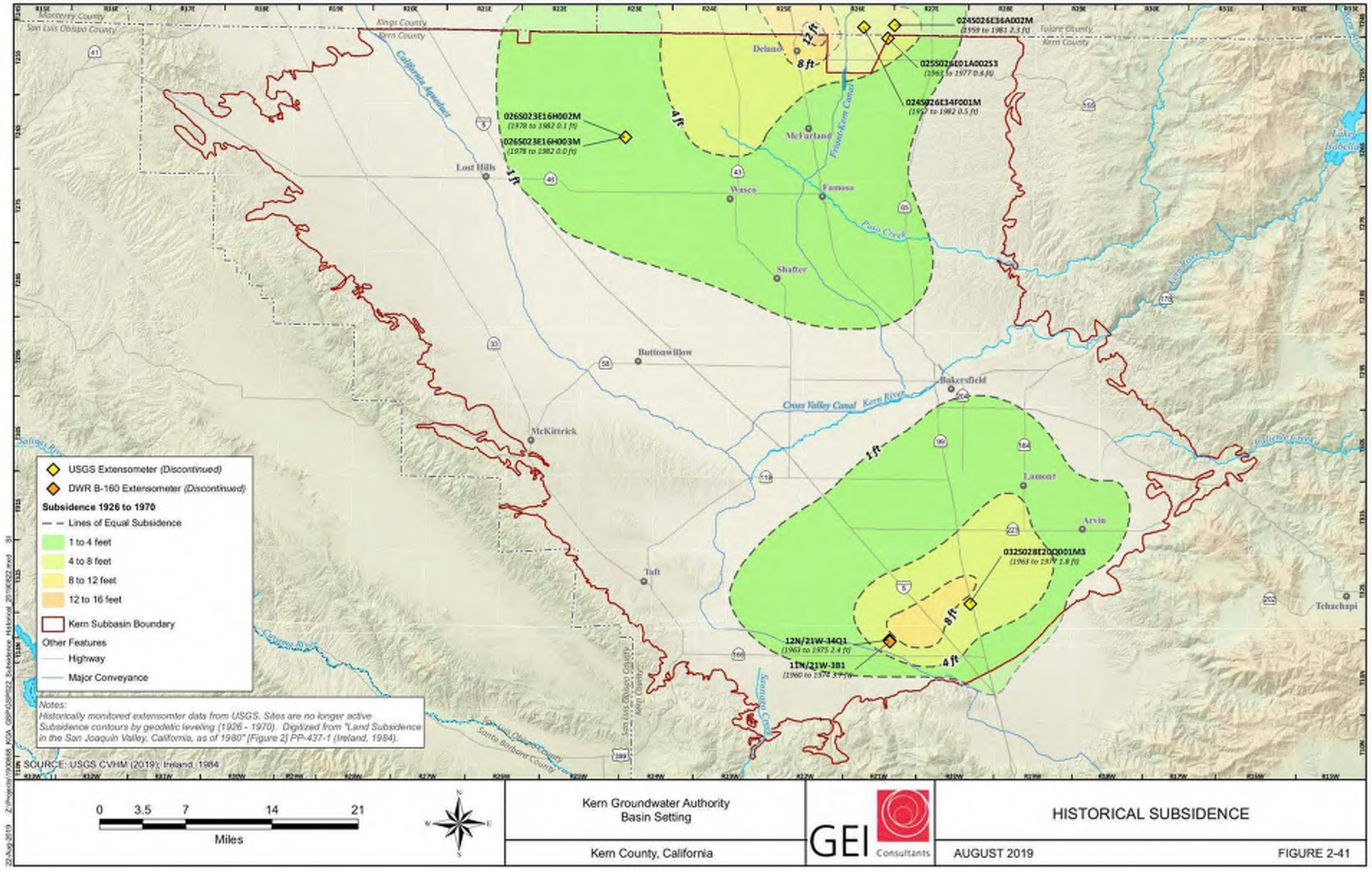


Figure 2-44. Historical Subsidence

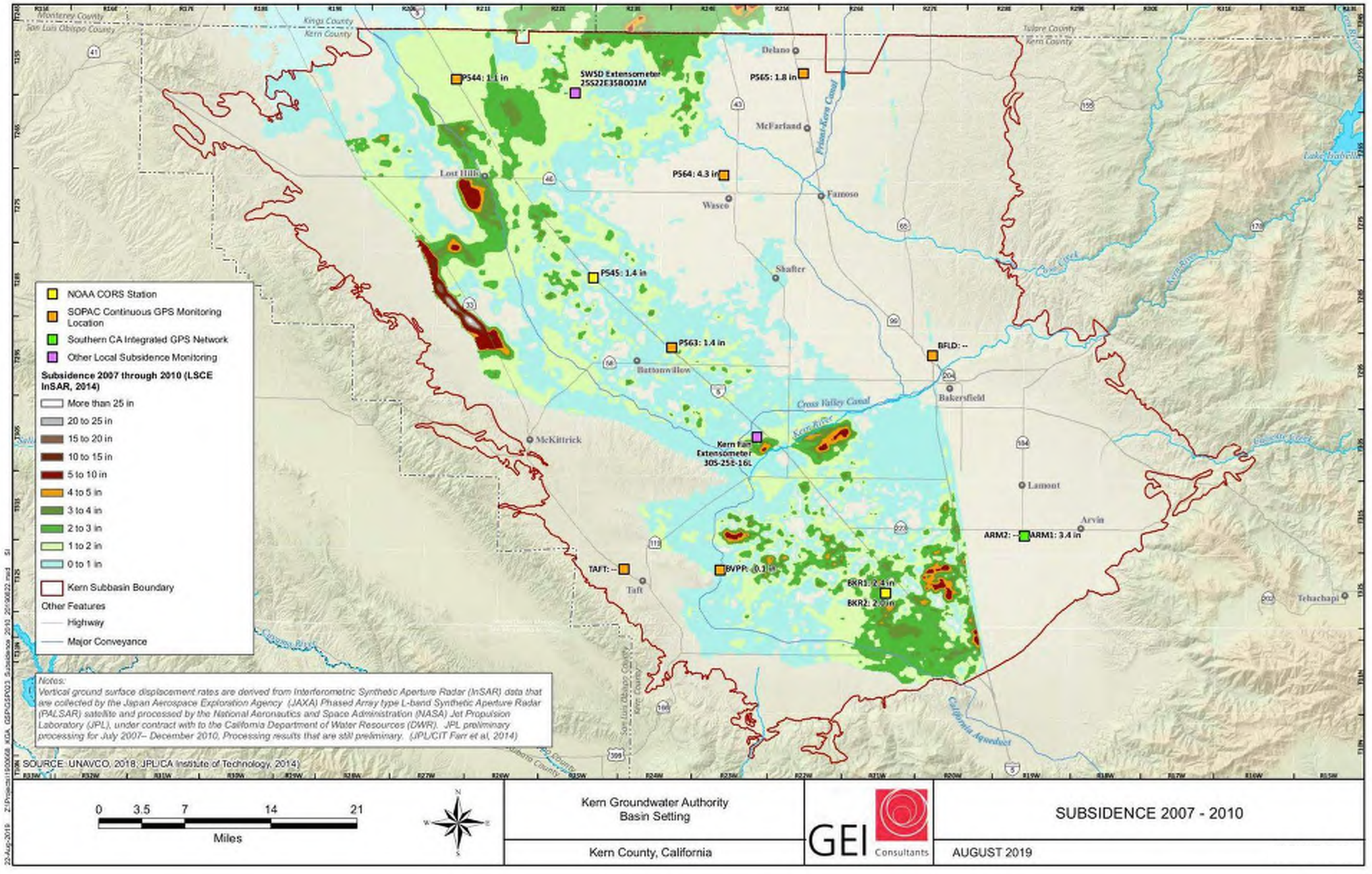


Figure 2-45. Subsidence 2007-2010

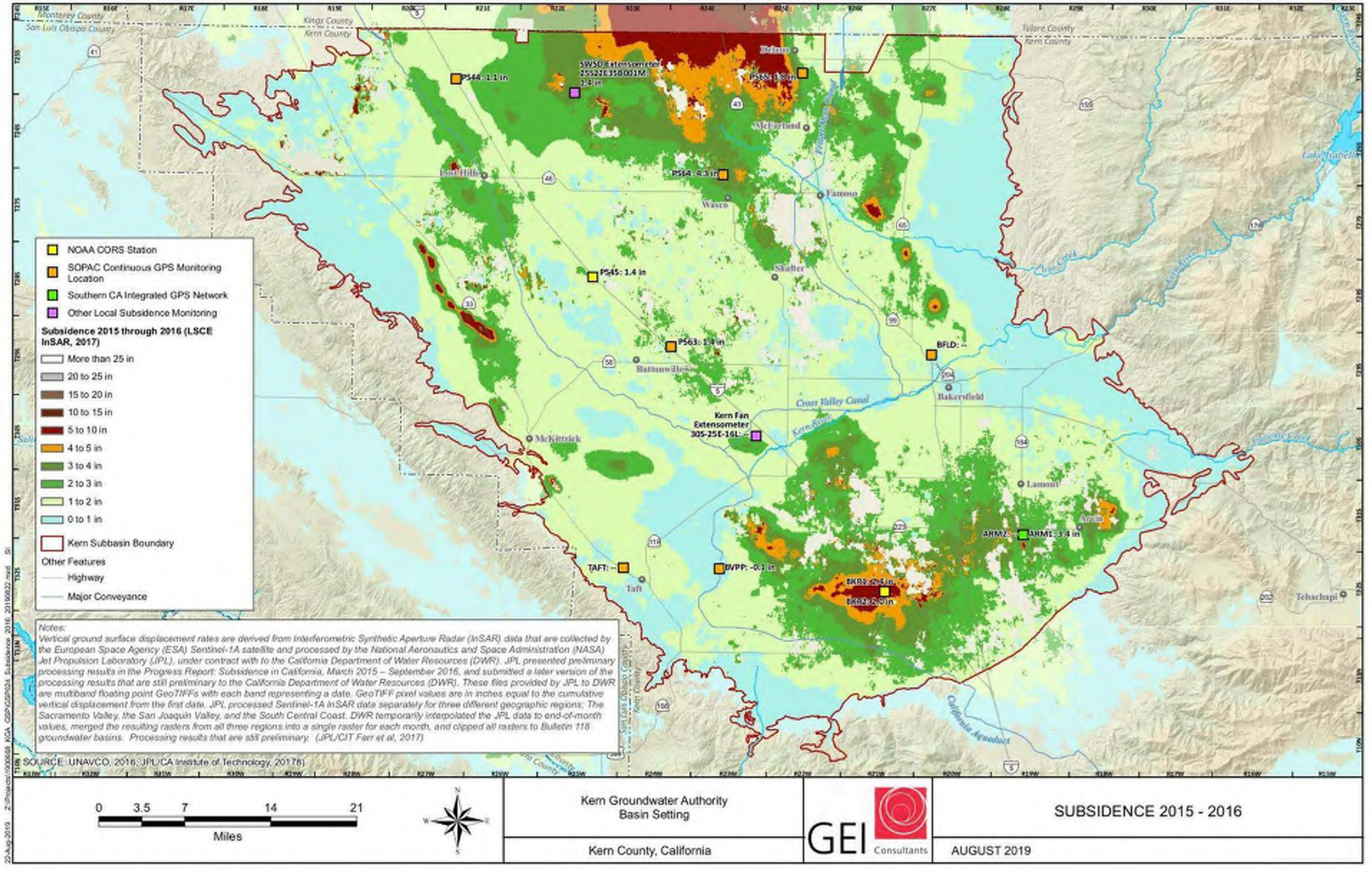


Figure 2-46. Subsidence 2015-2016

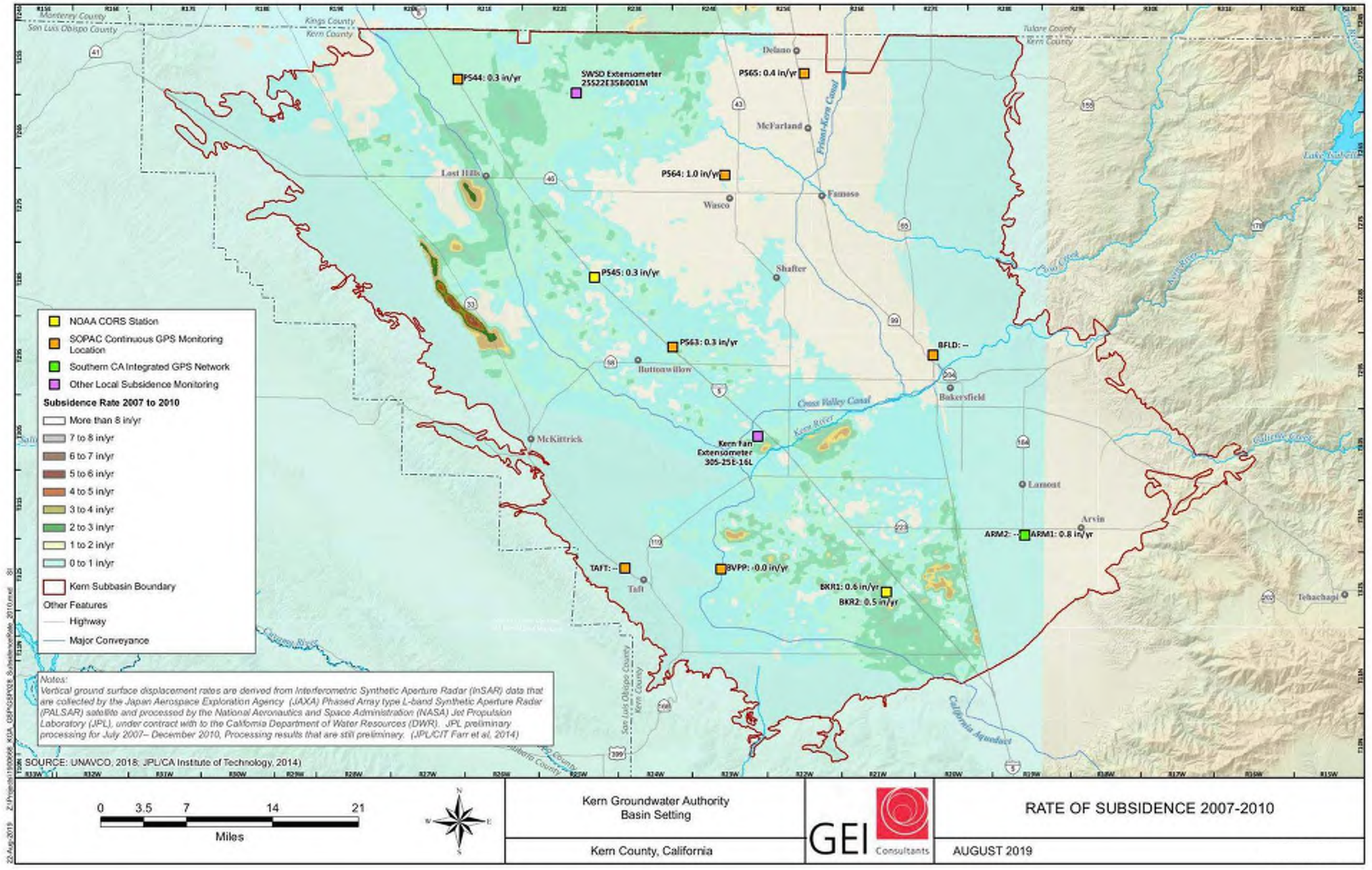


Figure 2-47. Rate of Subsidence 2007-2010

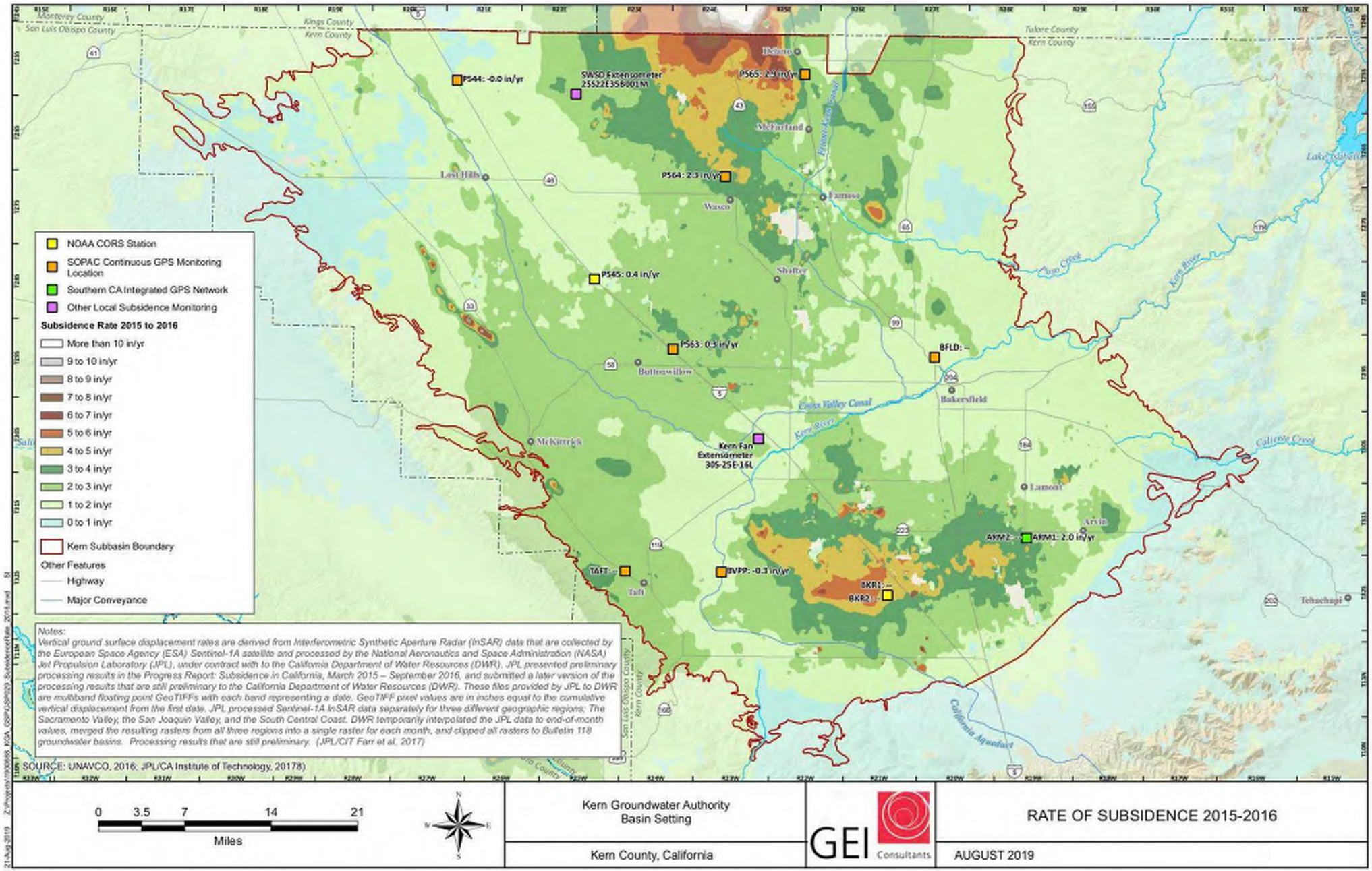


Figure 2-48. Rate of Subsidence 2015-2016

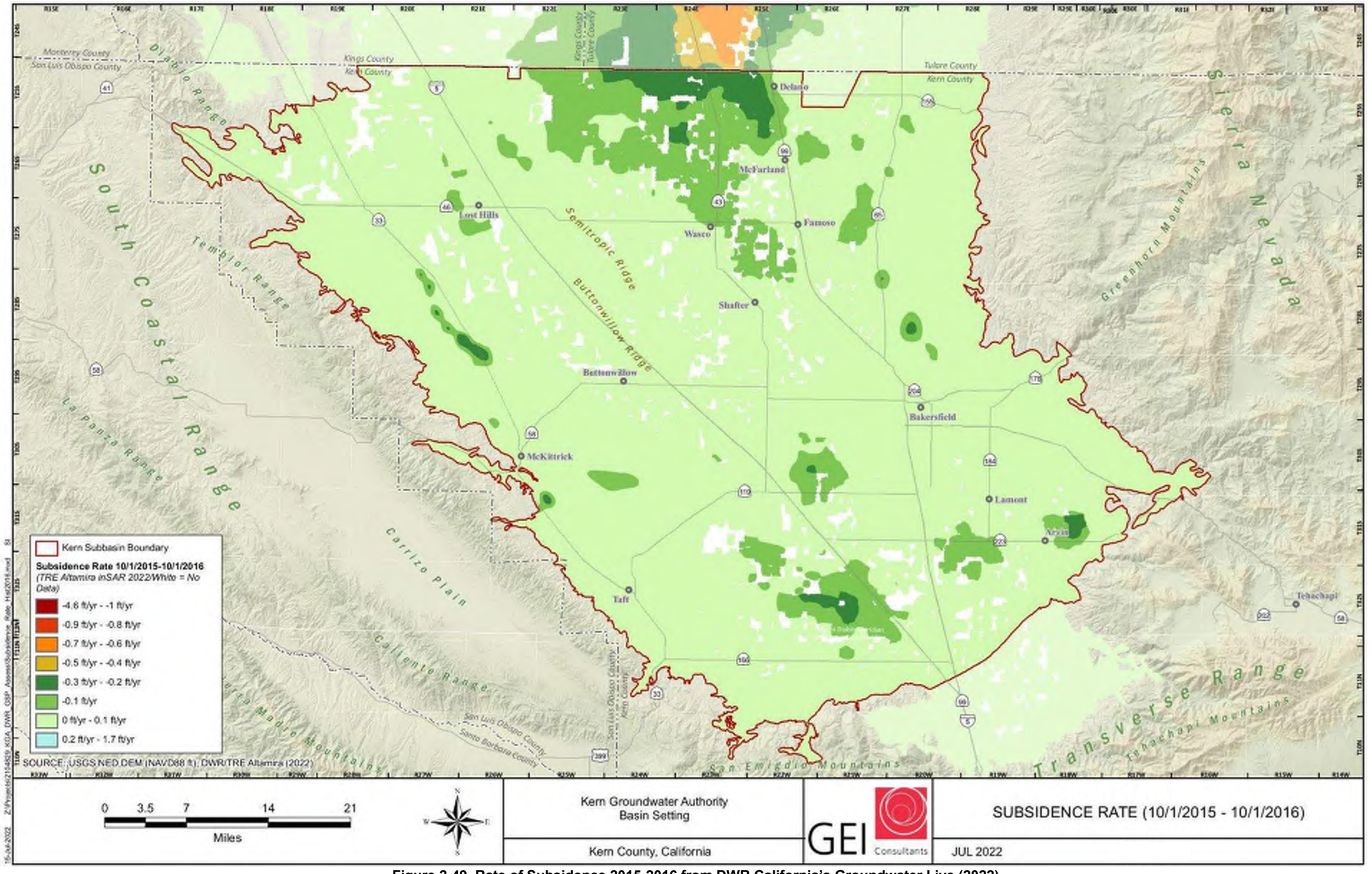


Figure 2-49. Rate of Subsidence 2015-2016 from DWR California's Groundwater Live (2022)

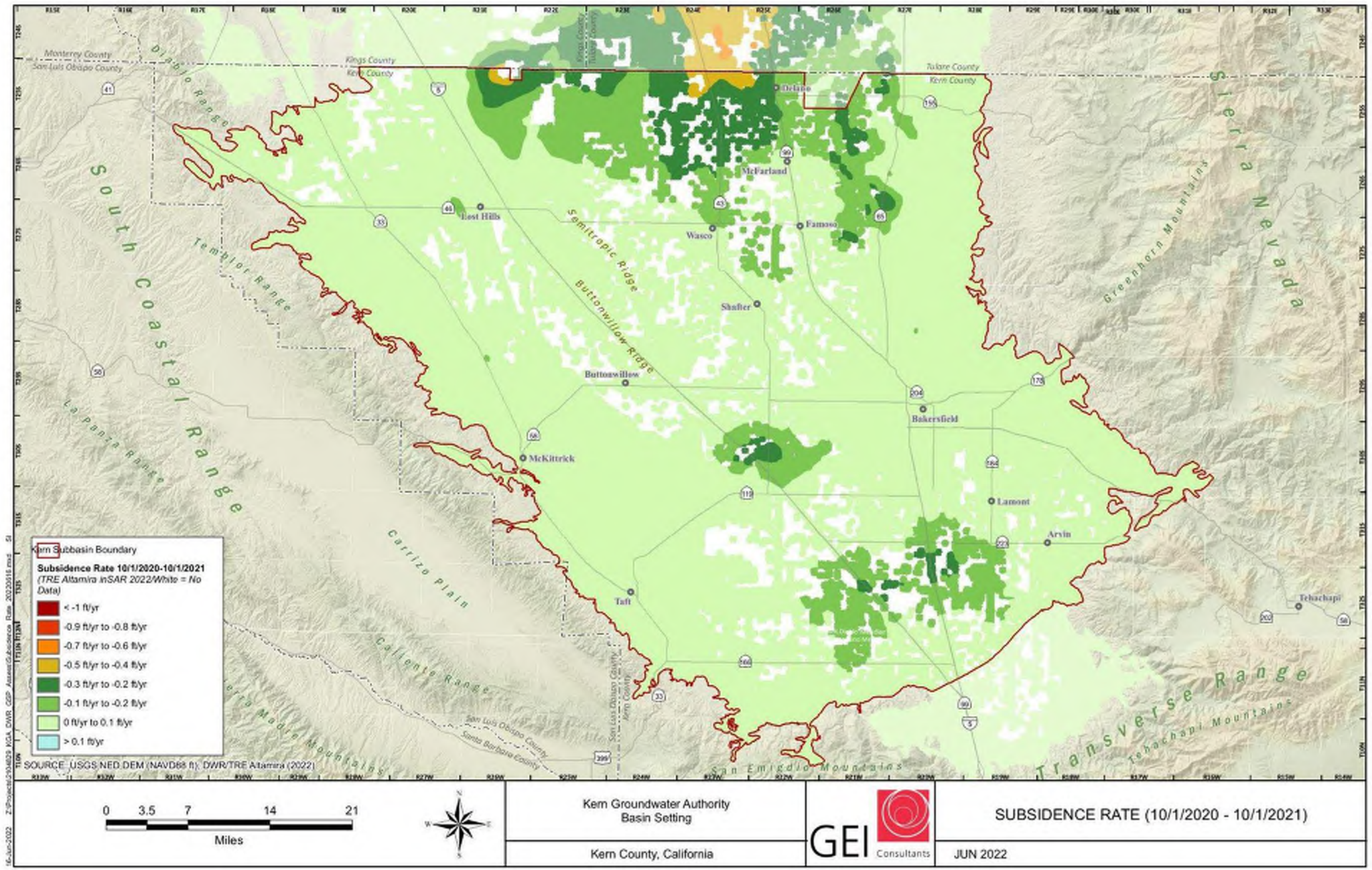


Figure 2-50. Rate of Subsidence 2020-2021 from DWR California's Groundwater Live (2022)

This Page is Intentionally Blank

2.3.5.1 Groundwater Elevation and the Kern River

Recent maps of groundwater contours developed by the Kern County Water Agency Improvement District 4 indicate there is a significant separation between the potentiometric surface near the river channel and the elevation of the river bed in areas where groundwater elevations have been mapped near the Kern River. The Hydrologic Profile from the most recent *Kern Fan Operations Report* (KCWA, 2018), illustrates prevailing groundwater conditions both spatially and temporally near the Kern River. This profile, which is transverse to the axis of the Kern River, indicates that during "wet" years, such as 1998 and 2006, groundwater elevations are highest directly below the Kern River bed while, during "dry" years, groundwater levels have declined to depths greater than 200 feet below the river bed. This prevailing pattern suggests that, during wet years, recharge to groundwater from the Kern River channel and nearby water banking operations forms a groundwater mound that gradually flows away from the river to the north and the south. Conversely, in dry years, there is an overall decrease in groundwater levels due to the lack of recharge from the Kern River and nearby water banking operations.

2.3.5.2 Hydrographs

Upstream of the Improvement District 4 monitoring coverage is a segment of the river, near Hart Park and the First Point of Measurement within Subbasin, that has available groundwater elevation data from the Kern County Water Agency for supply wells 29S/28E-02A01 and 29S/28E-10K01. These wells are located upgradient of Rocky Point Weir, and groundwater elevation data are plotted against the elevation of the adjacent river bed. In general, water levels in the wells consistently ranged from approximately 27 to 49 feet lower than the river bed between 1995 to 2016 (Figure 2-51). The Kern River is outside of the KGA jurisdictional area. For more information see the Olcese and Kern River GSA GSPs.

2.3.5.3 Stream Gaging

Stream gaging data for the Kern River are available for stations upstream of the Subbasin at Democrat Springs (USGS 11192500 and USGS 11192000), as well as at the First Point of Measurement upstream of Beardsley River Weir and Rocky Point Weir. Differences in annual flow volumes were calculated between Democrat Springs and the First Point of Measurement (factoring in diversions between these points) for water years 1990 through 2016. In general, streamflow tends to increase between Democrat Springs and the First Point of Measurement during wet years (i.e. 1993, 1998, 2005, and 2011), which in part reflects surface water inflow from tributaries along this segment of the River. In contrast, Kern River flows decrease during some dry years such as 2001, 2008, 2009, and 2013, but also exhibit gains during the periods from 2001 to 2002 and from 2013 to 2014.

The Kern River is outside of the KGA jurisdictional area. For more information see the Olcese and Kern River GSA GSPs.

2.3.5.4 Data Gaps

Although available data confirm that the Kern River is not interconnected with the underlying groundwater downstream of the First Point of Measurement, it appears that the Kern River from Democrat Springs to the First Point of Measurement may be gaining flow, with accretion from groundwater being one of the sources contributing to these gains. However, available data between these two locations (approximate 22 1/2-mile reach) are not adequate to refine the assessment of gaining and losing segments from the east boundary of the Subbasin to the First Point of Measurement (approximate 10-mile reach). In this regard, there are several mapped springs throughout the Kern River Canyon, with an absence of any mapped springs below the mouth of the canyon within the Subbasin, indicating that the majority of gains are likely within the canyon. For additional information see the Olcese and Kern River GSA GSP.

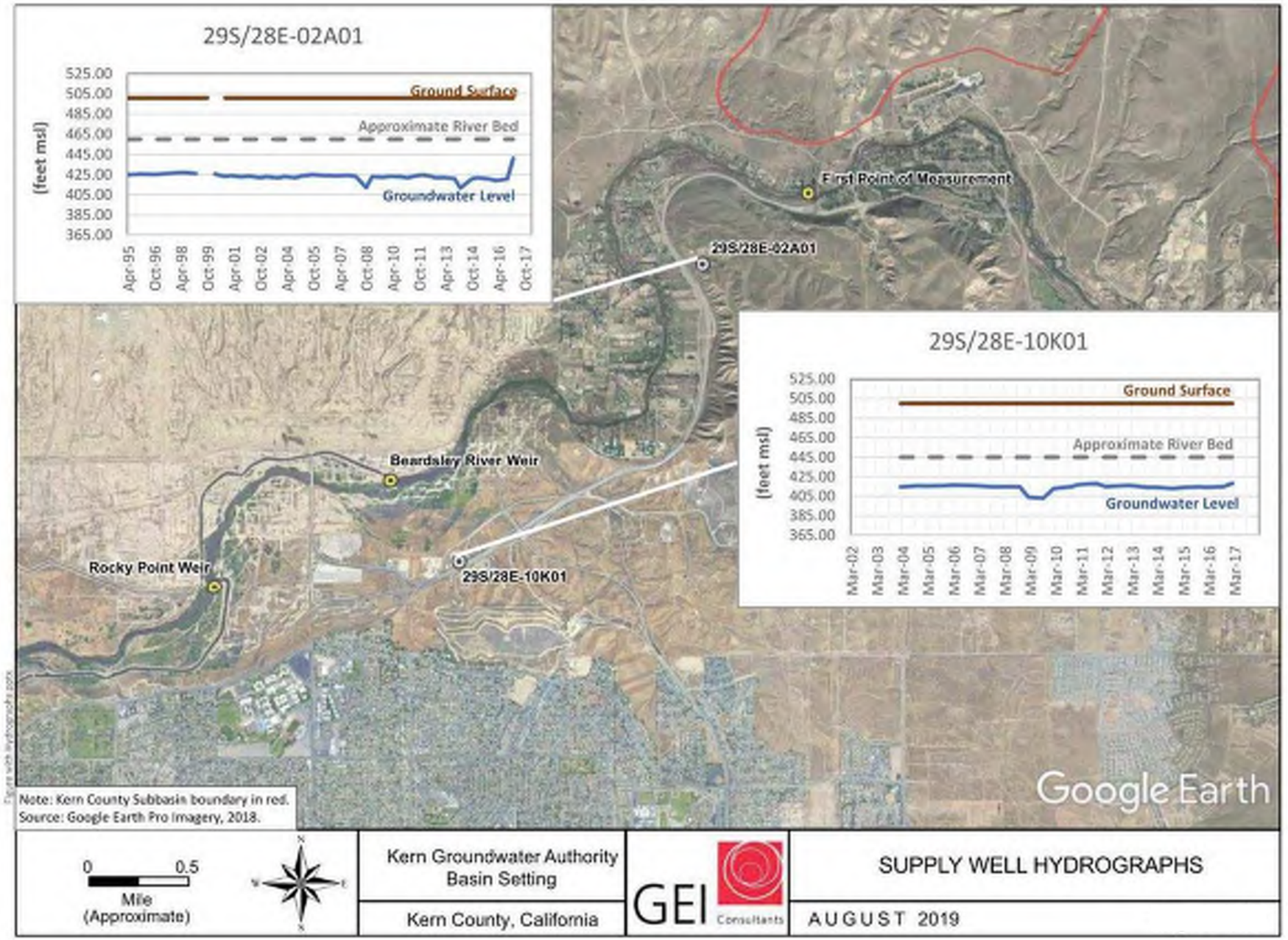


Figure 2-51. Supply Well Hydrographs

This Page is Intentionally Blank

2.3.6 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecological communities that depend on groundwater emerging from aquifers or groundwater occurring near the ground surface (shallow water table). In the Kern Subbasin, potential GDEs are likely to be associated with wetlands and riparian areas that are supported either by shallow groundwater or by a combination of shallow groundwater and surface water. As discussed previously, shallow groundwater is present in west-central and southern portions of the Subbasin. Ephemeral wetlands covered by water seasonally are likely to be supported by irrigation deliveries and precipitation and are unlikely to be surface expressions of groundwater. For example, the Kern National Wildlife Refuge, is now sustained by imported surface water (USFS, 2005). Other features having the potential to provide habitat, such as groundwater recharge basins that are artificially flooded with surface water, also depend on diversion of surface water rather than a shallow groundwater table. The distribution of potential GDEs in the Kern Subbasin was assessed based on DWR's Natural Communities Commonly Associated with Groundwater (NCCAG) data.

The following is taken from the DWR Natural Communities dataset website for NCCAG (DWR, 2019):

> *"*The Natural Communities dataset is a compilation of 48 publicly available State and Federal agency datasets that map vegetation, wetlands, springs, and seeps in California. A working group comprised of DWR, the California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC) reviewed the compiled dataset and conducted a screening process to exclude vegetation and wetland types less likely to be associated with groundwater and retain types commonly associated with groundwater, based on criteria described in Klausmeyer et al., 2018. Two habitat classes are included in the Natural Communities dataset: (1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and (2) vegetation types commonly associated with the sub-surface presence of groundwater (phreatophytes)."

The data included in the Natural Communities dataset do not represent DWRs determination of a GDE. However, the Natural Communities dataset can be used by GSAs as a starting point when approaching the task of identifying GDEs within a groundwater basin."

Figure 2-52 shows CDFW lands in the Central Region. Similarly, Figure 2-53a and 2-53b shows potential location of wetlands and GDEs in the Subbasin, respectively, as identified in the National Hydrography Dataset. In addition, the surface water bodies from the National Hydrography Dataset are also discussed in relation to potential GDEs.

The below discussion presents NCCAG dataset of the Subbasin. Any further details regarding these mapped datasets are provided in the management area plans. Where data gaps exist, future monitoring and GSP updates will seek to fill these gaps, as described in the management area plans of the individual KGA members.

2.3.6.1 NCCAG Mapped Data

Figure 2-29 displays the locations of seeps and springs based on data extracted from the National Hydrography Dataset at the base of the mountains and foothills in the southeast, southwest, and northwest edges of the Subbasin.

Figure 2-53a and 2-53b displays NCCAG data in the Subbasin. NCCAG features are mapped along spring-fed streams in the southwest along the perimeter of the Subbasin: Santiago Creek to San Emigdio Creek situated in the Wind Wolves Preserve. Toward the east, Pleitito and Pleito Creeks have mapped NCCAG datasets. Potential spring-fed streams to the southeast of Sycamore Canyon Golf Course may have associated NCCAG mapped data. In the southeast corner of the Subbasin, in the highlands along the Caliente Creek drainage are mapped NCCAG features. On the eastern side of the Subbasin, NCCAG wetlands and vegetation are mapped along the Kern River and Poso Creek. On the northern boundary of the Subbasin, NCCAG wetlands and vegetation are mapped in the Kern River channel to the southwest of Kern Wildlife Refuge. Along the western edges of the Subbasin, there are mapped NCCAG features.

Groundwater potentiometric surfaces from Kern Fan Monitoring Reports (KCWA, 2016) indicate that underlying aquifers are not connected with stream channels. Some flow in the Kern River, as well as in Poso Creek and other mountain-front creeks, is likely to be sustained periodically by release of bank storage (surface water stored in stream banks), but the underlying groundwater is too deep to sustain flow in the valley floor.

2.3.6.2 Evaluation of NCCAG Results

The conditions in the center of the Subbasin suggest that the groundwater production aquifer does not reach the shallow subsurface. The production aquifer lies at depths that prevent surface water expressions or accessibility for vegetation. The respective chapters within this GSP may present additional data regarding NCCAG mapped dataset.

Based on the NCCAG dataset along the margins of the Subbasin where spring-fed streams exist, further confirmation is needed to evaluate the presence of GDEs. Chapter-level GSPs, where necessary, provide local details regarding the current understanding of potential GDEs in the respective area.

In the west-central and southern-central Subbasin, shallow groundwater levels are present. These clays have historically been a concern regarding encroachment of poor-quality perched groundwater into crop root zones. The shallow groundwater in the west-central and southern-central Subbasin is not well suited for agricultural or domestic water supply; therefore, existing water management practices and practices that may be introduced through the implementation of SGMA are unlikely to draw on the shallow groundwater that may support potential GDEs.

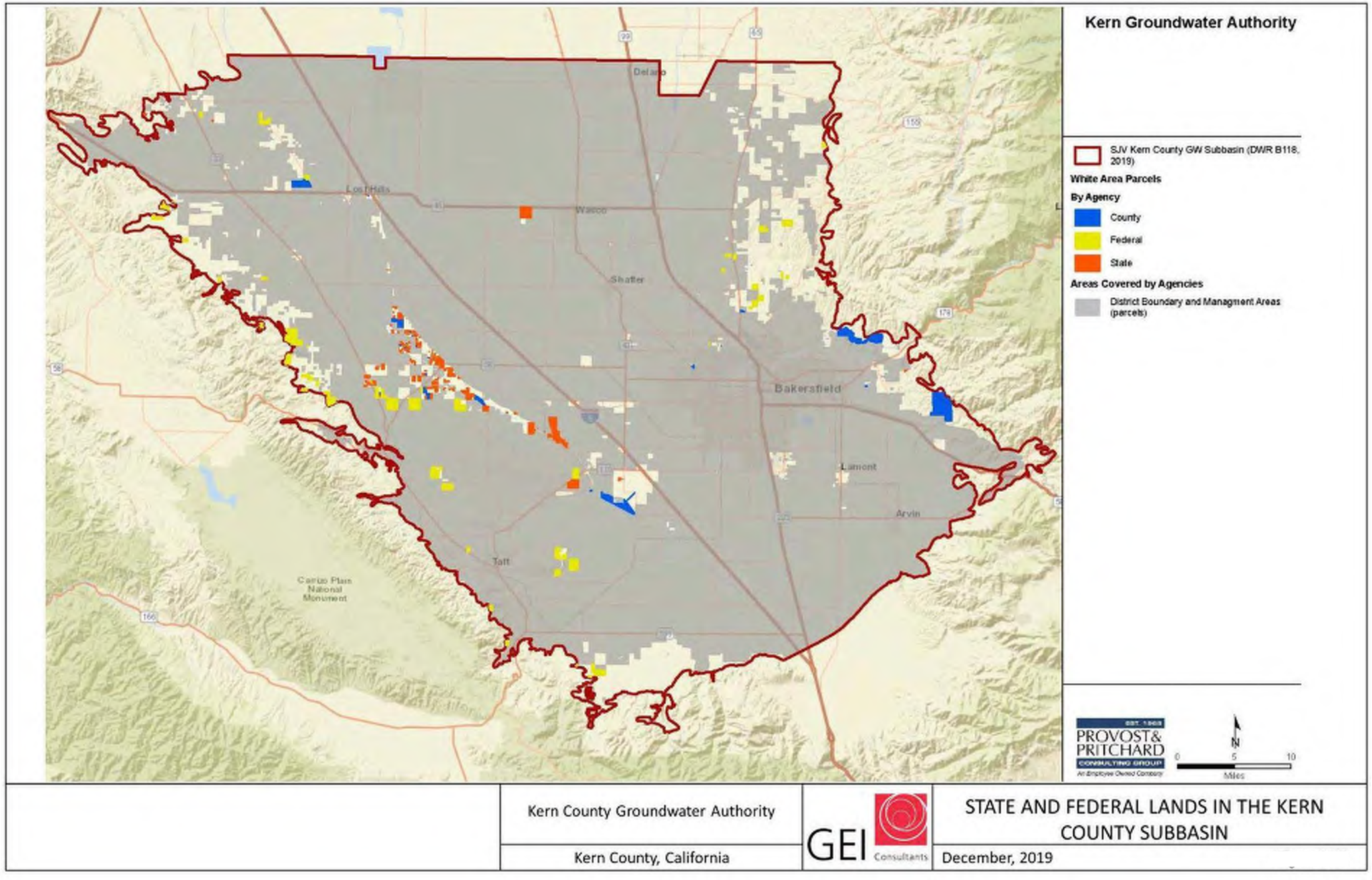


Figure 2-52. State and Federal Lands in the Kern County Subbasin

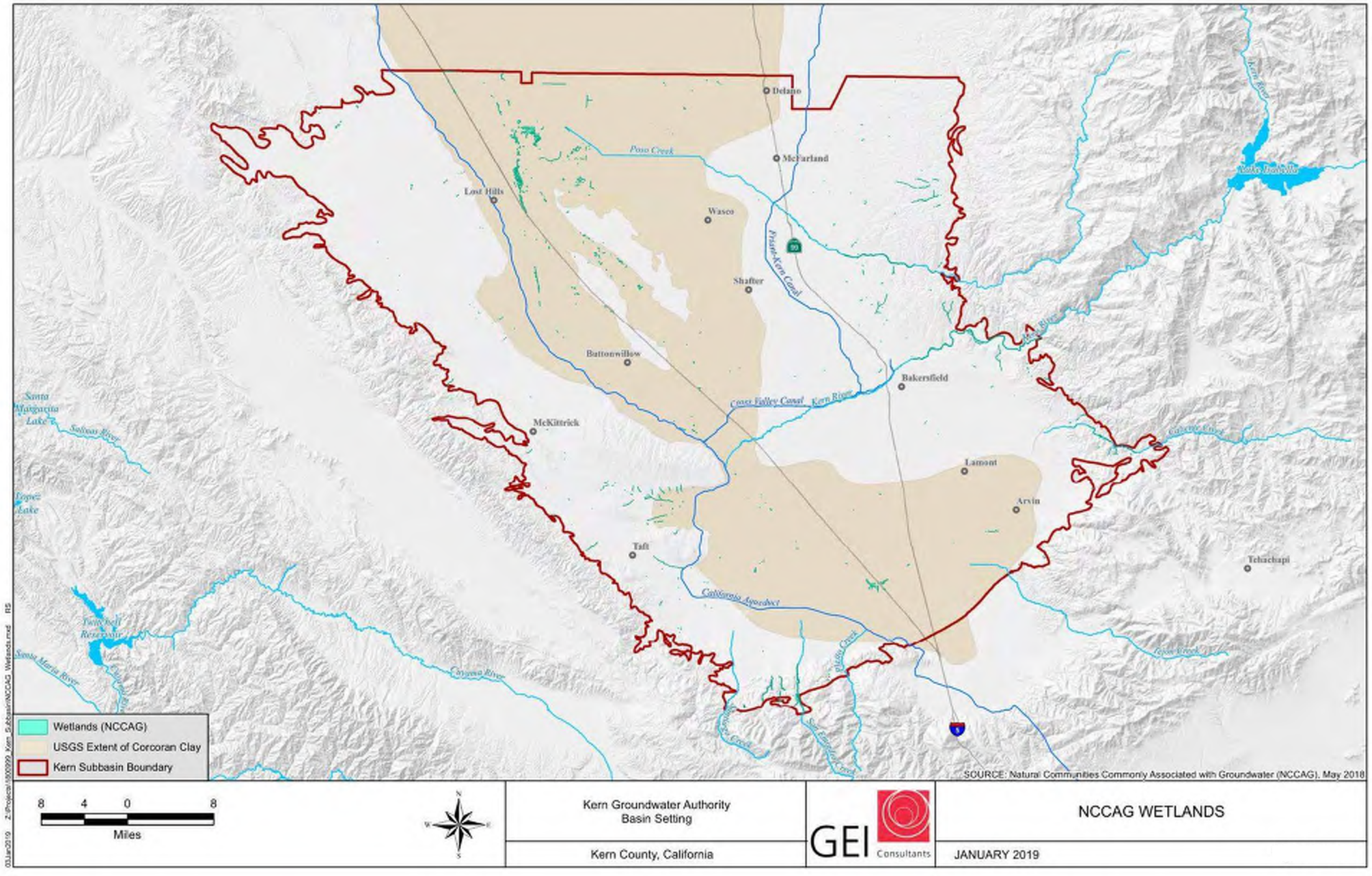


Figure 2-53a. NCCAG Wetlands

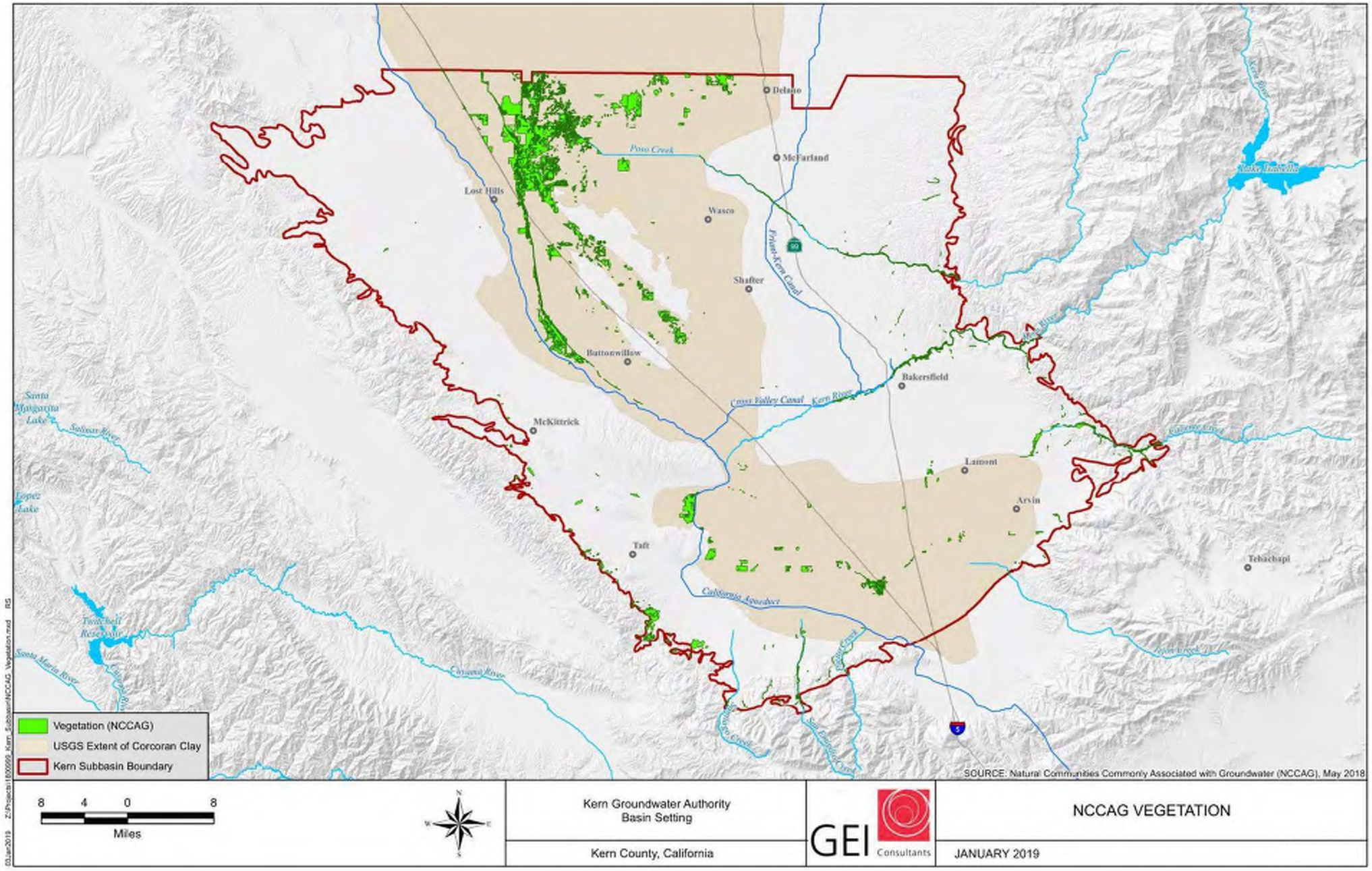


Figure 2-53b. NCCAG Vegetation

This Page is Intentionally Blank

2.4 Water Budget Information

All GSAs in the Subbasin coordinated and collaborated on the development of water modeling budgets (historical, baseline and projected). The GSAs entered into a Cost Share Agreement with the Kern River GSA who took the lead and contracted with Todd Groundwater to develop a groundwater model on behalf of the Subbasin. The contract required that Todd Groundwater use the California Central Valley Groundwater-Surface Water Simulation Model (C2VSim) provided by DWR. Considerable effort and resources were expended to update the C2VSim model with local data to better represent Subbasin conditions, as described below. The process Todd Groundwater used to update C2VSim is more fully described in the Historical and Projected Future Water Budget Development (Attachment H). Subbasin -wide water budget results from the numerical model-based water budget are provided in Attachment H and show the Subbasin, as a whole, has a total storage deficit of 324,326 acre-feet per year (AFY) over the baseline period.

The Subbasin's dynamic conjunctive use programs, water banking operations, and water transfers/exchanges made it necessary to coordinate a separate water accounting system using Subbasin specific values for supply, demand and net results. The C2VSim model results reflect Subbasin-wide conditions and does not allocate water shortages/surpluses, nor do the results allocate the "ownership" of water. As a result, the GSAs, through a coordinated effort, developed water budgets that estimate current conditions for each GSA that are generally consistent with the C2VSim model results under baseline condition. These GSA-level budgets are based upon best available information, recognizing however, each estimate includes data gaps and has varying degrees of accuracy and/or reliability. Table 2-8 reflects the coordinated development the GSA-level water budgets for the Kern Subbasin and is also included in the Coordination Agreement for the Kern Subbasin.

Table 2-8. (REVISED) Kern Subbasin GSA Level Water Budgets

Entity	Total Water Demand (acre-feet)	Total Water Supply (acre-feet)	Net Water Budget (acre-feet)
Kern Groundwater Authority	1,489,171	1,249,825	-239,346
Kern Groundwater Authority - Non-Districted	4,200		-4,200
Henry Miller GSA	40,884	35,791	-5,093
Olcese Water District GSA	2,650	3,202	552
Kern River GSA	305,310	276,157	-29,153
Kern River GSA – App. K Properties	1,308		-1,308
Buena Vista GSA	103,950	126,936	22,986
South of Kern GSA	464,051	433,303	-30,748
TOTALS:	**2,411,524**	**2,125,214**	**-286,310**
Todd Groundwater Model Results for Baseline Condition:			**-324,326**
Todd Groundwater Model Results for Historical Change in Groundwater Storage:			**-277,114**

*Most of the irrigated non-districted lands are now managed /covered under SGMA by GSAs.

To ensure the KGA individual water budgets reflected actual conditions, the KGA members developed a coordinated water accounting methodology. The result of that effort indicates a current baseline shortage/deficit for KGA members of -239,346AFY[1]. This reflects the difference between a total demand for KGA members of 1,489,171 AFY, and a total supply of 1,249,825 AFY. Each KGA member agency management area plan reflects their consistent management area water budget in their individual water budget sections.

2.4.1 Model Development

SGMA regulations require that water budget analyses for GSPs be conducted on a basin-wide basis. DWR developed C2VSim to simulate water demands and supplies in the Central Valley. The C2VSim Fine Grid Beta Model (C2VSimFG-Beta) is derived from a series of Central Valley hydrologic models developed by DWR and other agencies beginning in the early 1990s. C2VSimFG Beta includes historical input data for WY1922-2015 in the Kern Subbasin. These data include monthly precipitation and annual land use for each model element and estimated monthly evapotranspiration for each modeled land use type and agricultural crop. Historical surface water data include monthly surface water inflow for each river entering the model boundary and monthly surface water diversions.

C2VSimFG Beta input files have been modified to incorporate locally-derived managed water supply and demand data to better represent the local water balance for the Subbasin. known as C2VSimFG-Kern model. This model includes revised data for the Kern County subbasins to better represent local water conditions. To comply with the SGMA water budget requirements (Section 354.18), the KGA and the other four GSAs in the Subbasin engaged in a basin-wide effort to develop a basin-wide groundwater model. The results of this effort are provided in Attachment H - TODD Groundwater C2VSimFG-Kern Report and Results, which is summarized below.

2.4.2 Data Compilation

Historical surface water diversions, water bank recharge and water bank withdrawal information were collected from Kern County water purveyors. Urban land use was restricted to developed areas, and urban populations and per-capita water demands were updated. Detailed description of data compilation methodology, assumptions and sources are provided in Attachment H: Historical and Projected Future Water Budget Development with C2VSimFG-Kern.

2.4.3 Historical and Current Water Budget

C2VSimFG-Kern was used to develop historical (WY1995 to WY2014) water budget for the Kern County Subbasin and is presented in Figure 2-54. The results are summarized as follows:

[1] The water supplies available to each KGA member from the Pioneer and Kern Water Bank banking programs are incorporated into the listed total available supplies. Note that both programs only store surface supplies, and do not have consumptive demands that contribute to the listed shortages. For more detail on the banking projects, please see the respective chapters.

- **Deep Percolation –** This is defined as precipitation and applied water that reaches the groundwater after simulated transport across the unsaturated zone. The simulated historical 20-year average resulted in a net inflow of 669,398 AFY.
- **Managed Recharge and Canal Seepage –** This is defined as combined groundwater recharge from managed aquifer recharge operations, groundwater banking, and seepage from canals and other conveyance. The simulated historical 20-year average resulted in a net inflow of 583,598 AFY.
- **Net Groundwater-Surface Water (GW/SW) Interactions –** This is defined as net volumetric exchange of surface water and groundwater between the aquifer and streams: Positive represents a net groundwater recharge, and negative represents a net groundwater discharge to the stream. The simulated historical 20-year average resulted in a net inflow of 98,606 AFY.
- **Groundwater (GW) Pumping –** This is defined as total groundwater pumping by wells. Groundwater banking recovery pumping is specified as fixed input values and agricultural and municipal pumping is calculated by C2VSimFG-Kern based on demand minus surface water diversions. The simulated historical 20-year average resulted in a net outflow of 1,590,373 AFY.
- **Small Watershed Inflow –** This is defined as runoff, small stream inflow and subsurface inflow from the small watersheds and areas surrounding the groundwater basin. The simulated historical 20-year average resulted in a net inflow of 48,760 AFY.
- **Subsurface Flow with Adjacent Groundwater (GW) Basins –** This is defined as net subsurface groundwater flow to and from the Subbasin with adjoining groundwater basins: negative is a net flow out of the Subbasin and positive is a net flow into the Subbasin. The simulated historical 20-year average resulted in a net outflow of 87,102 AFY.
- **Change in Groundwater Storage –** This is the sum of the inflow components (positive numbers) plus the outflow components (negative numbers): positive is an increase in storage typified by a rise in groundwater levels whereas a negative is a decrease in storage typified by a decline in groundwater levels. The simulated historical 20-year average resulted in a decline in groundwater storage of 277,114 AFY.

Figure 2-55 presents the average annual historical water budget for the Subbasin that includes the out-of-basin groundwater banking obligation of 85,965 AFY.

Figure 2-56 shows the simulated annual and cumulative change in groundwater storage over the 20-year historical period. It was observed that during the periods of WY1995 to WY2000, WY2005 to WY2006 and WY2010 and WY2011, the groundwater storage volume was stable to increasing and correlates to the above average rainfall and surface water availability during these times. Similarly, during the periods WY2001 to WY2004, WY2007 to WY2009 and WY2012 to WY2015, groundwater storage volume decreased, correlated to periods of drought and low surface water availability. Figure 2-57 shows the simulated historical groundwater recharge by

source that also reflects a climatic pattern with high deep percolation to groundwater and steep increases in managed aquifer recharge and canal seepage during the above average rainfall periods and lower groundwater recharge during the drought years.

As a result, groundwater pumping for agriculture shows a general increasing trend from WY1995 to WY2014; however, groundwater pumping is lower in above average rainfall years and higher during droughts as shown in Figure 2-58. This general increasing trend follows a comparable decreasing trend in surface water deliveries over the same period as shown in Figure 2-59.

2.4.3.1 Sustainable Yield

SGMA defines Sustainable Yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result". To determine the sustainable yield for the Kern Subbasin, the results of the C2VSimFG-Kern model were used with two methods to estimate the amount of groundwater pumping that would avoid the undesirable result of a reduction in groundwater storage over the historical base period 1995 to 2014.

- **Sustainable Yield from Groundwater Pumping** – The model results produced an average annual groundwater pumping in the Kern Subbasin of 1,590,373 AFY with a decline in groundwater storage of 277,114 AFY. Subtracting the groundwater storage decline from groundwater pumping produced a sustainable yield of approximately 1,313,000 AFY for the Kern Subbasin.
- **Sustainable Yield from Groundwater Recharge** – The model results produced an average annual groundwater recharge in the Kern Subbasin of 1,400,362 AFY. The subsurface outflow from the GSA totals 87,102 AFY. Subtracting these losses from the groundwater recharge produced a sustainable yield of approximately 1,331,000 AFY.

Using WY1995 to WY2015 as the base period, C2VSimFG-Kern results show declining groundwater levels and long-term reduction of groundwater storage. During this period, average annual inflow to the aquifer is 1,400,362 AFY, and outflow is 1,677,475 AFY. This yields an average annual deficit of 277,144 AFY. Based on these historical C2VSimFG-Kern results, the sustainable yield of the basin is approximately 1,313,000 AFY, plus or minus 10%.

2.4.3.2 Native Yield

SGMA does not require the native yield to be considered or addressed, however, in the process of working on the Sustainable Yield, water budget allocations, and the water modeling for the entire Kern Subbasin, the discussion of the native yield and how best to address it in the Kern Subbasin occurred. The C2VSimFG-Kern results does model the concept of native yield, however, as described in section 4.2.2 of Attachment H, the Native Yield at this time is based on available data. However, there exists in this area data gaps and as such, as those data gaps are eliminated and management actions are implemented, the estimate of native yield is likely to

change. With the current available data for input to the C2VSimFG-Kern, the model provides the following results:

- The volume of precipitation that recharges the groundwater in the irrigated agricultural areas is 77,780 AFY
- The volume of precipitation that recharges groundwater in the other areas is 132,981 AFY
- The volume of inflow from unallocated small watersheds that recharges the groundwater in the irrigated agricultural areas is 48,760 AFY
- The above inputs resulted in a native yield for the Kern Subbasin of 259,520 AFY which resulted in the native yield estimate of 0.144 acre-feet per acre for the total area of the Kern County Subbasin.

During the process of working through the water budget allocations for the entire Kern Subbasin with all GSAs, the native yield was one of the most critical supply source to be coordinate. Acknowledging the presence of data gaps and implementation of projects and management actions, the GSAs of the Kern Subbasin have agreed to the continued analysis and refinement of the native yield, from a technical and legal basis. This has been identified as a management action for the KGA, in coordination with all other Kern Subbasin GSAs, in 2020.

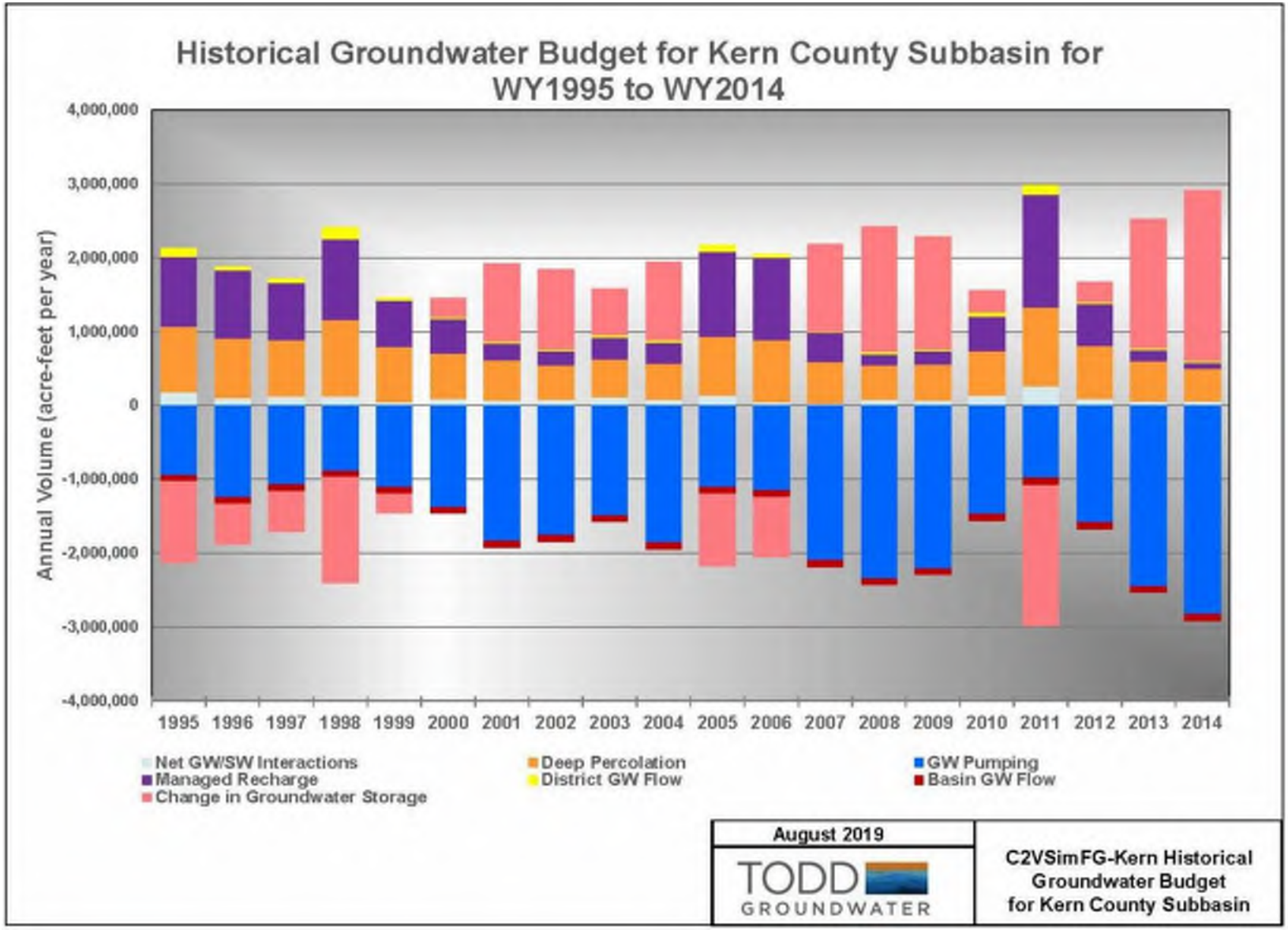


Figure 2-54. Historical Groundwater Budget for Kern County Subbasin for WY1995 to WY2014

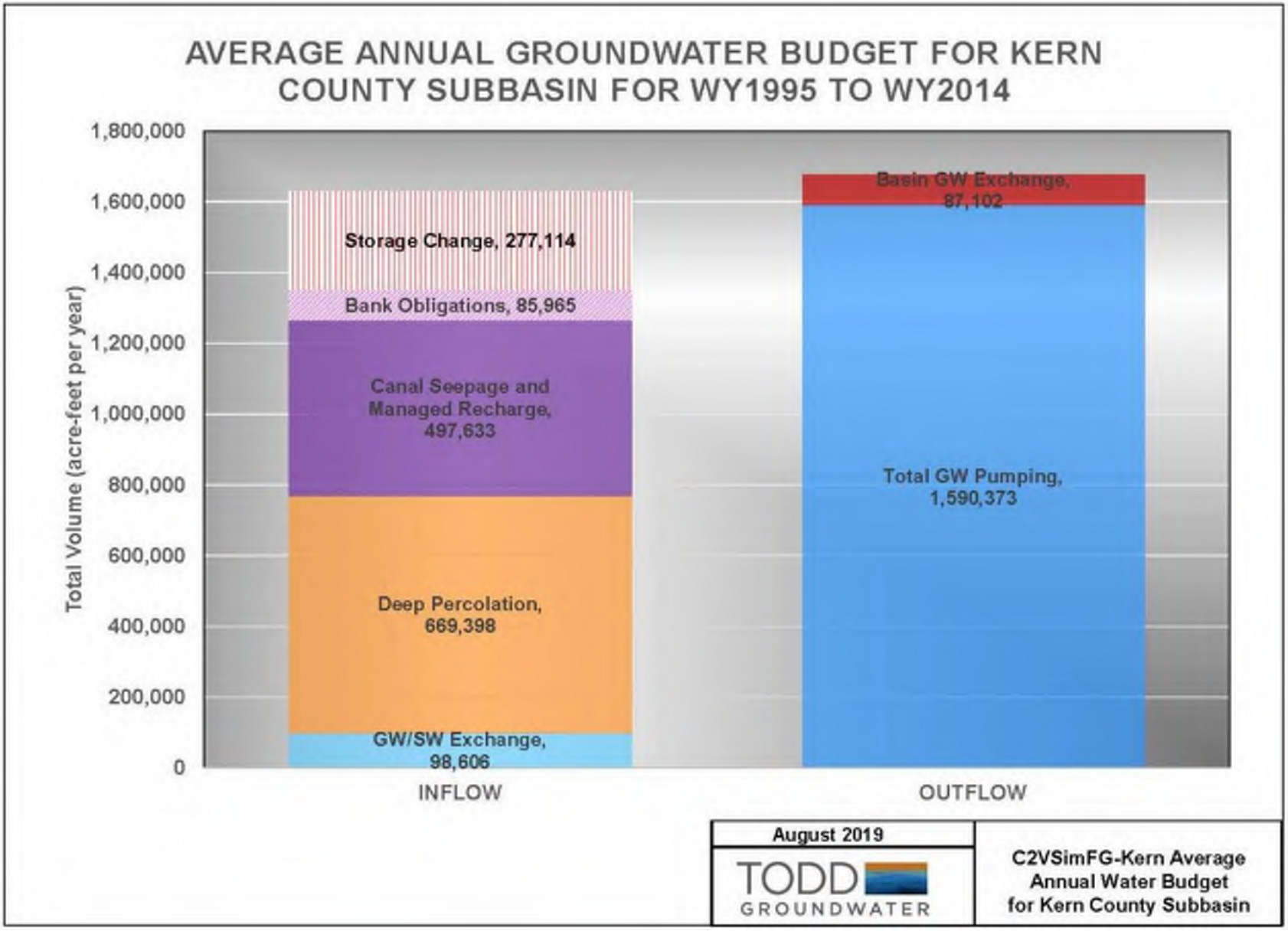


Figure 2-55. Average Annual Groundwater Budget for Kern County Subbasin for WY1995 to WY2014

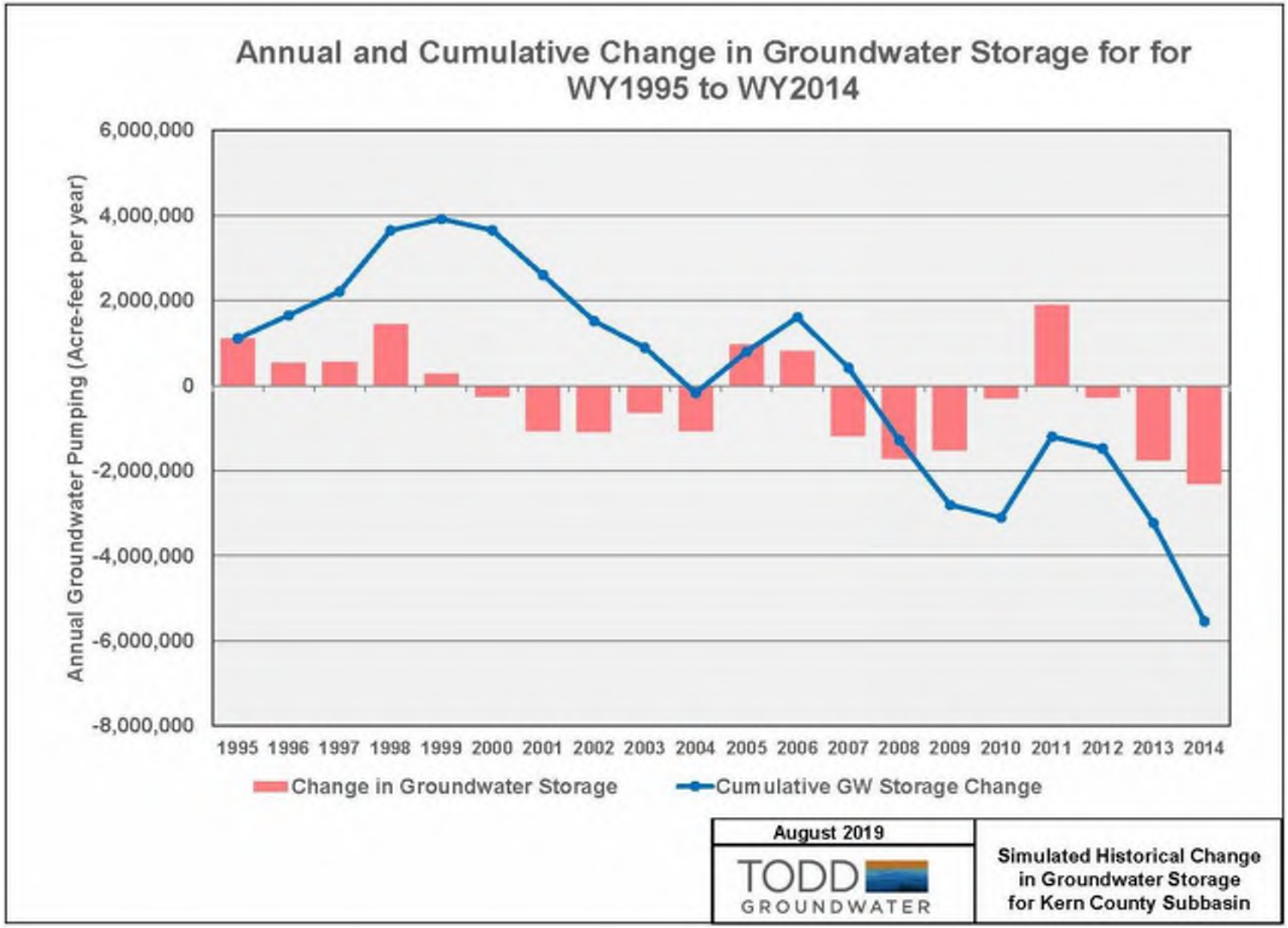


Figure 2-56. Annual and Cumulative Change in Groundwater Storage for WY1995 to WY2014

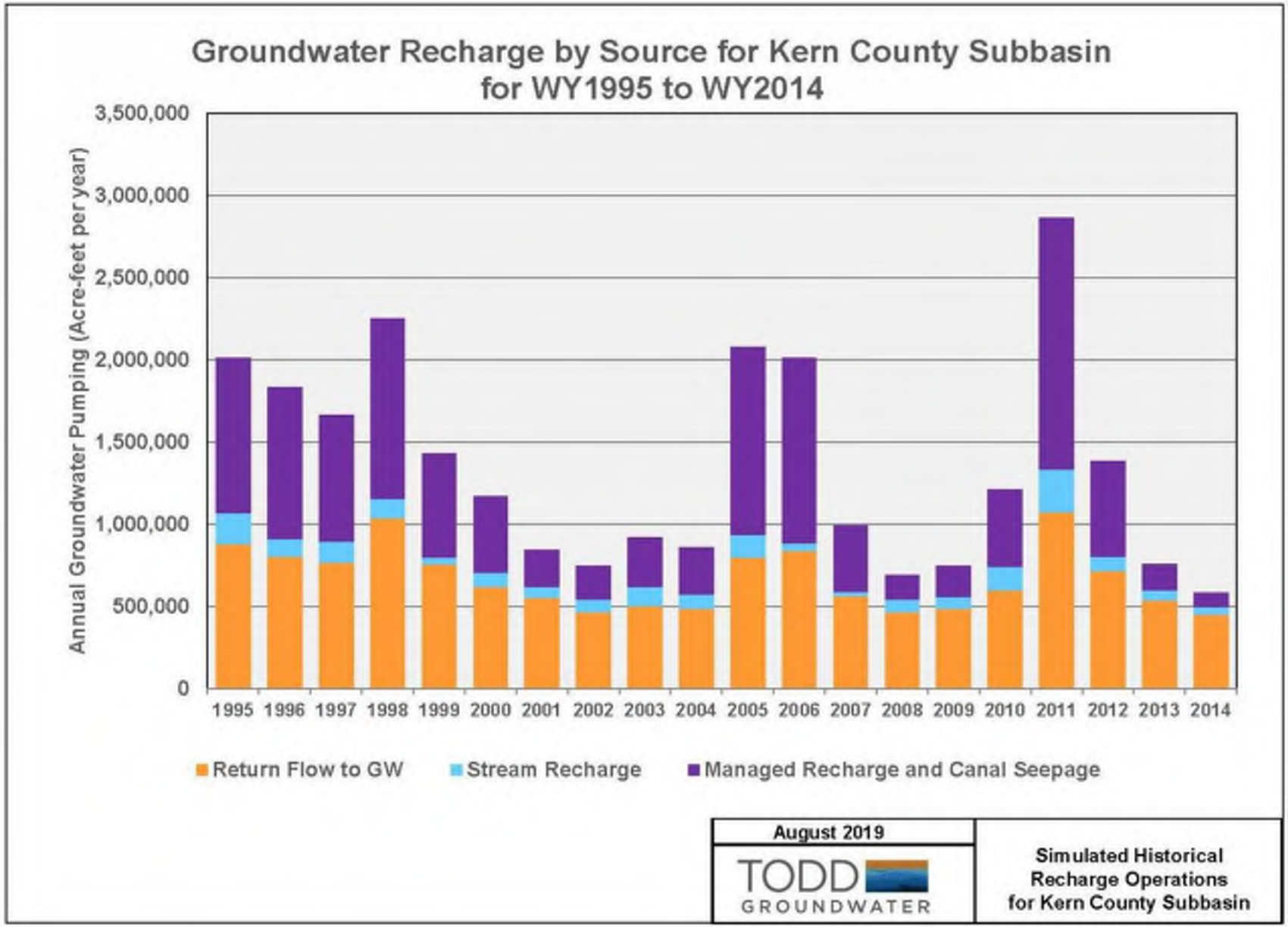


Figure 2-57. Groundwater Recharge by Source for Kern County Subbasin for WY1995 to WY2014

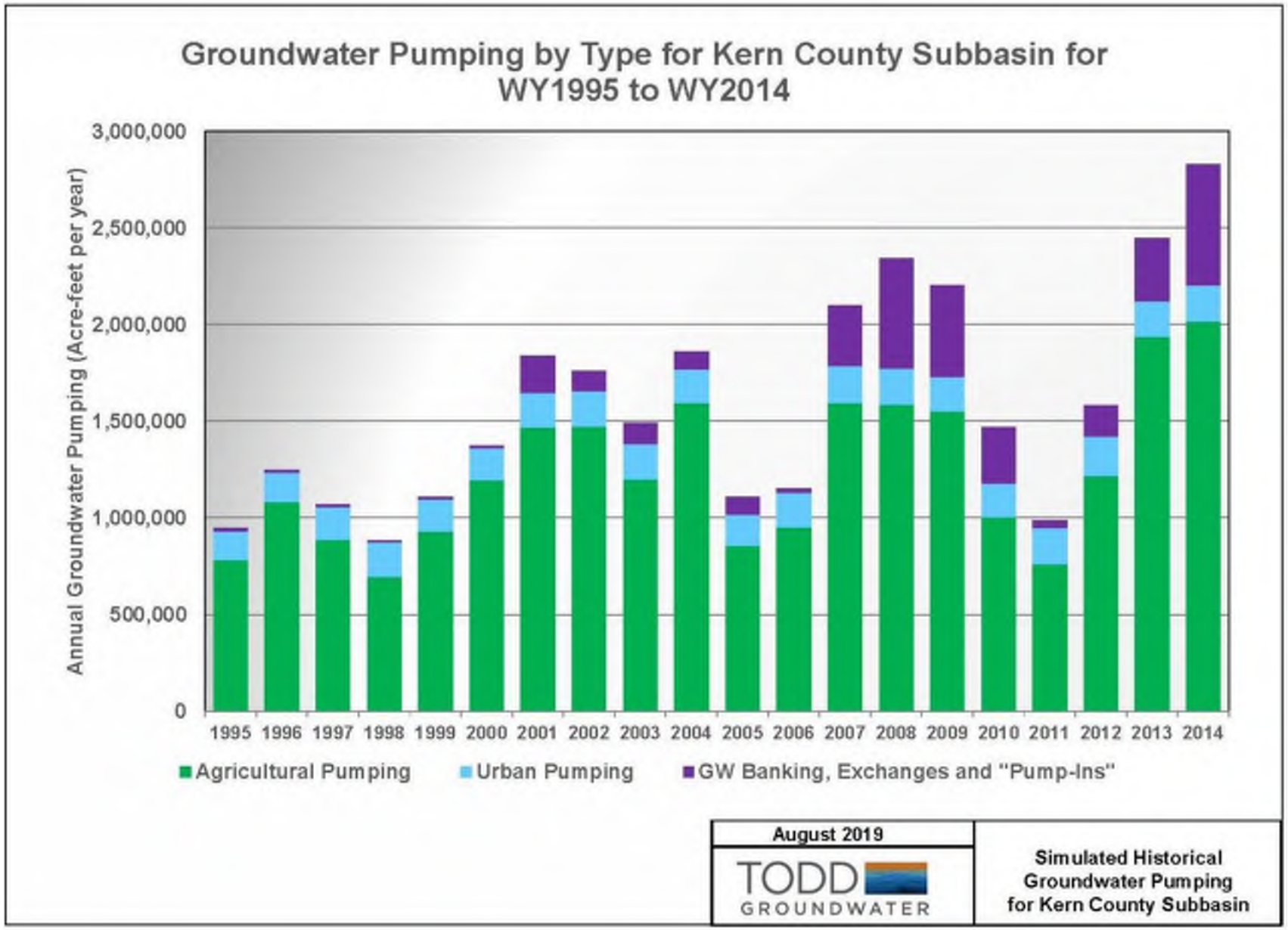


Figure 2-58. Groundwater Pumping by Type for Kern County Subbasin for WY1995 to WY2014

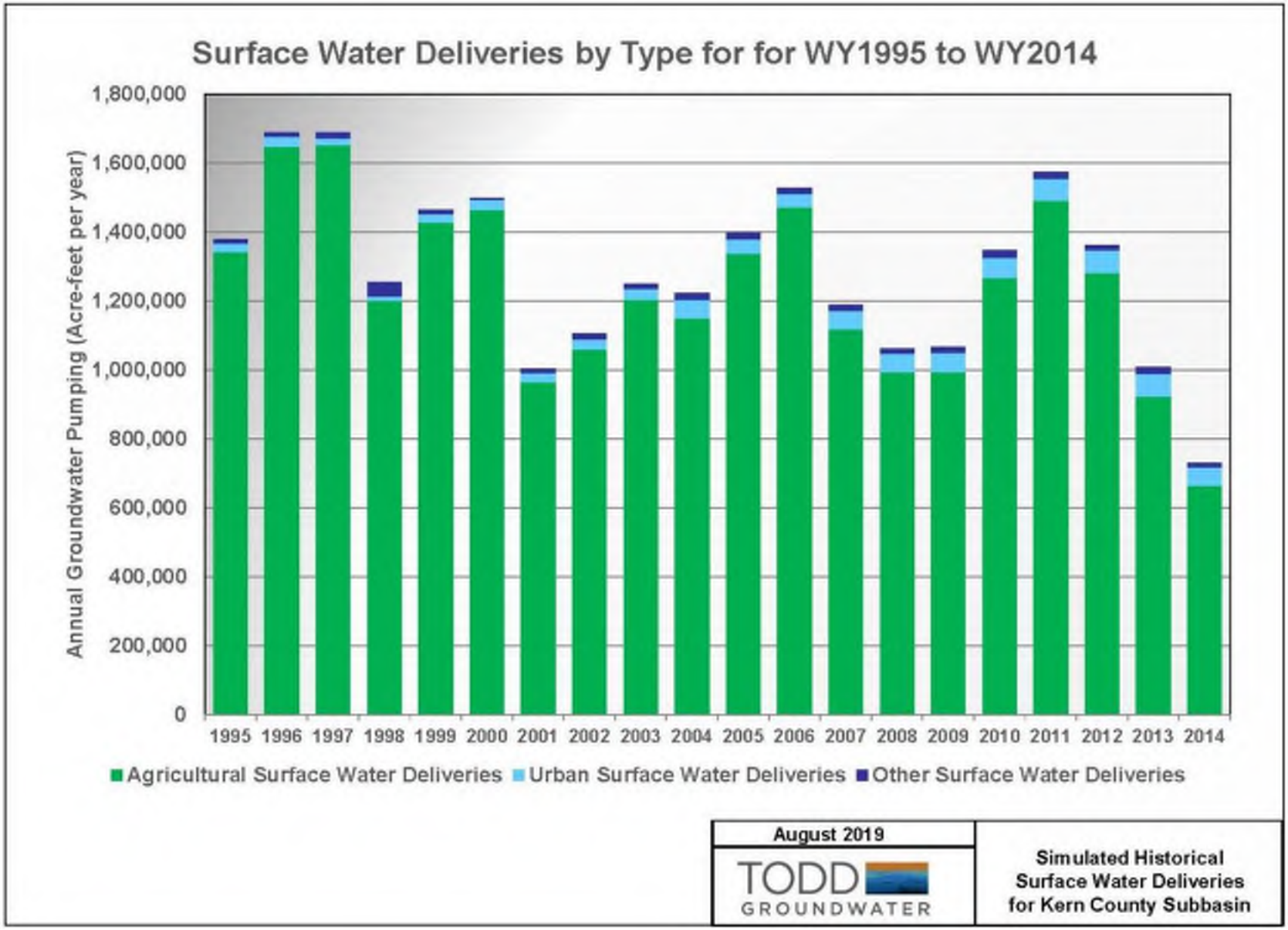


Figure 2-59. Surface Water Deliveries by Type for WY1995 to WY2014

2.4.4 Projected Future Water Budgets without SGMA Implementation

Projected future water budgets for the Subbasin were developed using the C2VSimFG-Kern for future baseline conditions and 2030 and 2070 Climate Conditions over a 50-year planning and implementation horizon. These scenario models provide a basis of comparison for evaluating proposed sustainability management actions and projects over the SGMA planning and implementation horizon.

- **Future Baseline Conditions:** Repeat historical hydrology with future water supply reliability provided by DWR.
- **2030 Climate Conditions:** Adjust historical hydrology for 2030 climatic conditions and water supply reliability provided by DWR.
- **2070 Climate Conditions:** Adjust historical hydrology for 2070 climatic conditions and water supply reliability provided by DWR.

Detailed description of assumptions, hydrology estimations, precipitation rates, surface water deliveries, sources of data and groundwater banking conditions are provided in Attachment H: Historical and Projected Future Water Budget Development with C2VSimFG-Kern.

2.4.4.1 Future Baseline Water Budget

The Baseline Scenario simulates how the Subbasin aquifer would respond if the recent hydrology were repeated with current expected surface water availability and current land use. The primary difference between historical conditions and the projected future baseline is a nearly 20% decrease in imported surface water deliveries primarily from the SWP due to the long-term Operational Criteria and Plan (OCAP) Biological Opinion and is replaced with additional groundwater pumping. As a result, total net aquifer outflows increase by about 35,600 AFY, total net aquifer inflows decrease by about 11,600 AFY with the average groundwater pumping of 1,625,000 AFY, which includes agricultural pumping, urban pumping and exported water. This results in an additional loss of groundwater storage of about 47,200 AFY over the 50-year projected future baseline. Baseline simulation results indicate that the Subbasin has an average annual overdraft of 324,326 AFY, however, with the implementation and completion of projects and management actions as stated in the individual management area plans and GSPs from the other GSAs in the Subbasin, the baseline simulation results show that the Subbasin has an average surplus of 85,578 AFY.

2.4.4.2 2030 Climate Change Water Budget

The 2030 Scenario simulates how the Subbasin aquifer would respond assuming hydrologic conditions representing a potentially drier climate (no or limited amount of snow pack) and are based on the DWR Climate Change Guidance (DWR 2018). The 2030 DWR climate change factors were applied to the Baseline Scenario Conditions. Additional adjustments were made to the imported surface water supplies from the SWP, CVP and Kern River, accounting for about an additional 2% decrease from the Baseline Conditions.

The results show a net increase in aquifer inflows of about 44,700 AFY along with an increase in aquifer net outflows of about 101,200 AFY. This is mostly attributed to the climate shift to earlier rainfall making more surface water available for managed aquifer recharge during the winter but less available for irrigation in the summer resulting in higher groundwater pumping. The net change in groundwater storage is an additional decline of about 56,600 AFY due to the climate change impacts. 2030 Climate Change simulation results indicate that the Subbasin has an average annual overdraft of 372,120 AFY with the net change in groundwater storage showing an additional decline of about 47,794 AFY, compared to the Baseline, due to the climate change impacts. However, with the implementation and completion of management actions/projects as stated in the individual management area plans and GSPs from the other GSAs in the Kern Subbasin, 2030 Climate Change simulation results indicate that the Subbasin has an average deficit of approximately 46,829 AFY.

2.4.4.3 2070 Climate Change Water Budget

The 2070 Scenario simulates how the Subbasin aquifer would respond assuming hydrologic conditions representing a potentially very dry climate and are based on the DWR Climate Change Guidance (DWR 2018). The 2070 DWR climate change factors were applied to the Baseline Scenario Conditions. Additional adjustments were made to the imported surface water supplies from the SWP, CVP and Kern River, but these accounted for an additional 6% decrease from the Baseline Conditions. The 2070 Climate Change Scenarios were run both with and without SGMA Projects.

The results show a net increase in aquifer inflows of about 66,100 AFY along with an increase in aquifer net outflows of about 231,600 AFY. This is mostly attributed to an even greater climate shift to earlier rainfall making more surface water available for managed aquifer recharge during the winter but less available for irrigation in the summer resulting in higher groundwater pumping. 2070 Climate Change simulation results indicate that the Kern County Subbasin has an average annual overdraft of 472,336 AFY with the net change in groundwater storage showing an additional decline of about 148,010 AFY due to the climate change assumptions. As indicated in the above model simulations, with the implementation and completion of management actions/projects as stated in the individual management area plans and GSPs from the other GSAs in the Kern Subbasin, the 2070 Climate Change model results unfortunately still indicate a average deficit of 45,969 AFY.

2.5 Management Areas

KGA members worked together to establish management areas and watch areas within the Subbasin to implement projects and management actions as well as better capture local groundwater conditions. To prevent undesirable results in adjacent management areas, members have established minimum thresholds consistent with each other. Definitions for management areas and watch areas are as follows:

- Management Area: Management areas are areas that will be considered against the determination of an undesirable result at the basin level.

- Watch Areas: Areas with no significant groundwater use and no planned groundwater use as documented in the management area plans. Watch areas will be monitored for land use changes and groundwater conditions that could change its designation to a "management area" with specified Sustainable Management Criteria.

The Subbasin consists of many entities with land use or water management authority. While a majority of these entities are members of the KGA who have water management authority as explained in Section 1.4, they retain their local responsibility for compliance with SGMA. The County of Kern and municipalities located within the management areas retain their land use jurisdiction. Ultimately the members of the KGA have the responsibility to implement projects and management actions, as described in Section 4 of this GSP and in the individual management area plans, to achieve sustainability within their management areas. The management areas within the KGA are summarized in Table 2-9. A detailed explanation of each management area under the KGA is provided in their respective management area plans. The following section provides a brief overview of how and why management areas were created as well as how each area will be managed.

Management areas were created by the districts/member agencies under the KGA to support groundwater sustainability in the Subbasin. While there is no one approach, majority of the management areas in the region maintain respective district boundaries. Districts and member agencies under the KGA already maintain/manage water rights, contracts, and governing agreements in their regions. By creating their own management areas, Districts/members can maintain/manage maximum flexibility and control over SGMA compliance within its service area, allowing them to implement projects and management actions applicable to their respective areas.

Management areas are designated within the Subbasin to leverage existing relationships with water users for local water accounting and management actions of imports; exports; water consumption and conservation; and groundwater pumping. While most were created from district boundaries, other management areas were developed based off groundwater and geological conditions in each respective service area, which is why some districts have multiple management areas as shown in Table 2-9. These management areas will preserve groundwater management practices and implement additional requirements set forth in this GSP. The JPA with KGA allows for each district or member agency to establish individual management areas and manage them to support the sustainability of the region.

Table 2-9. (REVISED) Management Areas Under the Kern Groundwater Authority

KGA Management Area	Acres in Management Area	Percentage of Subbasin
Cawelo GSA	62,616	3.5
Eastside Water Management Agency	38,222	2.1
Kern-Tulare Water District (in Kern)	11,219	0.6
North Kern WSD		
MA-1 (Old District)	61,741	3.4
MA-2 (RRID)	5,802	0.3
KCWA-Pioneer GSA	2,233	0.1
Kern Water Bank Authority	20,490	1.1
Rosedale-Rio Bravo WSD	48,610	2.7
Southern San Joaquin MUD	65,693	3.7
Shafter-Wasco Irrigation District	39,980	2.2
7th Standard Annex	10,045	0.6
Semitropic GSA		
MA-1 (Pond Poso)	82,638	4.6
MA-2 (Buttonwillow)	92,633	5.2
MA-3 (Undeveloped)	49,140	2.7
West Kern GSA		
North Project MA	521	0.0
South Project MA	889	0.0
Western Watch Area [1]	183,128	10.2
Lake Watch Area [1]	653	0.0
LSMV Watch Area [1]	1,947	0.1
Westside Districts Water Authority		
Westside District MA	195,263	10.9
Lost Hills Watch Area [1]	33,191	1.9
Southwest Watch Area [1]	48,739	2.7
Non-District White Lands Watch Areas [1]	210,034	11.7

1 - Watch Areas" are areas with no significant groundwater use and no planned groundwater use as documented by the management area member agency. Watch areas will be monitored for land use changes and groundwater conditions which could change its designation to a "management area" with specified SMCs.

3 Sustainable Management Criteria

The Sustainable Management Criteria requirements of a GSP are defined in Subarticle 3 of the GSP Regulations. The KGA has satisfied these requirements through the commitment of each of its Member Agencies to the following actions:

1. Manage their respective management areas at or above their measurable objectives,
2. Manage each management area to a water budget that will collectively eliminate the KGA Member Agencies deficit of 239,346 AFY by 2040 (see Section 2.4),
3. Implement projects and management actions identified in Section 4.0 and listed in Table 4.1.

The KGA has developed sustainable management criteria that meets the GSP Regulations and enhances the process by including additional steps to better manage political, operational and demographic conditions found across the Kern Subbasin. In establishing the criteria, the KGA and its members worked with adjacent GSAs and other members to achieve as much consistency as possible due to the different hydrogeological conditions and beneficial users. The KGA process is proactive in identifying and managing the occurrence of undesirable results to the beneficial users identified in each management area of the Subbasin as well as considering adjacent beneficial users. The complexity of the Kern Subbasin required the KGA and other Subbasin GSAs coordinate this process that recognizes the diversity found across the Subbasin. The core of this process is the identification of key beneficial users within each management area as well as adjacent beneficial users and conditions that create significant and unreasonable impacts to those beneficial users from groundwater operations in that management area. This enhanced process follows the following steps.

- Sustainability Goal (SGMA Requirement) – Developed as a Subbasin wide goal for achieving conditions of sustainability that recognizes the diversity of the hydrology and beneficial users in the Kern Subbasin. Due to this diversity each management area could elect to develop a supportive Sustainability Goal that specifies the objectives and desired conditions for sustainability within a management area and the protection of beneficial users and uses within that management area however with the consideration of adjacent beneficial users as well as the adjacent management area/GSA.
- Minimum Threshold Exceedances (KGA Enhancement) – Establishes a process for identifying and addressing a single minimum threshold exceedance to proactively manage potential degradation of groundwater conditions and impacts to beneficial users. This is facilitated through the KGA Exceedance Action Plan. The Exceedance Policy focuses on an area surrounding the exceedance to proactively identify and address the causes of the exceedance, thus attempting to limit to the potential of an entire management area exceedance (next step in the process). Even though this is a KGA policy, the KGA members will also work with other surrounding GSAs to explore the cause and to find solutions that limit further impacts to beneficial users and uses. In line with this, the Kern subbasin has agreed from the onset of submitting the annual report, to identify all minimum threshold exceedances and to address the management action to

correct. This is now being supported through the development of the Kern Subbasin data management system that enables managers to assess compliance within their respective management area(s) and throughout the Subbasin.

- Management Area Exceedance (KGA Enhancement) – Establishes the first trigger towards an undesirable result, defining the condition by which the management area could likely contribute to an undesirable result for the entire basin. A Management Area Exceedance occurs when a management area exceeds minimum thresholds at 40% or more of representative monitoring wells within a management area over four (4) consecutive bi-annual SGMA monitoring events, referred to as the Minimum Threshold Trigger. This also establishes a process for the Subbasin entities to collaborate on corrective measures to address further degradation of groundwater conditions and potential impacts to beneficial users. This proactive approach allows the KGA to collaboratively work amongst KGA member and with other GSAs in the Subbasin to identify and address causes of degrading groundwater conditions to prevent reaching an Subbasin-wide undesirable result.
- Undesirable Results (SGMA Requirement) – In the Kern Subbasin an undesirable result is defined as the geographic extent of minimum threshold exceedances across the entire Subbasin, measured by the accumulation of management area exceedances. During the development of the undesirable results for the Kern basin, it became apparent that the basin's hydrology and geography is so diverse that it would be necessary to have a management project called a "Basin Study". The Kern subbasin has just recently been granted $2.9 million dollars to move forward with the basin study to assist in achieving an understanding of complexity of the basin.
- Minimum Thresholds (SGMA Requirement) – Minimum thresholds have been set at each representative monitoring well as the point at which impacts to beneficial uses and users become significant and unreasonable and that cannot be mitigated. Minimum thresholds are collaboratively set with all Subbasin GSAs and are set within each management area with the overlying managing entity to ensure that the diversity of geographic conditions and distribution of beneficial users are considered and represented. In setting the minimum thresholds, the KGA members considered all beneficial users and uses by having a water well analysis as the foundation to work from. This provided an understanding of water depths of existing wells.
- Measurable Objectives (SGMA Requirement) – Similar to the minimum thresholds, the measurable objectives have been set at each representative monitoring well to represent a condition of sustainability. All KGA members have agreed and have management actions to operate their respective management areas at or above their measurable objectives. But note that SGMA is a 20-year process and the ability to manage to the measurable objectives is the goal of the KGA members with their respective management actions and projects to assist in that endeavor however at this time, most KGA members are achieving that goal.

- As described above and demonstrated in Figure 3-1, in the Kern Subbasin, Sustainable Management Criteria are more robust than the SGMA prescribed Undesirable Results, Measurable Objective and Minimum Threshold. Sustainable management begins with early identification of potential minimum threshold exceedances (one exceedance) and coordinated actions to address those early exceedances.

- An undesirable result is a condition that occurs throughout the Subbasin, demonstrating that the Subbasin is not sustainably managing groundwater conditions in the aggregate and that impacts to beneficial users are occurring on a scale (spatially and temporally) that is significant and unreasonable to beneficial users and groundwater managers alike. However, the KGA and other GSAs of the Subbasin, recognize that as groundwater approaches an undesirable result condition, exceedances of minimum thresholds will likely progressively occur in the absence of intervention, beginning with isolated exceedances which could impact beneficial users. A proactive approach to identifying and working with management areas to address these conditions will help address and mitigate degrading groundwater conditions. This approach is shown in Figure 3-1 and more fully detailed in the remainder of this section.

This Page is Intentionally Blank

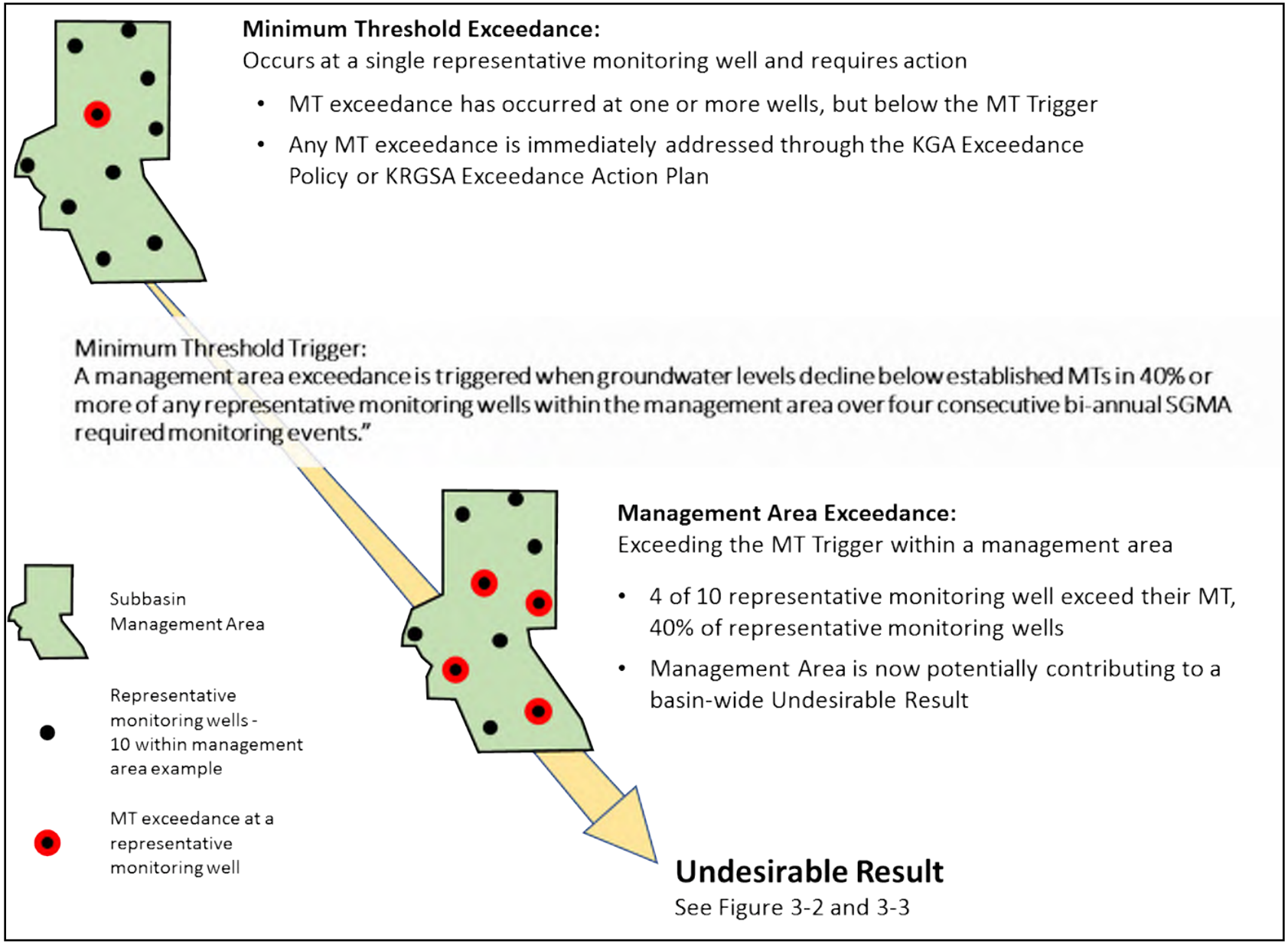


Figure 3-1 NEW. Representation of KGA Minimum Threshold Exceedance Management Policy.

This Page is Intentionally Blank

3.1 Sustainability Goal

SGMA requires that a sustainability goal be defined for the basin (23-CCR § 354.22), and that the sustainability goal be defined on a basin-wide basis. As introduced in Section 1.3, the KGA, working with all GSAs and its member agencies in the Subbasin have developed the following sustainability goals for the Kern County Subbasin:

- *Collectively bring the Subbasin into sustainability and to maintain sustainability over the implementation and planning horizon.*
- *Achieve sustainable groundwater management in the Kern County Subbasin through the implementation of projects and management actions at the member agency level of each GSA.*
- *Maintain its groundwater use within the sustainable yield of the basin as demonstrated by monitoring and reporting groundwater conditions.*
- *Operate within the established sustainable management criteria, which are based on the collective technical information presented in the GSPs in the Subbasin.*
- *Protect beneficial users for municipal and domestic drinking water supply wells.*

In addition, sustainability within the KGA will focus on maintaining the economic viability of agricultural while also balancing the needs of all beneficial users that rely on groundwater resources. To achieve this, KGA members manage to checkbook water budgets as well as implement projects and management actions within their respective management areas to sustain water levels at or above the measurable objectives to mitigate impacts to beneficial users.

3.2 Minimum Threshold Exceedances

To manage potential impacts to beneficial users from lowering groundwater levels the KGA has developed the KGA Exceedance Action Plan into its sustainable management practices. The Exceedance Policy calls for immediate action to address single minimum threshold exceedances at representative monitoring wells. While a single or isolated exceedance of a minimum threshold will not, by itself, cause a management area exceedance or undesirable result, an exceedance may be indicative of future or trending exceedances which could result in a management area exceedance – contributing to the undesirable results criterion. Therefore, early action to address such exceedances is important to prevent potential continued degradation of groundwater conditions.

The KGA Exceedance Action Plan directly addresses the chronic lowering of groundwater levels since beneficial users in the Subbasin are most impacted by groundwater levels. Within the management areas of the KGA, the Exceedance Policy also addresses reduction in groundwater storage and degradation of water quality, as a proxy.

The following four-step action plan has been developed to address a minimum threshold exceedance for the chronic lowering of groundwater levels at a single representative monitoring well, including coordination between KGA management areas and/or other GSAs.

1. **Identify Exceedance and Investigate the Representative Monitoring Well Area:** After each annual report, the KGA managers team will review data and identify any exceedances of minimum thresholds for each RMW and will compile a summary of minimum threshold exceedances, as noted in the annual report, for review by the KGA Board.

   Various conditions surrounding the representative monitoring well will be considered. For example: Are water levels declining in nearby wells? If so, how large of an area is affected? Has a new well been installed nearby or localized groundwater extraction increased? Is the problem related to area-wide drought conditions? Has local demand increased? If increased demand is responsible for the exceedance, then is a sustainable water budget needed and/or being adhered to in the area?
2. **Evaluate Outside Management Area Plan Contributing Factors:** Provided that aquifer connectivity exists between MAP areas and groundwater impacts cross MAP boundaries, declining groundwater levels in an area may be the result of operations in an adjacent MAP and/or an adjacent GSA. In this situation, the KGA member may not be able to resolve any exceedances unilaterally. KGA members in adjacent MAPs agree to coordinate. Updates or proposals will be reported back to the KGA board at a regular board meeting thus providing transparency.
3. **Consider Developing Management Actions and/or Projects:** Any KGA member with a minimum threshold exceedance may develop or modify existing management actions or projects to mitigate a minimum threshold exceedance and avoid undesirable results ("mitigation plan"). Any mitigation plan should be submitted to the KGA managers team for review. The mitigation plan along with any KGA managers team comments will be submitted to the KGA Board. To the extent the mitigation plan includes any new management actions, any proposed modifications to an existing management action or new projects, the KGA will consider how those changes will be incorporated into any update to the KGA GSP and the annual report.
4. **Consider Enforcement Plan:** In the event of a management area exceedance the KGA member or contributing member(s) will consider developing and/or implementing policies and programs intended to eliminate or mitigate the exceedance (enforcement plan). The enforcement plan(s) must be submitted to the KGA and the KGA will have 90 days to determine whether the enforcement plan is sufficient to demonstrate the avoidance of undesirable results. If no enforcement plan is submitted to KGA, the KGA Board may recommend policies or programs to the member(s) that could, in its discretion, take to remedy the existence of a management area exceedance(s) and to avoid undesirable results.

3.3 Management Area Exceedance

Within the Kern Subbasin a Management Area Exceedance occurs when a management area exceeds minimum thresholds at 40% or more of representative monitoring wells within a management area over four (4) consecutive bi-annual SGMA monitoring events, referred to as the Minimum Threshold Trigger. Once a management area triggers the Management Area

Exceedance, the management area will be counted towards the calculation of an undesirable result for the entire Subbasin.

The Management Area Exceedance criteria applies to Chronic Lowering of Groundwater Levels and by proxy to Reduction of Groundwater Storage, and Degraded Water Quality. Land Subsidence is considered as the rate of subsidence at California Aqueduct and the Friant-Kern Canal, as explained Section 3.4.5. Table 3-1 shows the total number of representative monitoring wells in each Subbasin management area for groundwater levels and the number of which would have to exceed their respective minimum threshold to for the management to trigger a Management Area Exceedance.

3.4 Undesirable Results

Undesirable results for each sustainability indicator have been developed through a collaborative process with all the GSAs in the Subbasin, compliant with GSP emergency regulations, which state that undesirable results are to be defined consistently throughout the basin (23-CCR § 354.20). Seawater intrusion and depletion of interconnected surface water were determined not to be present in the Subbasin; therefore, undesirable results for these sustainability indicators were not defined. Justification for these determinations is provided in Sections 3.2.4 and 3.2.5.

The undesirable results developed for this Subbasin represent a condition of significant and unreasonable impacts to the beneficial uses and users of groundwater over a broad area of the Subbasin. The undesirable results definition for the Subbasin allows flexibility for each management area within the Subbasin to define minimum thresholds that protect against significant and unreasonable impacts to the beneficial uses and users of groundwater within specific management areas and as was stated in Section 3, the KGA members used as a foundation a water well impact analysis for all beneficial users and uses. The minimum thresholds within a management area have also been coordinated with other management areas and/or other GSAs to ensure coordination and reasonable operating conditions between management areas.

Table 3-1 NEW. Kern Subbasin Management Area Exceedances Information

KGA Management Area	# of Representative Wells	# of Well Exceedances to Trigger Management Area Exceedance Criteria	Acres in Management Area	Percentage of Subbasin
Cawelo GSA	7	3	62,616	3.5
Eastside Water Management Agency	6	2	38,222	2.1
Kern-Tulare Water District (in Kern)	6	2	11,219	0.6
North Kern WSD				
MA-1 (Old District)	8	4	61,741	3.4
MA-2 (RRID)	2	1	5,802	0.3
KCWA-Pioneer GSA	5	2	2,233	0.1
Kern Water Bank Authority	0	0	20,490	1.1
Rosedale-Rio Bravo WSD	19	8	48,610	2.7
Southern San Joaquin MUD	10	4	65,693	3.7
Shafter-Wasco Irrigation District	7	3	39,980	2.2
7th Standard Annex	3	2	10,045	0.6
Semitropic GSA				
MA-1 (Pond Poso)	6	2	82,638	4.6
MA-2 (Buttonwillow)	5	2	92,633	5.2
MA-3 (Undeveloped)	2	1	49,140	2.7
West Kern GSA				
North Project MA	6	2	521	0.0
South Project MA	17	7	889	0.0
Western Watch Area [1]	n/a	n/a	183,128	10.2
Lake Watch Area [1]	n/a	n/a	653	0.0
LSMV Watch Area [1]	n/a	n/a	1,947	0.1
Westside Districts Water Authority				
Westside District MA	3	1	195,263	10.9
Lost Hills Watch Area [1]	n/a	n/a	33,191	1.9
Southwest Watch Area [1]	n/a	n/a	48,739	2.7
Non-District White Lands Watch Areas [1]	n/a	n/a	210,034	11.7

2. "Watch Areas" are areas with no significant groundwater use and no planned groundwater use as documented by the management area member agency. Water areas will be monitored for land use changes and groundwater conditions which could change its designation to a "management area" with specified SMCs.

Undesirable results for each sustainability indicator have been developed through a collaborative process with all the GSAs in the Subbasin, compliant with GSP emergency regulations, which state that undesirable results are to be defined consistently throughout the basin (23-CCR §

354.20). Seawater intrusion and depletion of interconnected surface water were determined not to be present in the Subbasin; therefore, undesirable results for these sustainability indicators were not defined. Justification for these determinations is provided in Sections 3.2.4 and 3.2.5.

The undesirable results developed for this Subbasin represent a condition of significant and unreasonable impacts to the beneficial uses and users of groundwater over a broad area of the Subbasin. The undesirable results definition for the Subbasin allows flexibility for each management area within the Subbasin to define minimum thresholds that protect against significant and unreasonable impacts to the beneficial uses and users of groundwater within specific management areas and as was stated in Section 3, the KGA members used as a foundation a well impact analysis for all beneficial users and uses. The minimum thresholds within a management area have also been coordinated with other management areas and/or other GSAs to ensure coordination and reasonable operating conditions between management areas.

3.4.1 Criteria Used to Define Undesirable Results

Defining the point of a Subbasin level undesirable result begins with a defined level of significant and unreasonable impacts to beneficial users, both spatially and temporally, within each management area of the Subbasin. The accumulation of impacts to beneficial users throughout the Subbasin, and across multiple management areas, representing a persistent and prevalent occurrence of impacts to beneficial users is considered an undesirable result.

For Chronic Lowering of Groundwater Levels, Reduction of Groundwater Storage and Degraded Water Quality the Kern Subbasin has defined the occurrence of an undesirable results as the level of impacts affecting either:

- 15% of the Subbasin area, measured as the combined acres of three adjacent management areas with Management Area Exceedances, or
- 30% of the Subbasin area, measured as the combine acres of any management area with Management Area Exceedances.

The criterion of three adjacent management areas of at least 15% of the Subbasin was developed to recognize a condition where degrading groundwater conditions from one management area spreads to adjacent management areas. This criterion recognizes that even the lesser percentage of the Subbasin (15%) as a contiguous area is significant with regards to the potential for further degradation of groundwater conditions across the Subbasin. The criterion of 30% of the Subbasin (generally noncontiguous management areas) recognizes a condition of widespread degradation of groundwater conditions across the whole of the Subbasin and across a diverse demographic of beneficial users, operational and geologic landscape.

Figure 3-2 provides an example of the occurrence of an undesirable result when Management Area Exceedances have occurred in at least three (3) adjacent management areas that represent at least 15% of the Subbasin (as measured by the acreage of each management area). In this example three management areas which are adjacent to each other are designated as

Management Area Exceedances (defined in Section 3.3) and whose management areas account for more than 15% of the Subbasin.

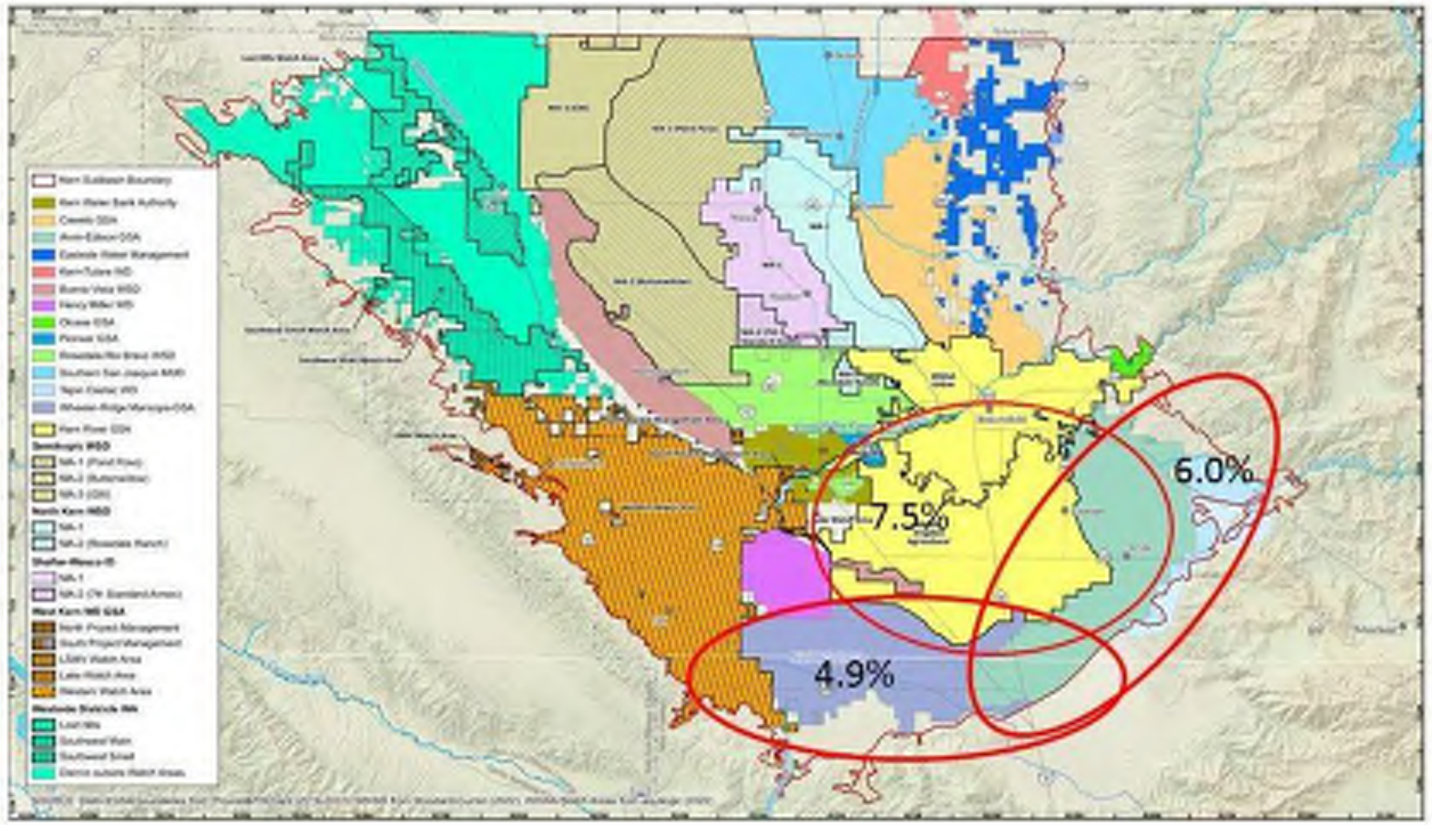
Figure 3-3 provides an example of the occurrence of the undesirable result criteria when Management Area Exceedances have occurred in greater than 30% of the Subbasin (as measured by the acreage of each management area). In this illustrative example seven (7) separate management areas are experiencing Management Area Exceedance areas (defined in Section 3.3) and the combined acreage accounts for more than 30% of the Subbasin. This criterion recognizes a large spread degraded of groundwater conditions across the whole of the Subbasin and across a diverse demographic of beneficial users, operational and geologic landscape. As the Kern subbasin GSAs were working through the criteria to define undesirable results, key characteristics of the basin that played an important role in the definitions were:

1. One important characteristic is the size of the basin and variation in hydrology and geology from the west side of the basin differs from the east side, as does the north boundary line to the south, and neither direction responds exactly the same to groundwater activities.
2. Another important characteristic is the scattering of beneficial users and uses as well as in some cases having no beneficial users and uses in some areas. This characteristic in some cases is even diverse between adjacent management areas. For example, one area has domestic beneficial users and the adjacent management area might have no beneficial users.

As the development of the definitions was moving forward, it became very apparent that there exist data gaps where the Basin Study would assist in more accurate approach and direction for the update GSPs in 2025.

Management Area	Acres	Percent of Subbasin
Cawelo GSA	62,616	3.5%
Eastside Water Management Area	38,222	2.1%
Kern- Tulare WD (in Kern County)	11,219	0.6%
North Kern WSD		
MA-1	61,741	3.4%
MA-2 (Rosedale Ranch)	5,802	0.3%
KCWA - Pioneer GSA	2,233	0.1%
Kern Water Bank Authority	20,490	1.1%
Rosedale-Rio Bravo WSD	48,618	2.7%
Southern San Joaquin MUD	65,893	3.7%
Shafter-Wasco ID		
MA-1	39,880	2.2%
MA-2 (7th Standard Annex)	10,045	0.6%
Semitropic GSA		
MA-1 (Pond Poso)	82,838	4.6%
MA-2 (Buttonwillow)	92,853	5.2%
MA-3 (Undeveloped)	49,140	2.7%
West Kern WD GSA		
North Project Management Area	521	0.0%
South Project Management Area	869	0.0%
Westgerm Watch Area	183,128	10.2%
Lake Watch Area	653	0.0%
LSMV Watch Area	1,847	0.1%
Westside District WA		
Westside District WA	195,263	10.9%
Lost Hills Watch Area	33,191	1.9%
Southwest Watch Area	48,738	2.7%
Non-Districts White Lands Watch Areas	210,034	11.7%
South of Kern River Districts		
Arvin Edison WSD GSA	107,728	6.0%
Tejon Castac WD GSA	19,280	1.1%
Wheeler Ridge-Maricopa WSD GSA	87,391	4.9%
Kern River GSA		
KRGSA - AG	134,104	7.5%
KRGSA - Banking	5,045	0.3%
KRGSA - Urban	93,358	5.2%
Buena Vista GSA	50,414	2.8%
Henry Miller GSA	26,055	1.5%
Olcese GSA	3,206	0.2%
TOTALS:	1,792,809	100.00%

"..least three (3) adjacent management areas that represent at least 15% of the Subbasin ..."



18.4 % of the Subbasin

Figure 3-2 NEW. Example of Undesirable Results Criteria for 15% of Subbasin.

Management Area	Acres	Percent of Subbasin
Cawelo GSA	62,676	3.5%
Eastside Water Management Area	38,222	2.1%
Kern-Tulare WD (in Kern County)	11,219	0.6%
North Kern WSD		
MA-1	61,741	3.4%
MA-2 (Rosedale Ranch)	5,892	0.3%
KCWA - Pioneer GSA	2,233	0.1%
Kern Water Bank Authority	20,490	1.1%
Rosedale-Rio Bravo WSD	48,610	2.7%
Southern San Joaquin MUD	65,683	3.7%
Shafter-Wasco ID		
MA-1	39,980	2.2%
MA-2 (7th Standard Annex)	10,045	0.6%
Semitropic GSA		
MA-1 (Pond Poso)	82,638	4.6%
MA-2 (Bellevue)	92,633	5.2%
MA-3 (Undeveloped)	49,140	2.7%
West Kern WD GSA		
North Project Management Area	531	0.0%
South Project Management Area	889	0.0%
Western Watch Area	183,126	10.2%
Lake Watch Area	653	0.0%
LBMV Watch Area	1,947	0.1%
Westside District WA		
Westside District WA	195,263	10.9%
Lost Hills Watch Area	33,191	1.9%
Southwest Watch Area	48,739	2.7%
Non-District White Lands Watch Areas	210,034	11.7%
South of Kern River Districts		
Arvin Edison WSD GSA	107,726	6.0%
Tejon Castac WD GSA	19,280	1.1%
Wheeler Ridge-Maricopa WSD GBA	87,391	4.9%
Kern River GSA		
KRGSA - AG	134,104	7.5%
KRGSA - Banking	5,049	0.3%
KRGSA - Urban	93,350	5.2%
Buena Vista GSA	50,414	2.8%
Henry Miller GSA	26,055	1.5%
Olcese GSA	3,206	0.2%
TOTALS:	1,792,000	100.00%

"... greater than 30% of the Subbasin (as measured by each management area)."

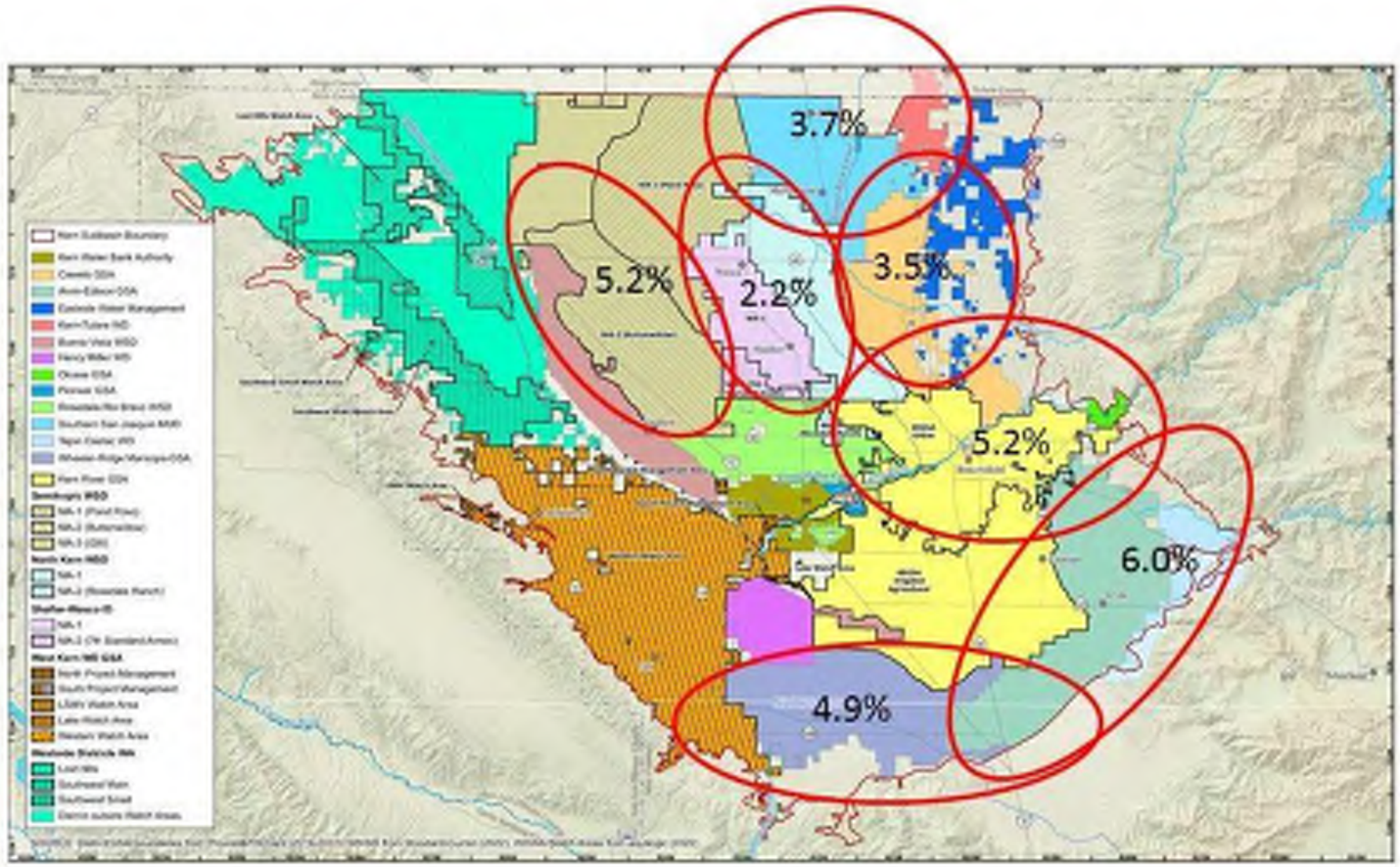


Figure 3-3 NEW. Example of Undesirable Results Criteria for 30% of Subbasin.

3.4.2 Undesirable Result for Chronic Lowering of Groundwater Levels

The basin-wide definition for undesirable results for chronic lowering of groundwater levels is as follows:

> *The point at which significant and unreasonable impacts over the planning and implementation horizon, as determined by depth/elevation of water, affect the reasonable and beneficial use of, and access to, groundwater by overlying users.*
>
> *This is determined when the minimum threshold for groundwater levels are exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the Subbasin (as measured by each management area). Minimum thresholds shall be set by each of the management areas through their respective management area plans or Groundwater Sustainability Plans.*

This undesirable result definition at the Subbasin level provides flexibility at the management area level to identify the appropriate users and uses of groundwater and the levels of impacts important in that area of the Subbasin. Consistent with DWR's Draft BMP for Sustainable Management Criteria, the Subbasin recognizes that: "overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." The Subbasin has agreed that a drought period of greater than 10-years would constitute prolonged drought and the lowering of groundwater levels or groundwater storage to below minimum thresholds resulting from a prolonged drought will not constitute an undesirable result.

The Subbasin is trying to avoid widespread occurrence of groundwater levels declining below the minimum thresholds, which indicates the Subbasin is not sustainably managing groundwater conditions in the aggregate and that beneficial users could be affected on a spatial and temporal scale that it too substantial to mitigate. If groundwater levels approach the minimum threshold, isolated exceedances will likely occur and is expected to progressively occur in multiple wells if there is no intervention. To avoid a widespread occurrence of MT exceedances, the KGA established an *Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater*, which is a proactive approach to identifying and working with management areas to address a single, isolated exceedance. If intervention at a single MT exceedance is unsuccessful, a Management Area Exceedance may be triggered, which could trigger a Subbasin-wide undesirable result.

As described above, an undesirable result for chronic lowering of groundwater levels occurs when a combination of management areas reaches Management Area Exceedance status, totaling 15% or 30% of the Subbasins acreage. This undesirable results criterion recognizes a large spread of chronic groundwater level declines across the whole of the Subbasin and across a diverse demographic of beneficial users, operational, and geologic landscape that significantly and unreasonably impacts beneficial users.

3.4.2.1 Potential Cause of Chronic Lowering of Groundwater Levels

Section 354.26(b)(1) of the GSP Regulations requires identification of potential causes of an undesirable result for each sustainability indicator. Potential causes of undesirable results for chronic lowering of groundwater levels vary throughout the Subbasin. Lowering groundwater levels can be attributed to increased groundwater pumping, reduced imported water supplies, reduced groundwater inflows from adjacent areas, and/or climate change that results in more frequent and extreme droughts and dry periods. Because of the size of the Kern subbasin and the geology and hydrology, each management area is not created equally and thus for more specific information regarding their specific cause of chronic lowering of groundwater levels in the regions of the Subbasin, refer to the management area plans. None of the KGA management areas have any other causes of chronic lowering of groundwater levels other than what are mentioned in this section however some management areas have different beneficial users and uses that are more dominate and have indicated that in their specific management area plans as well as how their will limit impacts to those users and uses.

3.4.2.2 Potential Effects of Chronic Lowering of Groundwater Levels

Section 354.26(b)(3) of the GSP regulations requires identification of potential effects of an undesirable result for chronic lowering of groundwater levels. Potential effects of an undesirable result due to the chronic lowering of groundwater levels is the potential to affect the reasonable and beneficial use of, and access to, groundwater by overlying beneficial users. As previously mentioned, the beneficial uses and users of water varies across the Subbasin and each management area plan address the potential effects on those uses and users. Also, as previously mentioned, these plans are coordinated to avoid impacts to the neighboring GSAs or management areas. As mentioned in Section 2.5 Management Areas and the reason why management areas were established, for more detailed information on how the effects or impacts to the beneficial users concerning the chronic lowering of groundwater levels in specific areas refer to the individual management area plans.

3.4.3 Undesirable Result for Reduction of Groundwater Storage

The basin-wide definition of an undesirable result for reduction of groundwater storage is as follows:

> *The point at which significant and unreasonable impacts, as determined by the amount of groundwater in the basin, affect the reasonable and beneficial use of, and access to, groundwater by overlying users over an extended 10-year drought period.*
>
> *This is determined when the volume of storage (above the groundwater level minimum threshold) is depleted to an elevation lower than the groundwater level minimum threshold in at least three (3) adjacent management areas that represent at least 15% of the subbasin or greater than 30% of the subbasin (as measured by the acreage of each management areas). Minimum thresholds shall be set by each of the management area through their respective management area plans or Groundwater Sustainability Plans.*

Groundwater storage is coordinated and collaborated across the Subbasin, based on groundwater modeling budgets (historical, baseline and projected). To protect groundwater in storage, KGA Members are managing to their MO, which provides sufficient groundwater to manage through a 10-year drought condition before water levels decline to the MT. Considering the Kern Subbasin's capacity to store water is plentiful, and that the MT for chronic lowering of groundwater levels was set to avoid significant and unreasonable impacts to beneficial users, when used as a proxy for groundwater in storage, groundwater levels are inherently protective of the groundwater storage. An undesirable result in the Kern Subbasin has been defined for the reduction of groundwater storage as a condition that occurs throughout the Subbasin which represents unsustainable management of basin-wide groundwater resources. This begins with a defined level of significant and unreasonable impacts to beneficial users from reduced groundwater storage, both spatially and temporally, in the Kern Subbasin as well as within each management area of the Subbasin. The accumulation of impacts to beneficial users throughout the Subbasin, and across multiple management areas, representing a persistent and prevalent occurrence of impacts to beneficial users that is considered an undesirable result. Refer to Figures 3-2 and 3-3 for applied examples of the undesirable results criteria for reduction of groundwater storage.

Because of the history of the Kern subbasin actively recharging the basin since the early 1950s and being the first agricultural county to execute contracts on the State Water Project back on November 16, 1963, groundwater storage is vital to the Kern subbasin. The Kern subbasin has a history of storing millions of acre feet of water in wet water years to limit the reduction of groundwater storage. This practice has allowed all beneficial users and uses the benefit of costs associated to power costs that are associated to extraction of groundwater, meaning that with recharging activities the beneficial users will pay less in power extraction costs. Using the new developed website from DWR called California Groundwater Live: reported dry wells, the Kern subbasin since 2015 (SGMA start date) has seen only 18 wells that have been reported, and no municipal well in that number. This provides some insight into the ability to store and thus limit the reduction of groundwater stored. Note that this timeline, covered the last drought period.

Another item to note, is the hydrology and geology of the Kern subbasin is so complex that data gaps are very apparent. The Kern subbasin's base of fresh water is below the set of the minimum thresholds and the Basin Study will assist in providing concrete data to support that assumption during the development and submittal of the updated 2025 GSP. Also, during the development and submittal of the annual reports, the Kern subbasin re-evaluates the groundwater storage in volume amount and with the grant funds now available to begin the Basin Study, the Kern subbasin is working to have in the updated 2025 GSPs, volume data on groundwater storage that is accurate. During the development of the 2020 GSPs, the Kern subbasin acknowledged the data gaps and thus the updated GSPs will provide groundwater storage in volume based on the new calibrated water model that will come from the Basin Study.

3.4.3.1 Potential Cause of Reduction of Groundwater Storage

Section 354.26(b)(1) of the GSP regulations requires identification of potential causes of undesirable results for each sustainability indicator. Potential causes of an undesirable result for reduction of groundwater storage vary throughout the Subbasin, specifically the volume of storage needed to manage to a 10-year drought condition while maintaining groundwater levels at or above the minimum threshold for chronic lowering of groundwater levels. Although the SGMA regulations state drought conditions cannot trigger an undesirable result, the KGA members developed undesirable result definitions with consideration of how best to manage to a 10-year drought condition. To protect groundwater storage, the KGA members are using their water budgets to manage at or above the measurable objective and sustainably manage through a 10-year drought. Thus, difference between the measurable objective and minimum threshold equates to the volume of groundwater storage needed to sustainably manage through a 10-year drought. Reduction of groundwater storage can be attributed to increased groundwater pumping; reduced imported water supplies; reduced surface water and banking; reduced groundwater inflows from adjacent areas; and/or climate change that results in more frequent and extreme droughts and dry periods. Similar to the chronic lowering of groundwater levels, for more specific areas of the Subbasin and to determine the potential cause of reduction of groundwater storage, refer to the management area plan for the specific area.

3.4.3.2 Potential Effects of Reduction of Groundwater Storage

Section 354.26(b)(3) of the GSP regulations requires identification of potential effects of an undesirable result for reduction of groundwater storage. Potential effects of reduction of groundwater storage could lead the limited groundwater availability during a prolonged drought with impacts to beneficial users and uses in high power costs, construction of wells to accommodate the reduction and possible relocation of some water wells.

3.4.4 Undesirable Result for Degraded Water Quality

The basin-wide definition of an undesirable result for degraded water quality is as follows:

> *The point at which significant and unreasonable impacts over the planning and implementation horizon, as caused by water management actions, that affect the reasonable and beneficial use of, and access to, groundwater by overlying users.*
>
> *This is determined when the minimum threshold for a groundwater quality constituent of concern is exceeded in at least three (3) adjacent management areas that represent at least 15% of the subbasin or greater than 30% of the designated monitoring points within the basin. Minimum thresholds shall be set by each of the management areas through their respective management area plans or Groundwater Sustainability Plans.*

As with chronic lowering of groundwater levels, the above basin-wide definition allows for local definition, within each management area of the Subbasin, of the minimum thresholds that constitute a significant and unreasonable impact to the beneficial users within each management area. Due to the hydrology and geology of the basin as well as the size of the basin this approach

provides more accurate specific setting of the minimum thresholds that will accomplish compliance with SGMA.

Similar to reduction of groundwater storage, groundwater levels are also used as a proxy for degraded water quality in some management areas. As with the previous sustainability indicators, an undesirable result in the Kern Subbasin for the degraded water quality represents a condition that occurs throughout the Subbasin representing unsustainable management of basin-wide groundwater resources. This begins with a defined level of significant and unreasonable impacts to beneficial users from degraded water quality conditions, both spatially and temporally, within each management area of the Subbasin. The accumulation of defined water quality impacts to beneficial users throughout the Subbasin, measured as a Management Area Exceedance, representing a persistent and prevalent occurrence of impacts to beneficial users is considered an undesirable result. Refer to Figures 3-2 and 3-3 for applied examples undesirable results criteria for reduction of reduction of water quality.

Establishment of specific measurable objectives and minimum thresholds based on the above definition for this undesirable result can be found in Section 3.3.

An overview of the existing water quality conditions in the Subbasin is provided in the basin setting section of this GSP. Additionally, details of the water quality monitoring in the KGA can be found in Section 3.6.7.2.

3.4.4.1 Potential Cause of Degraded Water Quality

Section 354.26(b)(1) of the GSP regulations requires identification of potential causes of undesirable results for each sustainability indicator. Potential causes of an undesirable result for degraded water quality vary throughout the Subbasin. Water quality in the Subbasin has been historically sustainable with few exceptions. In the future, water quality can be degraded by significant increase in groundwater pumping or unforeseen point source contamination issues caused by natural or human activity. Each management area plan addresses the cause of degraded water quality in their management area differently since the Subbasin has dynamic differences in hydrology and water supplies and uses. For detailed causes of degraded water quality in a specific area, refer to the management area plans.

3.4.4.2 Potential Effects of Degraded Water Quality

Section 354.26(b)(3) of the GSP regulations requires identification of potential effects of an undesirable result for degraded water quality. An undesirable result for degraded water quality could affect beneficial users. This could potentially reduce the amount of usable supply delivered to groundwater users and require the need for treatment systems, which could potentially have a negative economic effect. As mentioned above for the cause of degraded water quality, the effects or impacts vary in the Subbasin and the management area plans provide more detailed information for their specific areas.

3.4.5 Undesirable Result for Land Subsidence

The basin-wide definition of an undesirable result for land subsidence is as follows:

The point at which significant and unreasonable impacts, as determined by a subsidence rate and extent in the basin, that affects the surface land uses or critical infrastructure.

This is determined when subsidence results in significant and unreasonable impacts to critical infrastructure as indicated by monitoring points established by a basin wide coordinated GSP subsidence monitoring plan.

An undesirable result for land subsidence is further identified as the occurrence of a single minimum threshold exceedance along either the Aqueduct or the Friant-Kern Canal. The minimum thresholds for the Aqueduct are detailed in the white paper in Attachment E3. See the Friant-Kern white paper (Attachment 4) for a detail discussion the minimum thresholds for that facility.

CA Aqueduct

The California Aqueduct (Aqueduct) has been identified as regional critical infrastructure on the west side of the Subbasin. The Subbasin definition of an undesirable result for land subsidence is the point at which the amount of inelastic subsidence, if caused by SGMA-related Subbasin groundwater extractions, creates a significant and unreasonable impact (requiring either retrofitting or replacement to a point that is economically unfeasible to the beneficial users) to surface land uses or critical infrastructure. A significant loss in functionality that could be mitigated through retrofitting and is considered economically feasible to the beneficial users would not be considered undesirable.

Friant-Kern Canal

An undesirable result for land subsidence is defined as the point at which the amount of inelastic subsidence, if caused by Subbasin groundwater extractions, creates a significant and unreasonable impact to surface land uses or critical infrastructure. A significant and unreasonable impact to the FKC is determined when the flow capacity through the Lower Reach is reduced to capacities below historical operational flow capacities over the previous 10 years, impacting surface land uses of available water supplies, as a result of groundwater extractions from agricultural, domestic, municipal, or urban beneficial users within the Kern County Subbasin.

Establishment of specific measurable objectives and minimum thresholds based on the above definition for this undesirable result can be found in Section 3.5 and within each management area plan. Additional details on subsidence monitoring can be found in 3.6.7.4.

3.4.5.1 Potential Cause of Land Subsidence

Section 354.25(b)(1) of the GSP regulations requires identification of potential causes of an undesirable result for land subsidence. Potential causes of land subsidence vary throughout the Subbasin. A variety of subsurface conditions and mechanisms, not all completely understood, can cause subsidence. A relatively minor amount of subsidence over a wide area can be insignificant and/or imperceptible, whereas a significant amount of localized subsidence can create an unreasonable impact to overlying infrastructure. Although groundwater extractions for agricultural or other uses have potential under limited conditions to cause subsidence, recent

studies conducted by Management Areas on the west side and the KGA have identified soluble soils, natural differential compaction and oil and gas production activities as potential contributors to subsidence along the Aqueduct. None of the subsidence modes besides groundwater extraction for agricultural and other Management Area beneficial uses are within the control or jurisdiction of Subbasin GSAs. Identifying the subsurface conditions and mechanisms causing subsidence in the Subbasin will be a critical first step to managing current and future impacts and identifying appropriate management actions. Recent reports of damage to critical infrastructure due to land subsidence are provided in detail in the management area plans. Data gaps and challenges to setting sustainable management criteria and monitoring for undesirable results due to land subsidence are presented in Section 3.4. Potential Effects of Land Subsidence

Section 354.26(b)(3) of the GSP regulations requires identification of potential effects of an undesirable result for land subsidence. Potential effects of land subsidence include damage to critical infrastructure including pipelines, roads, building, water conveyance systems, and flood control facilities. In the Kern Subbasin, the most sensitive infrastructure is the California Aqueduct and Friant-Kern Canal. Damage to these systems could impact surface water deliveries, resulting in increased groundwater use.

3.4.6 Seawater Intrusion

The Subbasin is located approximately 60 miles from the Pacific Ocean, separated by the Coastal Range and other geologic features that prevent seawater from migrating into the Subbasin. Details of the geologic structure of the Subbasin can be found in the basin setting of this GSP. Based on the separation of the Subbasin from any source of seawater, the Subbasin has not developed sustainable management criteria for this sustainability indicator.

3.4.7 Interconnected Surface Water

As defined in the California Code of Regulations (§ 351. Definitions), “Interconnected Surface Water” refers to water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.” A discussion on interconnected surface water is included in Section 2.3.5. As there are no known natural interconnected surface water systems within the KGA boundary, this sustainability indicator is not included in this GSP.

3.5 Minimum Thresholds and Measurable Objectives

The SGMA planning effort began in 2013, prior to the enactment of SGMA, as districts in the Subbasin recognized the need to begin coordination of groundwater management activities. The initial efforts focused on developing an understanding of the significant issues facing groundwater management at the Subbasin and at the district level. Particularly important to this process was understanding the unique conditions that existed in the Subbasin. These conditions include, but are not limited to:

- Not all management areas have equal access to groundwater resources (quantity or quality).
- Each management area has variable imported or local water supplies (State Water Project, Friant Project, Kern River) each with their own management and reliability challenges.
- The ability to implement water management programs within management areas varies by the authorities of the managing entity and in some cases challenges coordination between districts.
- The beneficial uses and users of groundwater varied across the Subbasin.

Despite these unique conditions, the management areas within the Subbasin understood the need to coordinate the development of groundwater management activities and common technical methods on which to develop future management activities.

The KGA was formed under a JPA in 2017 and through that process the KGA/GSA Managers Group was formalized. The KGA/GSA Managers Group includes representatives from all KGA member agencies, typically the district general managers and technical experts, as well as representatives from each of the other GSAs developing a GSP in the Subbasin; Kern River GSA, Buena Vista GSA, Henry Miller GSA, Olcese GSA and South of Kern River GSAs. The measurable objectives and minimum thresholds within the Subbasin were developed in a collaborative process, starting with the KGA/GSA Managers Group. The Manager's Group has been meeting on a weekly basis to address coordination issues; develop and share technical information; identify and resolve potential conflicts; the development of all the annual reports: and, where appropriate, elevated issues to the Board of Directors of their respected GSAs and/or the Kern SGMA Coordination Committee comprised of representatives of all GSAs in the Subbasin.

Through the Managers Group, the process for developing minimum thresholds and measurable objectives for the entire subbasin was initiated. This process involved review of the SGMA requirements for thresholds and objectives, including their relationship and coordination to management areas; presentation of technical methods for establishing thresholds and objectives; and coordination between districts and GSAs through the establishment of draft and final thresholds and objectives.

The process was facilitated by the KGA/GSA Planning Manager and technical team with input and identification of issues from member agencies and GSA representatives. The general process for developing minimum thresholds and measurable objectives is outlined below:

Step 1: Regulatory and technical review of minimum threshold and measurable objectives requirements.

- **KGA/GSA Managers Group:** Provided overview of regulatory and technical requirements.
- **Member agencies and GSA representatives and technical consultants:** Sharing of technical approaches to establishing thresholds and objectives for their respective management areas.

Step 2: Defining roles and responsibilities for GSAs and management areas (district areas).

- **KGA/GSA Managers Group:** Presentations on roles and responsibilities for managing resources through proposed thresholds and objectives.
- **Member agencies and GSA representatives and technical consultants:** Identification of potential management area conflicts and opportunities for joint resource management strategies.

Step 3: Development of first draft minimum thresholds and measurable objectives for all Subbasin management areas.

- **KGA/GSA Managers Group:** Facilitate review of draft thresholds and objectives, including development of contour maps and cross-sections of thresholds and objectives.
- **Member agencies and GSA representatives and technical consultants:** Develop and execute technical approach for developing thresholds and objectives with presentation to the KGA Managers Group for review.

Step 4: Development of second draft thresholds and objectives for all Subbasin management areas.

- **KGA/GSA Managers Group:** Facilitate review of draft minimum thresholds and measurable objectives, including development of contour maps and cross-sections of thresholds and objectives.
- **Member agencies and GSA representatives and technical consultants:** Develop and execute technical approach for developing thresholds and objectives and presentation to the KGA Managers Group for review. Identify areas of potential conflicting minimum thresholds and measurable objectives in adjacent management areas and coordinate resolution with adjacent management area.

Step 5: Adoption of final minimum thresholds and measurable objectives.

- **KGA/GSA Managers Group:** Facilitate review of final thresholds and objectives and presentation of thresholds and objectives to KGA Board of Directors.
- **Member agencies and GSA representatives and technical consultants:** Resolve any outstanding conflicts and review thresholds and objectives with management area Boards of Directors and stakeholder groups
- **GSA Boards:** KGA/GSA managers presented to their specific boards for policy board approval

As demonstrated in the steps above, the KGA/GSA Managers Group facilitated the coordination and review of the Subbasin's minimum thresholds and measurable objectives. The technical work required to establish thresholds and objectives at the management area level was completed by the member agencies or GSAs. For the details of the technical processes utilized by KGA member agencies see their respective management area plans. One item to note, that during this

entire process the KGA held several stakeholder/beneficial users workshops to roll-out the minimum thresholds and measurable objectives for their input at each step. Also, at the KGA Board meetings, the minimum thresholds and measurable objectives appeared as discussion items.

All KGA Management Areas used a Well Impact Study to identify beneficial uses and users within each management area that reflects the types of users that actively rely on local groundwater resources and those that can be directly affected by groundwater management, impacts of operating at proposed Measurable Objectives (MO), and impacts of exceeding Minimum Thresholds (MT). Each MAP provides the details of the data and methodology applied to the Well Impact Study specific to that management area and identifies an estimate of potential impacts to beneficial users (in terms of dewatered wells) if groundwater elevations reach the MO and MT in the management area. Table 3-2 provides a tabular summary and Figure 3-4 shows a graphic summary of the number of wells for each beneficial use category (M-municipal, D-domestic, A-agricultural) and the potential impact to each category as a percent of wells that could be dewatered at the measurable objective. Table 3-3 shows a tabular summary of Figure 3-5 shows a graphic summary of the percent of wells that could be dewatered at the minimum threshold.

KGA Representative Monitoring Wells

Table 3-4 provides a list of the KGA groundwater level Representative Monitoring Wells with the MT and MO, as approved in June 2022. This table also shows where groundwater level is a representative proxy for water quality and land subsidence. Across the Subbasin, water levels are used as a proxy for groundwater in storage. There is also a column with a brief summary from each management area describing their definition of a MT Exceedance for each sustainability indicator. The purpose of this table is to show consistency amongst the KGA, and where there is a difference, there is an explanation of why a different threshold is most applicable to the management area. Figures 3-6 provides a map showing the RMW locations. Figures 3-7 and 3-8 show the MT and MO contours.

RMWs presented in Table 3-4 and Figures 3-4 through 3-6 do not include proposed changes in the amended Management Area Plans. The Monitoring Network will be updated to reflect management area revisions before the fall seasonal water level monitoring period begins. Table 3-5 summarizes the management areas that proposed changes.

Table 3-2. Tabular Summary of Wells Potentially Dewatered at the Measurable Objective

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	0	0	0%
EWMA	2	11	41	24%	0	0	0	0%
NK	1	22	161	13%	0	0	2	0%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	0	0	0%
SWID	16	68	118	42%	0	8	7	10%
SSJMUD	19	67	243	26%	0	13	11	15%
SWSD	4	138	763	16%	0	10	4	7%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	2	0	18%
Total	81	577	1827	26%	0	33	24	5%

0 Municipal wells going dry at the MT's

Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M= Municipal, D= Domestic, and A=Agricultural

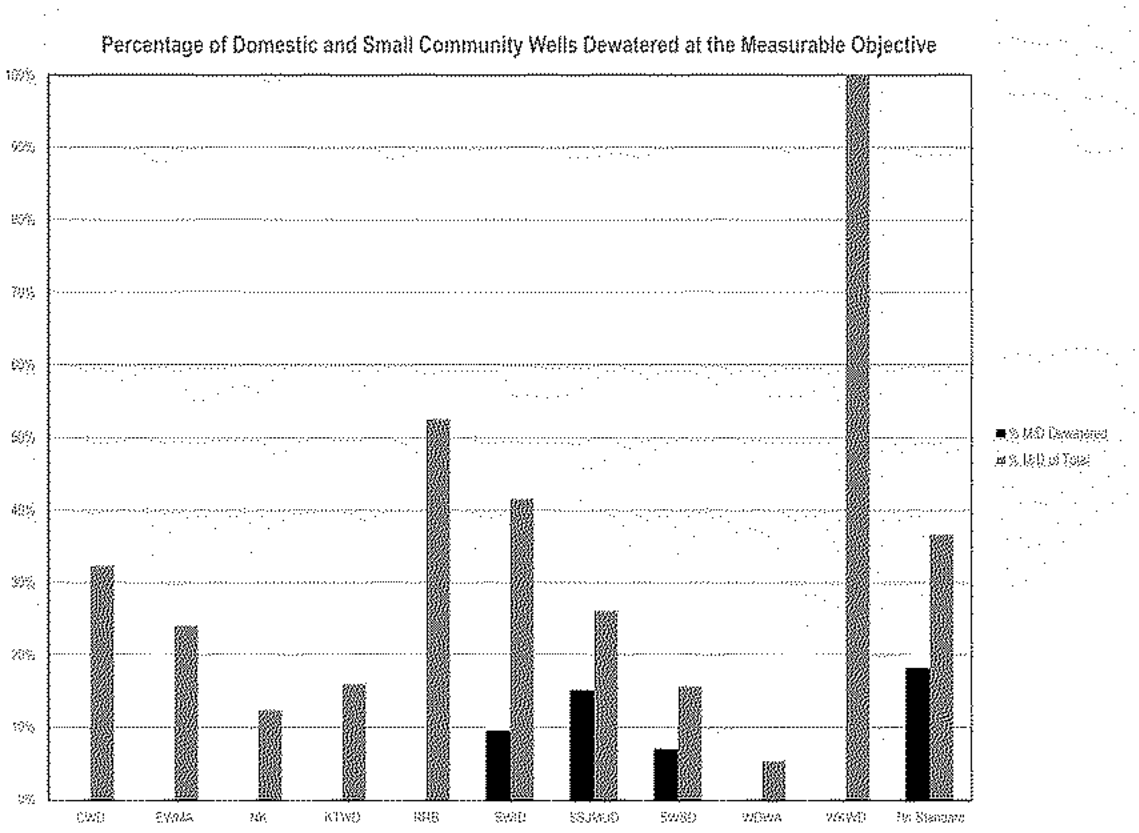


Figure 3-4. Graphic Summary of Wells Potentially Dewatered at the Measurable Objective

Table 3-3. Tabular Summary of Wells Potentially Dewatered at the Minimum Threshold

	Number of Wells				Number of Dewatered Wells			
	M	D	A	% M/D Wells	M	D	A	% M/D Wells
CWD	0	93	197	32%	0	3	1	3%
EWMA	2	11	41	24%	0	3	0	23%
NK	1	22	161	13%	0	2	5	9%
KTWD	0	18	94	16%	0	0	0	0%
RRB	24	149	156	53%	0	21	0	12%
SWID	16	68	118	42%	0	22	13	26%
SSJMUD	19	67	243	26%	0	29	25	34%
SWSD	4	138	763	16%	0	41	52	29%
WDWA	0	2	35	5%	0	0	0	0%
WKWD	13	0	0	100%	0	0	0	0%
7th Standard	2	9	19	37%	0	5	2	45%
Total	81	577	1827	26%	0	126	98	19%

0 Municipal wells going dry at the MT's

Anyone over 5% of Domestic wells dewatered required to put together a mitigation plan

M= Municipal, D= Domestic, and A=Agricultural

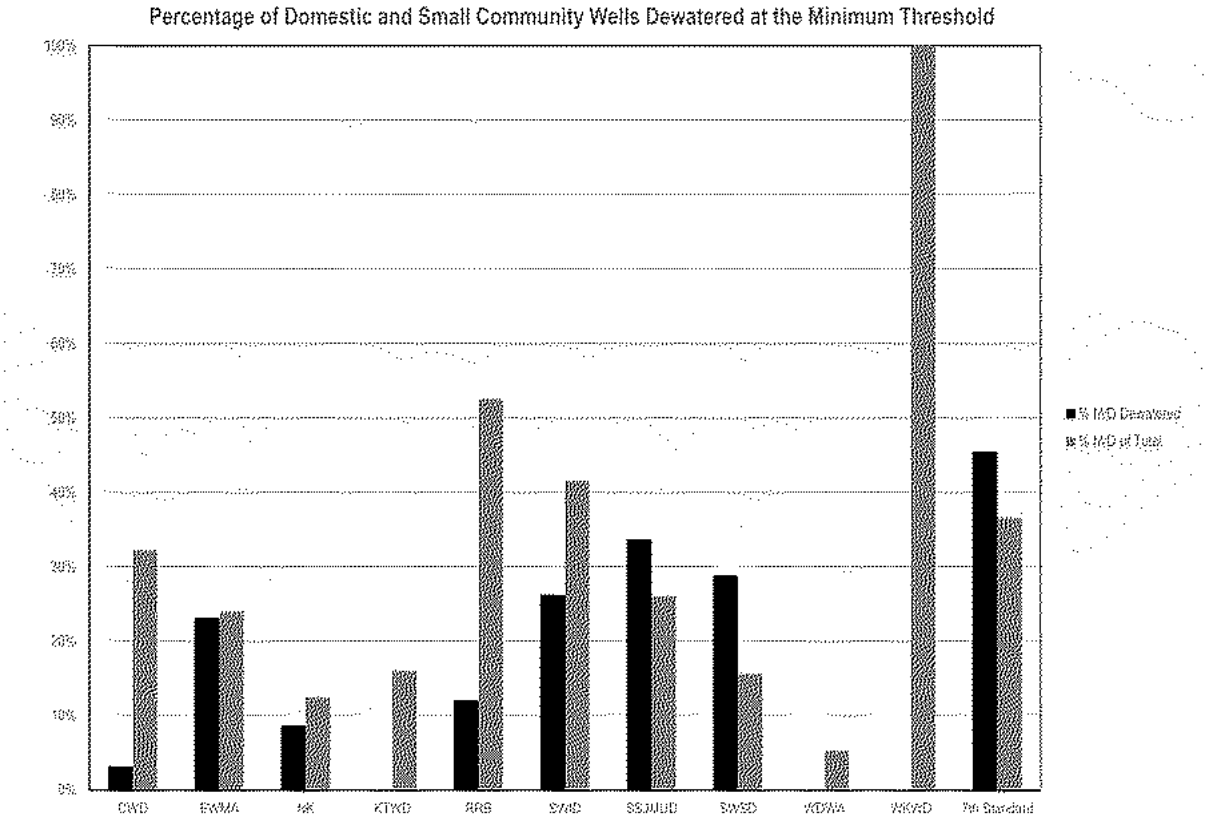


Figure 3-5. Graphic Summary of Wells Potentially Dewatered at the Minimum Threshold

KGA Representative Monitoring Wells

Table 3-4 provides a list of the KGA groundwater level Representative Monitoring Wells with the MT and MO, as approved in June 2022. This table also shows where groundwater level is a representative proxy for water quality and land subsidence. Across the Subbasin, water levels are used as a proxy for groundwater in storage. There is also a column with a brief summary from each management area describing their definition of a MT Exceedance for each sustainability indicator. The purpose of this table is to show consistency amongst the KGA, and where there is a difference, there is an explanation of why a different threshold is most applicable to the management area. Figures 3-6 provides a map showing the RMW locations. Figures 3-7 and 3-8 show the MT and MO contours.

RMWs presented in Table 3-4 and Figures 3-4 through 3-6 do not include proposed changes in the amended Management Area Plans. The Monitoring Network will be updated to reflect management area revisions before the fall seasonal water level monitoring period begins. Table 3-5 summarizes the management areas that proposed changes.

Table 3-4. Management Area Proposed Changes to the Regional Monitoring System

Management Area	Summary of Proposed Changes
North Kern WSD MA-1 (Old District)	MTs for RMWs in the southern portion of NKWSD will be raised 50-ft to reduce impacts to beneficial users and to coordinate with neighboring districts, MOs are also raised as appropriate. Refer to MAP Section 4.4, Table 4-3.
North Kern WSD MA-2 (Rosedale Ranch)	Two new wells were identified to serve as RMWs to represent this Management Area. MTs and MOs were set to be coordination with neighboring districts and with consideration for impacts to beneficial user. Refer to MAP Section 4.4, Table 4-3.
Shafter-Wasco Irrigation District (MA-1)	MTs for RMWs in the southern portion of SWID will be raised 50-ft to reduce impacts to beneficial users and to coordinate with neighboring districts. Refer to MAP Section 4.4, Table 4-4.
Shafter-Wasco 7th Standard Annex	Will raise the MTs and MOs for Chronic Lowering of Groundwater Levels by 50-ft to reduce impacts to beneficial users and to coordinate with adjacent Management Areas. Refer to Section 13.1.
Rosedale-Rio Bravo WSD	To provide clarity and to better coordinate with neighboring MAs, RRBMA prepared multiple groundwater level and MT cross-sections in the general direction of groundwater flow and crossing multiple MAs. MTs and MOs were compared and adjusted to the projected water levels for consistency across the coordinating MA's. Refer to MAP Section 5.7 for further details.
Semitropic Water Storage District	Added two RMW's to MA-2 (Buttonwillow) to coordinate and interpret groundwater responses with management areas on the Districts south and southeastern boundaries. MOs and MT with Rosedale-Rio Bravo. Refer to Chapter MAP Section 4.3.4 and Figure 4.1.

This Page is Intentionally Blank.

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Cawelo GSA		Well 12H	RMW-167	25	ft msl	103	ft msl	X		X	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA fall below the MT during three (3) successive spring measurements.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA fall below the MT during three (3) successive spring measurements.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The undesirable result will be triggered when 30 percent or more of the monitoring wells in the Cawelo GSA have TDS concentrations rising above the MT for two continuous years.~~ A management area exceedance is considered to occur when more than 40% of representative monitoring wells used to monitor TDS concentrations exceed their minimum thresholds for two consecutive annual monitoring periods.	Since groundwater elevations below historical lows may lead to localized land subsidence undesirable results, the exceedance of the land subsidence MT at a single representative monitoring well will be considered a management area exceedance.
		Well 24R	RMW-170	-43	ft msl	35	ft msl	X		X				
		Well 11M	RMW-171	-81	ft msl	3	ft msl	X		X				
		Well 6C	RMW-172	-85	ft msl	-1	ft msl	X		X				
		Well 33C	RMW-173	-64	ft msl	20	ft msl	X		X				
		Well 28L	RMW-169	26	ft msl	110	ft msl	X		X				
		Well 4R	RMW-168	-24	ft msl	60	ft msl	X		X				
Eastside Water Management Authority		EWMA #04 *(added July 2020)*	RMW-283	-133.21	ft msl	87.79	ft msl	X			~~Measurement of water levels below minimum thresholds, in four (4) consecutive semiannual monitoring periods, in no less than 50% of the Representative monitoring network wells, rounded down to the nearest whole number, i.e., four (4) wells.~~ (Sec 12.1.2) A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Same as GW levels criteria.~~ (Sec 12.2.2) A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Chronic lowering of groundwater levels or changes in storage may potentially draw saline water into the area of groundwater production in these units in the EWMA, thus monitoring for TDS will be necessary to foresee and avoid Undesirable Results related to degradation of groundwater quality. (Sec 12.4).	There have been no known occurrences of significant (i.e., magnitude more than one foot) land subsidence within the EWMA (Figure GWC-4) and no observed negative effects. Since no "critical infrastructure" are located within the EWMA, no Undesirable Results are defined within the EWMA.. (Sec 12.5.3)
		EWMA #23	RMW-278	-71	ft msl	132	ft msl	X						
		EWMA #30	RMW-187	-228	ft msl	-71	ft msl	X						
		EWMA #10 *(added July 2020)*	RMW-280	-43	ft msl	175.8	ft msl	X						
		EWMA #41	RMW-189	-41	ft msl	230	ft msl	X						
		EWMA #49 *(added April 2022)*	RMW-	312.0	ft msl	381.9	ft msl	X						
Kern-Tulare Water District		Well 4P1	RMW-175	-150	ft msl	20	ft msl	X			~~An Undesirable Result for the KTWD would be lowering the groundwater levels to the extent that the minimum threshold for groundwater levels are exceeded in 33% of the monitoring wells located within the District. The 33% criteria was chosen to be consistent with criteria used throughout the Kern Subbasin.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Undesirable Result and Minimum Threshold for reduction of groundwater storage shall be the same threshold associated with chronic lowering of groundwater levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	A management area exceedance is triggered when the MT for groundwater quality is exceeded in 40% or more of any representative monitoring wells within the management area. KTWD believes that the main constituent of concern associated with the chronic lowering of groundwater levels is TDS. Immediately west of the District, the Santa Margarita Formation becomes saline. The District has established a minimum threshold for TDS as 750 mg/L.	KTWD has not established any management area critical infrastructure. The District is unaware of any loss of functionality or incurred costs to replace or repair infrastructure due to subsidence within the District.
		Well 20C1	RMW-176	-150	ft msl	20	ft msl	X						
		Well 15P1	RMW-177	-150	ft msl	20	ft msl	X						
		Well 24Q1	RMW-178	-150	ft msl	20	ft msl	X						
		Well 32M1	RMW-179	-150	ft msl	20	ft msl	X						
		Well 8L1	RMW-180	-150	ft msl	20	ft msl	X						

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives – CONTINUED.

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Rosedale-Rio Bravo Management Area		1 Bushnell	RMW-050	-33.1	ft msl	48	ft msl	X			~~The RBMA will seek to maintain at least two water level monitoring points for each monitoring zone. To the extent that average water levels in of designated monitoring points has exceeded the minimum threshold of the monitoring zone, it will be considered an undesirable result. To the extent that two of the North, Central, and South of River zones exceed this criterion, the RBMA will consider it an undesirable result to the extent that either the South or East zones exceed this criterion, the RBMA will consider it an undesirable result.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Minimum Threshold for the RRB MA groundwater storage as calculated by its cumulative balance (Appendix D) will be 0 AF and its Measurable Objective is 663,000 AF. The storage level with respect to the calculated water surface calculations will assume the level Minimum Threshold to be 0.~~ The RRBMA will coordinate with the other KGA MAP's and utilize groundwater levels as a proxy until such time as a basin study can be completed and volumetric methodologies are adopted. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The Measurable Objective will be any applicable beneficial use COC value that is less than the MCL and a value increase less than 10 percent of the 2015-2020 value. An undesirable result will exist if any applicable beneficial use COC value that is greater that the current MCL and value increase of greater than 10 percent from the 2015-2020 value.~~ A Management Area exceedance is triggered when groundwater quality rises above the established minimum threshold in 40% or more of any representative monitoring wells within the respective Management Area over two-consecutive annual SGMA required monitoring events.	~~Until a regional program is developed, a threshold of 2 foot will be assigned given that there is not a history of subsidence in the RBMA. A measurable objective of less than 1 foot will be assigned and a 2030 milestone of less than 1.5 feet will be assigned.~~ A Management Area exceedance is triggered when the average measured subsidence rate at the representative monitoring sites exceeds the established minimum threshold over a six-year rolling average.
		3 L.R. Stout	RMW-052	-2.7	ft msl	78	ft msl	X						
		5 RBG School	RMW-053	3.5	ft msl	85	ft msl	X						
		18 Cauzza	RMW-057	8.3	ft msl	82	ft msl	X						
		6 P. Enns Domestic	RMW-054	41.9	ft msl	116	ft msl	X						
		16 Section 18	RMW-055	16.0	ft msl	90	ft msl	X						
		17 Blacco HQ	RMW-056	9.0	ft msl	83	ft msl	X						
		19 Parsons	RMW-058	28.3	ft msl	127	ft msl	X						
		20 West I-5	RMW-059	44.0	ft msl	143	ft msl	X						
		22 Virgil Bussell	RMW-060	49.0	ft msl	148	ft msl	X						
		27N_Mayer	RMW-061a	55.0	ft msl	154	ft msl	X						
		30 Enos	RMW-062a	69.0	ft msl	168	ft msl	X						
		9 Chet Reed	RMW-063	101.0	ft msl	209	ft msl	X						
		13 Home Place	RMW-064	88.4	ft msl	196	ft msl	X						
		32 Greeley	RMW-065a	84.0	ft msl	192	ft msl	X						
		36 Harvest Ranch	RMW-066	91.0	ft msl	199	ft msl	X						
		37 RRBWSD Shop	RMW-067a	107.0	ft msl	215	ft msl	X						
		28J Triple	RMW-069b	129.0	ft msl	196	ft msl	X						
		32N Triple	RMW-068a	127.0	ft msl	189	ft msl	X						
		Frito Lay	RMW-?						X					
		Brock South	RMW-?						X					
		Nord Road Water	RMW-?						X					
		I-5 and Stockdale Hwy	RMP-?					X		X				
		Stockdale Hwy and Hwy 43	RMP-?					X		X				
		Allen Road and Hwy 58	RMP-?					X		X				
		Hwy 58 and Hwy 43	RMP-?					X		X				
		Hwy 43 and 7th Standard Rd	RMP-?					X		X				

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives – CONTINUED.

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Kern County Water Agency - Pioneer		30S26E04J002M	J002	-12.5	ft msl	186.3	ft msl	X	X		~~N/A~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~N/A~~ N/A-Pioneer is a banking program in which all withdrawals recover previously stored water, and therefore does not contribute to the basin's change in storage.	~~N/A~~ Degraded Water Quality is monitored by proxy using groundwater levels. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Within the Pioneer GSA Area there is no Management Area Critical Infrastructure, defined as infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area. Therefore, no subsidence thresholds have been established for the Pioneer MAP.
		30S26E04J003M	RMW-259	-147	ft msl	156	ft msl	X	X					
		30S26E10P004M	RMW-048	-24.8	ft msl	92.7	ft msl	X	X					
		30S26E15N003M	RMW-049	-24.8	ft msl	92.7	ft msl	X	X					
		30S26E04D003M	RMW-045	-51.4	ft msl	111	ft msl	X	X					
North Kern Water Storage District and Shafter Wasco Irrigation District	NKWSD MA-1 (Old District)	88-03-009	RMW-145	-127	ft msl	-52	ft msl	X	X		~~A management area will be considered an undesirable watch area when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, the Subbasin would be considered to be experiencing an undesirable result.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~A management area will be considered an undesirable results watch area for reduction in groundwater storage when 51% of the representative monitoring sites in a management area violate their MT for groundwater levels, since water elevations serve as a proxy for reduction of groundwater storage. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, the Subbasin would be considered to be experiencing an undesirable result.~~ Groundwater levels are used as a proxy for storage. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~A management area will be considered an undesirable results watch area for degraded water quality when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since groundwater levels serve as a proxy for degraded water quality. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, the Subbasin would be considered to be experiencing an undesirable result.~~ Groundwater levels are used as a proxy for water quality. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events	The Lower Reach of the Friant-Kern Canal, defined as Regional Critical Infrastructure for the Subbasin, crosses through the MAP area. An undesirable result is triggered when the six-year rolling average annual subsidence rate exceeds the established MT rate. No other local infrastructure have been identified as Management Area Critical Infrastructure and any adverse impacts to district structures will be mitigated by the respective district.
		88-09-009	RMW-146	-141	ft msl	-66	ft msl	X	X					
		88-21-005	RMW-147	-131	ft msl	-56	ft msl	X	X					
		88-29-014	RMW-148	-133	ft msl	-57	ft msl	X	X					
		99-00-003	RMW-149	-52	ft msl	24	ft msl	X	X					
		99-00-081	RMW-150	-192	ft msl	-114	ft msl	X	X					
		99-22-084	RMW-151	-213	ft msl	-135	ft msl	X	X					
		Shafter Well 18	RMW-271	-128	ft msl	-54	ft msl	X	X					
	NKWSD MA-2 (RRID)													
	SWID MA-1	Shafter Well 7	RMW-205	-163	ft msl	-85	ft msl	X	X					
		Shafter Well 12	RMW-254	-159	ft msl	-81	ft msl	X	X					
		Shafter Well 15	RMW-204	-146.9	ft msl	-68	ft msl	X	X					
		Wasco 8 *(added July 2020)*	RMW-263	-235	ft msl	-153	ft msl	X	X					
		Wasco 11 *(added July 2020)*	RMW-276	-229	ft msl	-147	ft msl	X	X					
		Wasco 12	RMW-256	-242.9	ft msl	-159	ft msl	X	X					
		Shafter Well 14	RMW-257	-144	ft msl	-67	ft msl	X	X					

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives – CONTINUED.

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Shafter-Wasco Irrigation District	MA-2 7TH Standard Annex	28S/25E 15G	RMW-269	-137	ft msl	-79	ft msl	X			~~Undesirable Results are triggered if the MT is exceeded at one or more of the three RMSs over three consecutive monitoring periods (events).~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Undesirable Results are triggered if and when groundwater storage is reduced by an amount that could cause the groundwater levels in one or more RMSs to exceed their MTs for Chronic Lowering of Groundwater Levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Undesirable Results for Degraded Water Quality are not defined.~~ Until additional groundwater level and groundwater quality information is available to refine the correlation analysis, it is considered a local undesirable results for degraded water quality within the management area if the arsenic concentrations exceed the MTs in 40% or more of the representative monitoring wells within the management area over two consecutive annual SGMA required monitoring events, such that it cannot be managed to provide drinking water supply (i.e., that treatment or blending is not possible or practicable).	Based on the limited to no historical subsidence observed in the management area, the lack of regional critical infrastructure (i.e., the California Aqueduct and the Friant Kern Canal), and mapping of the Corcoran clay in the basin which suggests that it does not extend in the management area, undesirable results for land subsidence are not defined.
		Well 31J	RMW-248	-137	ft msl	-79	ft msl	X						
		28S/24E-35C	RMW-249	-137	ft msl	-79	ft msl	X						
Southern San Joaquin Municipal Utility District		McFarland Taylor Ave. Well	RMW-208	-117	ft msl	-42	ft msl	X	X		~~The SSJMUD management area will be considered an undesirable results watch area when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, as defined by the basin-wide definition, the Subbasin would be considered to be experiencing an undesirable result.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The SSJMUD management area will be considered an undesirable results watch area for reduction in groundwater storage when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since groundwater levels serve as a proxy for reduction of groundwater storage. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, the Subbasin would be considered to be experiencing an undesirable result.~~ Groundwater levels are used as a proxy for storage. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~The SSJMUD management area will be considered an undesirable results watch area for degraded water quality when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since groundwater levels serve as a proxy for degraded water quality. If multiple undesirable results watch areas meet the criteria for a Subbasin undesirable result, as defined above, the Subbasin would be considered to be experiencing an undesirable result.~~ Groundwater levels are used as a proxy for water quality. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~As no impacts to critical infrastructure have been identified and because it is not clearly understood how groundwater pumping in different areas of the basin affects subsidence, SSJMUD has identified land subsidence as a data gap. As a result, no minimum thresholds for local infrastructure are established for land subsidence at this time.~~ The Lower Reach of the Friant-Kern Canal, defined as Regional Critical Infrastructure for the Subbasin, crosses through the MAP area. An undesirable result is triggered when the six-year rolling average annual subsidence rate exceeds the established MT rate. No other local infrastructure have been identified as Management Area Critical Infrastructure and any adverse impacts to district structures will be mitigated by the respective district.
		Delano 34	RMW-281	-216	ft msl	-118	ft msl	X	X					
		Delano 30	RMW-252	-100	ft msl	-6	ft msl	X	X					
		SSJMUD-8	RMW-157	-329	ft msl	-227	ft msl	X	X					
		SSJMUD-14	RMW-158	-136	ft msl	-57	ft msl	X	X					
		SSJMUD-23	RMW-159	-278	ft msl	-183	ft msl	X	X					
		SSJMUD-42	RMW-163	-123	ft msl	-48	ft msl	X	X					
		SSJMUD-53	RMW-160	-131	ft msl	-55	ft msl	X	X					
		SSJMUD-59	RMW-161	-112	ft msl	-37	ft msl	X	X					
		SSJMUD-62	RMW-162	-83	ft msl	-7	ft msl	X	X					

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives – CONTINUED.

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
				Minimum Threshold		Measurable Objective								
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Value	Unit	Value	Unit	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
Semitropic WSD GSA	MA-2 Buttonwillow	S-02	RMW-119	-200	ft msl	-127	ft msl	X	X		~~Within the Semitropic GSA, a management area will be considered an undesirable result with area when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Within the Semitropic GSA, a management area will be considered an undesirable result with area for reduction in groundwater storage when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since water elevations serve as a proxy for reduction of groundwater storage.~~ Groundwater levels are used as a proxy for storage. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~Within the Semitropic GSA, a management area will be considered an undesirable result with area for degraded water quality when 51% of the representative monitoring sites in a management area violate their minimum threshold for groundwater levels, since groundwater levels serve as a proxy for degraded water quality.~~ Groundwater levels are used as a proxy for water quality. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Semitropic has identified land subsidence as a data gap. The SWSD GSA has not historically experienced impacts to local infrastructure from the levels of subsidence historically experienced. As such no minimum thresholds for local infrastructure are established for land subsidence at this time.
		S-04	RMW-121	-144	ft msl	-76	ft msl	X	X					
		S-05	RMW-122	-242	ft msl	-161	ft msl	X	X					
		S-1 *(added February 2020)*	RMW-277	-165	ft msl	-80	ft msl	X	X					
		948L02 Cluster 1 of 2	RMW-139	-180	ft msl	-101	ft msl	X	X					
	MA-3 Undeveloped	S-11	RMW-130	-258	ft msl	-195	ft msl	X	X					
		S-12	RMW-131	-264	ft msl	-194	ft msl	X	X					
	MA-1 Pond-Poso	S-06	RMW-123	-306	ft msl	-209	ft msl	X	X					
		S-09A Cluster 1 of 2	RMW-128	-227	ft msl	-146	ft msl	X	X					
		S-13A Cluster 1 of 2	RMW-132	-371	ft msl	-269	ft msl	X	X					
		S-14B Cluster 2 of 2	RMW-135	-335	ft msl	-233	ft msl	X	X					
		26S-23E-15A1	RMW-137	-345	ft msl	-244	ft msl	X	X					
		S-8A Cluster 1 of 2	RMW-126	-331	ft msl	-229	ft msl	X	X					
Westside Districts Water Authority		S#14 *(added November 2020)*	RMW-279	150	ft msl	200	ft msl	X			~~There has been little historical pumping for irrigation in the interior areas of the WDWA due to naturally degrade ground water. The WDWA maintains two sentry coordination zones with adjacent groundwater management areas to the east and will expand its network of monitor wells as part of PMA #1. An undesirable result is identified if a sentry zone records a measured GW level falls below its MT over three consecutive monitor events.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	~~See response to Lowering of GW Levels.~~ A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	Water quality in the WDWA is known to be naturally degraded due to local geology. As a result over 95% of water used in the WDWA is surface water.	Land subsidence is an identified data gap, as such interim MOs/ MTs have been identified for regional critical infrastructure and associated management area infrastructure pursuant to the Basin-wide coordinated GSP subsidence plan. The interim MOs/MTs are valid until 2025 at which time they may be updated based on additional data. Areas of InSAR identified subsidence in the WDWA include the Lost Hills and Belridge oilfields. Recent subsidence studies by the WDWA to assess impacts to the Aqueduct (MP 195-215) have identified sources other than agricultural pumping as the likely primary cause. This material was shared with the subsidence experts within the DWR in early 2020 subsequent to GSP submittal. The WDWA is coordinating with adjacent water districts to assess interim MOs/MTs pending acquiring additional subsidence data as described in the KGA GSP Subsidence Management Plan.
		7108-66 *(added March 2020)*	RMW-275	-115	ft msl	-62	ft msl	X						
		7106-63	RMW-203	59	ft msl	101	ft msl	X						

Table 3-4. Summary of Minimum Thresholds and Measurable Objectives – CONTINUED.

Monitoring Sites				Lowering of Groundwater Levels				Groundwater Level Used as Proxy?			Description of Sustainable Management Criteria in Each KGA Management Area and Definition of a Trigger to a Management Area Exceedance			
Member Agency	Sub-Management Area	Monitoring Site/ Parameter	RMW Number	Minimum Threshold		Measurable Objective		Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence	Lowering of Groundwater Levels	Reduction of Groundwater Storage	Degraded Water Quality	Land Subsidence
				Value	Unit	Value	Unit							
West Kern Water District	North Project MA	NWM1-S	RMW-068	56	ft msl	110	ft msl	X	X		N/A A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	N/A A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	N/A Degraded Water Quality is monitored by proxy using groundwater levels. A management area exceedance is triggered when groundwater levels decline below established MTs in 40% or more of any representative monitoring wells within the management area over four consecutive bi-annual SGMA required monitoring events.	N/A Within the WKWD GSA Area there is no Management Area Critical Infrastructure, defined as infrastructure located within a particular Subbasin Management Area whose loss of significant functionality due to inelastic subsidence if caused by Subbasin groundwater extractions would have significant impacts to beneficial users within that Subbasin Management Area. Therefore, no subsidence thresholds have been established for the WKWD MAP.
		NWM1-M	RMW-266	27	ft msl	71	ft msl	X	X					
		NWM1-D	RMW-267	4	ft msl	60	ft msl	X	X					
		NWM2-S	RMW-069	49	ft msl	93	ft msl	X	X					
		NWM2-M	RMW-264	39	ft msl	80	ft msl	X	X					
		NWM2-D	RMW-265	0	ft msl	78	ft msl	X	X					
	South Project MA	Well 6-04	RMW-067	-82	ft msl	125	ft msl	X	X					
		Well 7	RMW-074	-42	ft msl	106	ft msl	X	X					
		21L-D	RMW-082c	-61	ft msl	105	ft msl	X	X					
		21L-M	RMW-082b	-54	ft msl	115	ft msl	X	X					
		21L-S	RMW-082a	-26	ft msl	159	ft msl	X	X					
		21R-D	RMW-076c	-46	ft msl	90	ft msl	X	X					
		21R-M	RMW-076b	-72	ft msl	121	ft msl	X	X					
		21R-S	RMW-076a	-107	ft msl	109	ft msl	X	X					
		22K-D	RMW-079c	95	ft msl	104	ft msl	X	X					
		22K-M	RMW-079b	37	ft msl	163	ft msl	X	X					
		22K-S	RMW-079a	2	ft msl	139	ft msl	X	X					
		23M-D	RMW-085c	23	ft msl	166	ft msl	X	X					
		23M-M	RMW-085b	-8	ft msl	132	ft msl	X	X					
		23M-S	RMW-085a	4	ft msl	133	ft msl	X	X					
		28E-D	RMW-072c	0	ft msl	122	ft msl	X	X					
		28E-M	RMW-072b	68	ft msl	162	ft msl	X	X					
		28E-S	RMW-072a	90	ft msl	163	ft msl	X	X					

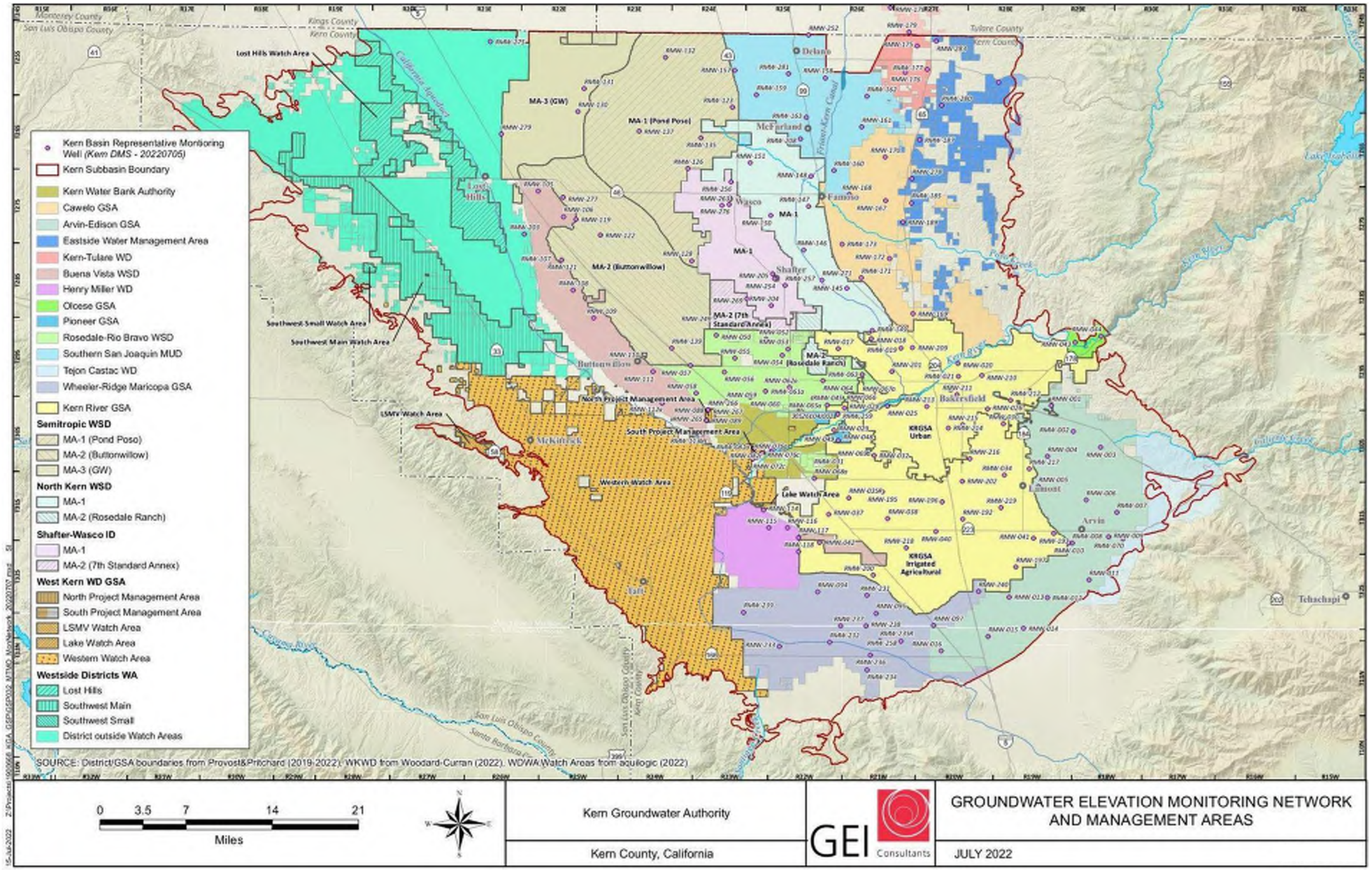


Figure 3-6R. REVISED Regional Groundwater Level Monitoring Network

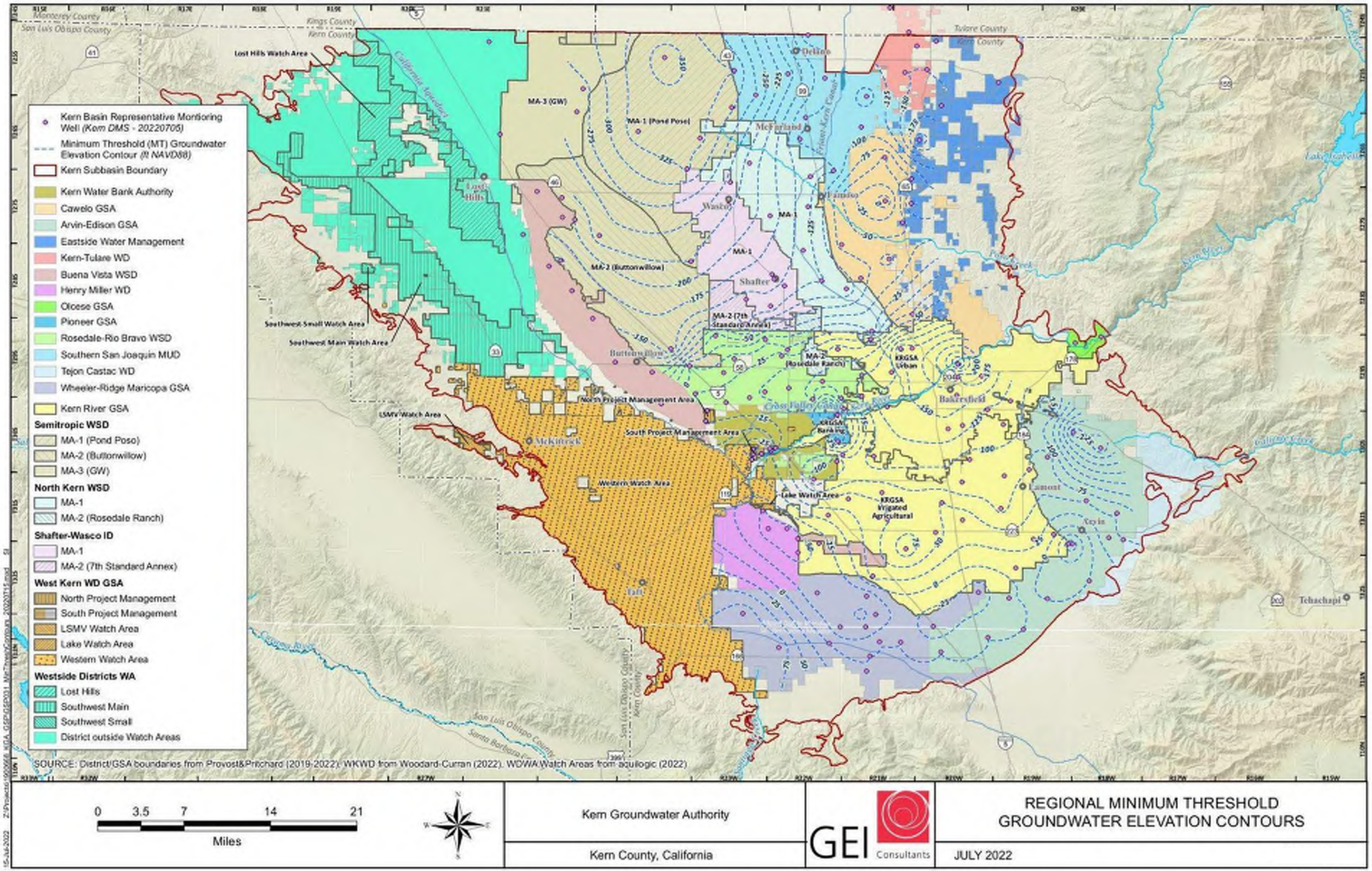


Figure 3-7R REVISED Regional Minimum Threshold Contours for Groundwater Levels

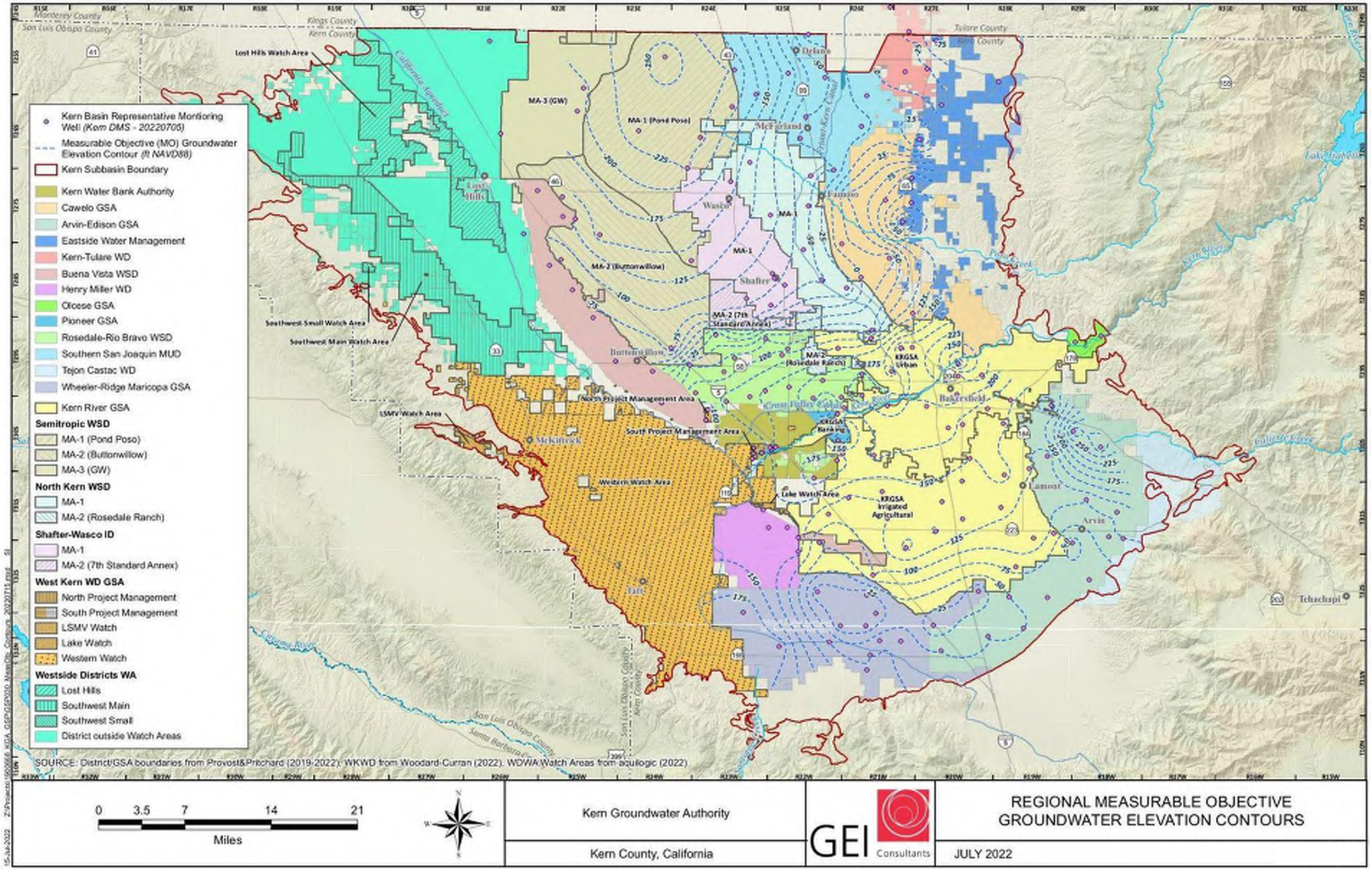


Figure 3-8R. REVISED Regional Measurable Objective Contours for Groundwater Levels

This Page is Intentionally Blank

3.5.1 Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage

The final Subbasin minimum thresholds and measurable objectives values for the chronic lowering of groundwater levels sustainability indicator at each representative monitoring well are presented in Table 3-4 with an indication of whether that RWM is used as a proxy for reduction of groundwater storage or degraded water quality. The location of the representative monitoring well are shown in Figure 3-6. Figure 3-7 show only the minimum thresholds for the groundwater levels sustainability indicator with elevation contours between each of the representative monitoring sites. This figure provides an indication of how the thresholds values at each representative monitoring site relate to adjacent monitoring site values. Contour maps such as these were used in the review of draft thresholds to determine areas of potential conflicting thresholds between neighboring management areas, such as drastically differing threshold values, elevation gradients steeper than typically observed gradients, or elevation gradients contrary to typically observed gradients.

Figure 3-8 shows only the measurable objective values for groundwater levels sustainability indicator at each representative monitoring site, with elevation contours between monitoring site. The draft measurable objectives were reviewed in the same manner as minimum thresholds.

Through the KGA/GSA Managers Group coordination meetings, it was generally agreed that the withdrawal of groundwater from the Subbasin would not create impacts to beneficial uses or users of groundwater in the Subbasin if groundwater elevations are maintained above the minimum threshold values. The chronic lowering of groundwater level minimum thresholds and measurable objective values serve as proxy for the reduction of groundwater storage and in some case water quality and subsidence for the KGA Member Agencies. Table 3-4 show the measurable objectives and minimum threshold for chronic lowering of groundwater levels for each KGA Member Agency RMW; provides an indication of whether groundwater levels are used as a proxy for reduction of groundwater storage, degraded water quality, or land subsidence; and how the minimum threshold of each sustainability indictor has been changed to address DWR comments. The process for re-establishing consistent minimum threshold triggers (which identify Management Area Exceedances, leading to contributions to an undesirable result as explained above) involved collaboration and negotiation with all GSAs in the Kern Subbasin.

3.5.2 Degraded Water Quality

The minimum thresholds and measurable objectives for degraded water quality were established by each of the management areas. All the representative monitoring sites for water quality are summarized in Table 3-4. In many instances, the minimum threshold and measurable objectives values for groundwater levels serves as a proxy for water quality. In other words, no water quality degradation, migration of contaminate plumes, or other indicators of water quality impairment would be experienced at the groundwater level minimum threshold value at that representative monitoring site.

3.5.3 Land Subsidence

Because of the variability of subsidence in time, we have examined the temporal variation in rates for the entire region, as well as for the four sub-domains (central, east, west, and south, as shown in Figure 3-9). These are area-wide averages and, as noted below, do not capture the spatial variability in rates. Still, the averages provide an indication of the temporal variability in rates. The large-scale (spatially) rates indicate a background 'floor" of subsidence values of around -0.4 inches/year for the eastern, western, and southern regions, interrupted by decreases in subsidence in wetter years leading to net uplift. The central region, with its greater exposure to the large-scale subsidence bowl to the north, has a larger background rate that is higher, around -0.6 inches/year. Again, during wet years the subsidence is arrested and can even reverse to uplift. This indicates the potential for water-banking or some other mitigation technique to reduce subsidence if applied on a large scale. There are indications that the subsidence rate has increased since 2020, most dramatically in the central region. Perhaps the easiest way to visualize the temporal changes in the four regions is to examine. The time series of displacements for the three regions (east, west, south) is roughly linear, then interrupted by a rather abrupt shift upward, likely due to the effects of the wet years, availability of surface water, existing water banking programs and a pause or end of the drought around 2017. As noted above, this shift occurs at different times for the central and western regions. Factors contributing to this temporal difference may include proximity to areas of natural recharge, such as in the west (the central region is more distal), groundwater dependence (the central region has higher dependence), and availability of surface water. In the two other regions s (southern and eastern), the shift might represent natural recharge of deeper aquifers. The shift is then followed by a linear behavior in time, at roughly the same slope as before, suggesting a return to the previous subsidence rate. The behavior for the central region is different in that the curve does not return to a linear trend, but rather seems to indicate an increase in the rate of subsidence after 2020 or so. One take-away from these results is that when calculating rates, it can be important to consider the temporal changes in rates. A rate calculation incorporating the rapid shift during the wet time interval, can significantly skew the rate estimates.

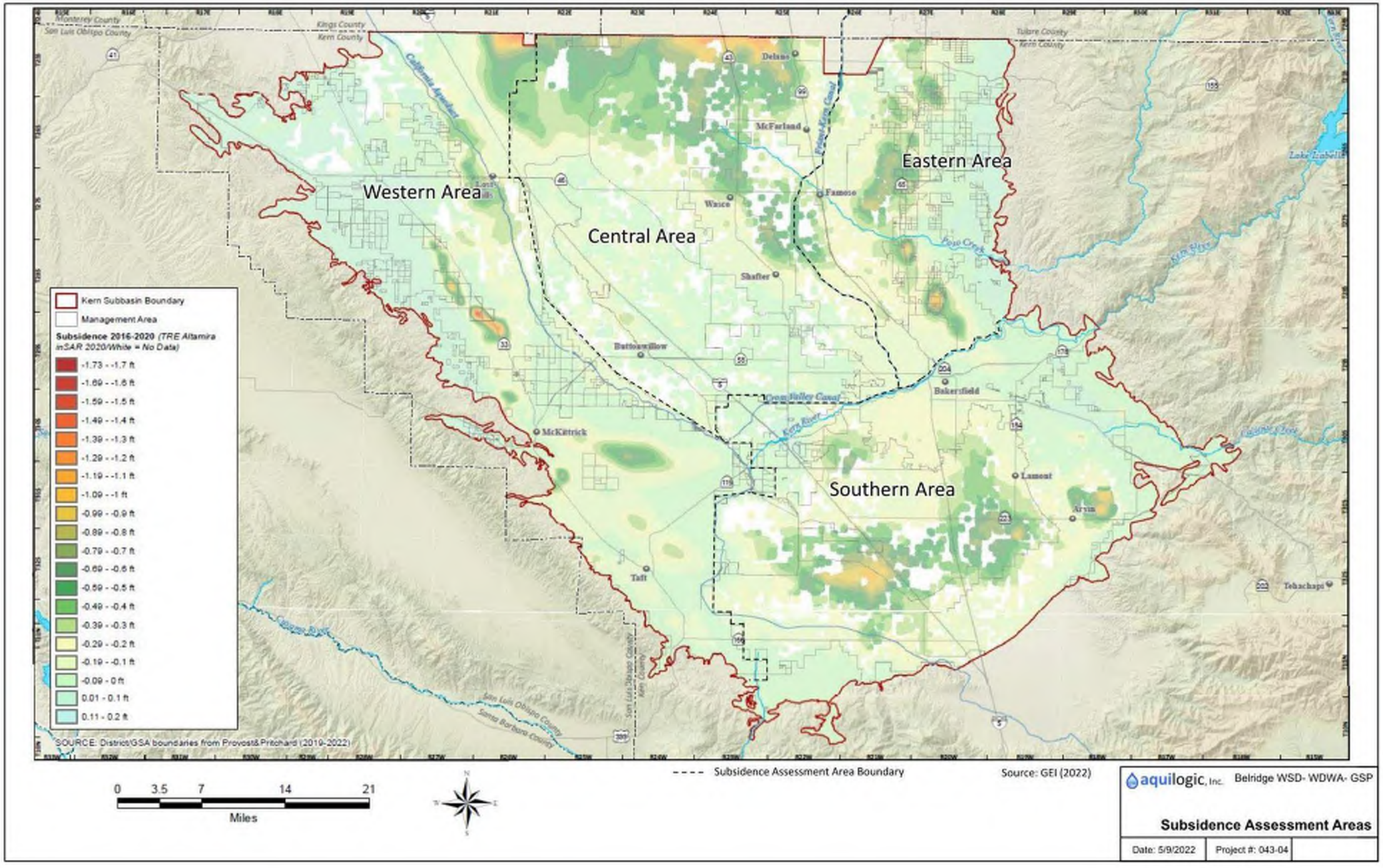


Figure 3-9. Kern Subbasin Subsidence Sub-Regions

This Page is Intentionally Blank

The spatial distribution of surface displacement, and hence subsidence, is highly variable and typically concentrated within the various sub-regions. This concentration is most notable for oil and gas fields. These regions can have dramatic changes, both subsidence and uplift, over short periods (Vasco et al. 2017), and probably cannot be characterized accurately by a single rate. Still, it is possible to examine yearly averages that measure accumulated surface deformation. In this study, we considered the deformation rate for the year 2020, and the spatial variability in rates that can occur within the four sub-domains. The yearly rates of change in 2020 were calculated for all points of the four regions. In order to capture the spatial variability within each region, we scanned the rates and determined the locations with the maximum subsidence and the minimum rate of subsidence (typically uplift), as well as computing the mean of all of the rates for the given sub-domain. The resulting maximum rates of subsidence were around 2-3 inches/year with an anomalously large value of -7.7 inches/year in the western sub-area. At the northeastern corner of the western sub-region. The activities in this area should probably be examined in more detail, as the subsidence rate is significant and fairly concentrated. Outside of this anomalous area, the western sub-domain has relatively moderate subsidence in 2020, though there are concentrations in selected oil and gas fields. We should note that the yearly rates of -3.2, -2.6, and -2.4 inches/year for the central, southern, and eastern areas are in line with estimates in the March 2021 report by Earth Consultants International, who found subsidence rates of 2-3 inches/year in the northern edge of the Kern County Subbasin and 3-4 inches/year south of Bakersfield.

Again, peak rates for specific areas are subject to dramatic temporal changes as local activities vary. When focusing on specific infrastructure we can derive more detailed and specific estimates along the given paths of the canals, pipelines, and transmission lines. Given current rates of subsidence buried infrastructure, like pipelines, would not experience significant adverse effects provided “hinge line” factors (stream crossings, faults, changes in elevation and grade etc.) were minimal. However, further study is needed to quantify and confirm the types of stresses that may be present. In addition, the line-of-sight displacements are dominated by subsidence but there will also be notable horizontal displacement, particularly from the subsidence bowl at the northern edge of the subbasin. Such north-south displacement can be estimated from an inversion for volume change, as in Vasco et al. (2019), followed by a forward geomechanical calculation of three-dimensional displacements, as in Vasco et al. (2017).

3.5.3.1 Interim Measurable Objectives and Interim Minimum Thresholds

At the June 17, 2022, meeting with DWR, the Kern subbasin presented the findings of two important subsidence studies that were conducted subsequent to the January 2020 submission of the GSPs. DWR staff indicated their understanding of the studies/data and appreciated the challenge of setting sustainable management criteria in the face of data gaps thus stated that an interim SMC with caveats would be better than setting no SMC. The caveats for subsidence are the following which may not be inclusive:

- The sustainable management criteria can be interim, will only be valid until 2025, and will be updated in the 2025 GSP update;

- Due to the complexity of the Kern Subbasin, setting of an interim SMC for subsidence, does not require GSAs take responsibility, manage, regulate or otherwise be liable for impacts resulting from actions outside the authority of the GSA or outside the GSA's ability to manage sustainability under SGMA; and
- That the Kern Subbasin GSAs are not responsible for addressing subsidence caused by activities outside of the jurisdiction of SGMA i.e., extractions from exempt aquifers, or caused by activities other than extraction of water on behalf of the beneficial users under the purview of SGMA.

The Interim Measurable Objective for land subsidence for the California Aqueduct is defined as the avoidance of a permanent loss (associated with inelastic subsidence) of conveyance capacity as attributable to subsidence as limited by remaining concrete liner freeboard for a specific Aqueduct Pool that exceeds the average observed rate from 2016-2022. Using the 2022 CASP survey data, the average observed rate was calculated to be -0.05 ft/yr for all Pools of the Aqueduct within the Kern Subbasin.). The MO rate of subsidence is calculated and assessed as an average annual rate over a rolling 6-year monitoring period.

The Minimum Threshold for land subsidence for the California Aqueduct is defined as the avoidance of a permanent loss (associated with inelastic subsidence) of conveyance capacity as attributable to subsidence as limited by remaining concrete liner freeboard for a specific Aqueduct Pool that exceeds twice the average observed rate from 2016-2022. Using the 2022 CASP survey data, twice the average observed rate was calculated to be -0.10 ft/yr for all Pools of the Aqueduct within the Kern Subbasin.). The MT rate of subsidence is calculated and assessed as an average annual rate over a rolling 6-year monitoring period.

3.5.3.2 California Aqueduct

The above methodology for developing MOs and MTs, recognizing the baseline subsidence rate as calculated from the latest CASP survey data, is supported by the findings of the KGA Subsidence Study and Lawrence Livermore Study. The Subsidence Rate for the MO and MT as described below are interim, pending the collection and analysis of additional data, and will be updated in the 2025 GSP. Table 3-6 presents an interim MO and MT by Pool in the Kern Subbasin.

Table 3-6. Subsidence (INTERIM) MO and (INTERIM) MTs for CA Aqueduct Pools in Kern Subbasin

CA Aqueduct Pool	[1]Measurable Objective Rate (INTERIM) from 2022-2025 (Ft/Yr)	*[2]Measurable Objective Total Extent (INTERIM) from 2022-2040 (Ft)*	[1]Minimum Threshold Rate (INTERIM) from 2022-2025 (Ft/Yr)	*[2]Minimum Threshold Total Extent (INTERIM) from 2022-2040(Ft)*
Pool 23	-0.05	*-0.9*	-0.1	*-1.8*
Pool 24	-0.05	*-0.9*	-0.1	*-1.8*
Pool 25	-0.05	*-0.9*	-0.1	*-1.8*
Pool 26	-0.05	*-0.9*	-0.1	*-1.8*
Pool 27	-0.05	*-0.9*	-0.1	*-1.8*
Pool 28	-0.05	*-0.9*	-0.1	*-1.8*
Pool 29	-0.05	*-0.9*	-0.1	*-1.8*
Pool 30	-0.05	*-0.9*	-0.1	*-1.8*
Pool 31	-0.05	*-0.9*	-0.1	*-1.8*
Pool 32	-0.05	*-0.9*	-0.1	*-1.8*
Pool 33[3]	-0.07	*-1.35*	-0.15	*-2.7*
Pool 34[3]	-0.07	*-1.35*	-0.15	*-2.7*
Pool 35[3]	-0.07	*-1.35*	-0.15	*-2.7*
[1]The MO & MT rate are calculated over a rolling 6-yr period, averaging Pools 23-32 and Pools 33-35; the interim rate identified for the MO and MT is for subsidence due to activities under the purview of SGMA. The interim rate is established based upon findings from the 2022 CASP survey data, and the InSAR Study and LBL preliminary study (KGA 2021). **The Interim Rate will be updated in the 2025 GSP Update.**				
[2]The extent of subsidence (INTERIM) for the term 2022 – 2040 utilizes the Interim MO and MT Rate and will be updated as the MO and MT rates for subsidence are updated in the 2025 GSP Update. [3]Information regarding the SMC for Pools 33, 34, and 35 can be found in the South of Kern River GSP.				

The Interim Measurable Objectives and Minimum Thresholds are only valid until 2025 and they will be updated in the 2025 GSP Update, and only apply when the permanent loss of freeboard is a result of subsidence due to SGMA-related groundwater extractions from the following beneficial uses/users: agricultural, domestic, municipal, or urban. Permanent loss of freeboard from land subsidence due to other causes including but not limited to due to oil or gas production, natural compaction of shallow underlying soils beneath or near the Aqueduct, or any other cause that is not within the jurisdiction of a GSA, shall not be considered as a loss of freeboard that contributes to the amount specified for any MO or MT. When considering Measurable Objective and Minimum Threshold rates beyond 2025 it will be critical to fully understand design considerations of the identified critical infrastructure. It is typical that major infrastructure designs incorporate assumptions for natural settling, subsidence of any type, service life, repair and replacement cycles, etc. It is expected that when selecting Minimum Threshold rates of subsidence beyond the interim 2025 period that MO and MT rates may require reduction based on these and other critical elements as the basin approaches its 2040 sustainability goal.

For example, if the MT for subsidence for a particular pool of the Aqueduct within a Management Area was determined to be 0.10 ft/yr over a 6-year period, and SGMA-related beneficial uses within the jurisdiction of a GSA were deemed to cause 0.07 ft /yr of subsidence within that pool while non-jurisdictional uses were deemed to cause 0.15 ft/yr, the Management Area would only consider the 0.07 ft/yr subsidence rate (and related loss of pool freeboard) when evaluating MT compliance, and in that case would not determine that an MT exceedance has occurred. Friant-Kern Canal.

Interim Measurable Objectives and Interim Minimum Thresholds - Friant-Kern Canal

Refer to *Attachment E4 for the Friant-Kern Canal White Paper*. The methodology to determine and set minimum thresholds is defined as the avoidance of permanent loss of historical operational flow capacities for the Lower Reach as a result of groundwater extractions from agricultural, domestic, municipal, or urban beneficial users within the Kern County Subbasin. In order to set an appropriate MT, additional studies and subsidence modeling is necessary to understand the cause of subsidence, identify appropriate management actions, and develop a mitigation plan. However, as noted above, the Subbasin GSAs will establish an interim MT.

The interim MT for the entire Lower Reach within the Kern Subbasin is defined as the average annual rate of subsidence over the last 6 years and the corresponding total interim extent from 2022 until 2040. Based on information provided by the DWR's California Groundwater Live website, the annual rate of subsidence is presented as a range and MT is set at the average of lower elevation of the subsidence ranges. The MT rate of allowable subsidence is -0.2 feet per year and MT extent is -3.6 ft until the 2040. A new MT rate and extent will be established in the 2025 GSP updates based on data from the previously discussed basin study and subsidence modeling. Tables 3-7 summarizes the MO, MT and temporal extent.

Table 3-7. FKC Lower Reach Interim Measurable Objectives, Minimum Thresholds and Extent

Measurable Objectives Rate from 2022 to 2025 (Ft/Yr)	Measurable Objective Total Extent from 2022 to 2040 (Ft)	Minimum Threshold Rate from 2022 to 2025 (Ft/Yr)	Minimum Threshold Total Extent from 2022 to 2040 (Ft)
-0.1	-1.8	-0.2	-3.6

3.5.4 Seawater Intrusion

As described above, the Subbasin is located approximately 60 miles from the Pacific Ocean, separated by the Coastal Range and other geologic features that prevent seawater from migrating into the Subbasin. Details of the geologic structure of the Subbasin can be found in the basin setting of this GSP. Based on the separation of the Subbasin from any source of seawater, the Subbasin has not developed sustainable management criteria for this sustainability indicator.

3.5.5 Depletions of Interconnected Surface Water

As described above the Subbasin, has not identified any areas of interconnected surface waters. Though many studies have been conducted in the Subbasin, including in areas such as the Kern River and Poso Creek, results do not show evidence of surface water within the Subbasin to be interconnected. As there are no known natural interconnected surface water systems within the KGA boundary or the Subbasin, this sustainability indicator is not included in this GSP. Additional information can be found in basin setting section of this GSP and in the management area plans.

3.6 Monitoring Network

The monitoring networks, protocols, and standards described within this section and in the respective management area plans meet the requirements of §352.2, and §354.32 to §354.40 of the California Code of Regulations. The Kern subbasin collaboratively developed the monitoring network for the Kern subbasin as well as coordinating the setting of the SMC for water levels at the same time. The monitoring network for the Kern subbasin also include monitoring protocols that stipulated the time frames for collecting the SMC data and how that data is used in preparing the annual report. The monitoring protocols have been updated to provide more accountability on confirming that SMC data is collected, see 3.6.7.

3.6.1 Monitoring Network Description

Management areas within the KGA generally align with member agency boundaries and represent areas of common water management practices. Management areas are designated and managed by KGA member agencies (Table 3-7) and shown in Figures 3-5 and 3-6. KGA members are best suited to leverage existing relationships with water users for local groundwater monitoring and site access.

The monitoring network for the KGA represents the coordination of the monitoring networks and activities of the KGA member agencies within their respective management areas as well as the coordination with the other GSAs in the Kern subbasin. The KGA and the other GSAs in the Kern subbasin will coordinate the annual collection and reporting of monitoring data to DWR and will ensure the monitoring network and protocols are compliant with SGMA.

Monitoring Network is capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation. The monitoring network objectives accomplish the following:

1) Demonstrate progress toward achieving measurable objectives described in the management area and throughout the Subbasin
2) Monitor impacts to the beneficial uses and users of groundwater
3) Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
4) Quantify annual changes in water budget components

3.6.2 Monitoring Network Objectives

The objectives of the KGA monitoring network are to:

- demonstrate progress toward achieving measurable objectives summarized in this GSP and detailed in the attached management area plans;
- monitor impacts to the beneficial uses of groundwater and stakeholders within the Subbasin; monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds; quantify annual changes in water budget components; and
- monitor changes for the following pertinent sustainability indicators in the Subbasin;
    - Groundwater Potentiometric Surfaces, or Groundwater Levels,
    - Groundwater Storage,
    - Groundwater Quality, and
    - Land Subsidence.

And to coordinate with the other GSAs in the basin to consider all beneficial users and uses. Seawater intrusion and depletions of interconnected surface water are not pertinent to the monitoring network as they were not considered pertinent sustainability indicators, as described in the basin setting.

3.6.3 Monitoring Data Quality Objectives

As described in DWR's *Groundwater Monitoring Protocols, Standards, and Sites BMP* (DWR, 2016c), the processes for maintaining quality control and quality assurance are iterative, and, as such, will be evaluated every 5 years for effectiveness. The monitoring networks implemented as part of this GSP include the analytical approaches to obtain acceptable data that can monitor the sustainability indicators against minimum thresholds and interim milestones. Where necessary, revisions can be made every 5 years as this GSP is updated.

The monitoring network (see Figures 3-6 and Table 3-4) will be capable of collecting sufficient data to demonstrate seasonal, short-term (1 to 5 years), and long-term (5 to 10 years) trends in groundwater and related surface conditions and yield representative information about groundwater conditions as necessary to evaluate Plan implementation. The frequency at which data will be collected for each network will be described herein.

3.6.4 Monitoring Progress Toward Measurable Objectives

As described in the above section, groundwater levels in the KGA are the key sustainability indicator to monitor undesirable results. Seasonal groundwater levels in selected monitoring wells will be used to monitor progress towards identified measurable objectives. While most of the management areas have used groundwater level as a proxy to monitor other sustainability indicators, certain management areas have defined specific interim milestones for other primary sustainability indicators such as degraded water quality and groundwater storage. The details of these milestones can be found in the management area plans.

After adopting this GSP, the KGA and its member agencies will monitor the progress towards reaching interim milestones for groundwater levels. This progress will be compared with

monitoring data for storage, land subsidence, and water quality as well as their respective minimum thresholds, to evaluate the effectiveness of groundwater level as proxies for these other the sustainability indicators. Where needed, interim milestones for groundwater levels or other sustainability indicators may be adjusted to maintain the objectives of the GSP.

The proposed monitoring networks will provide data used to monitor impacts of sustainable groundwater management to beneficial uses and users of groundwater. The proposed approach for monitoring impacts to beneficial uses and users of groundwater are described in Table 3-8.

Table 3-8. Monitoring Impacts to Beneficial Uses and Users

Potential impacts on beneficial uses and users of groundwater	Monitoring Network	Notes
Groundwater elevation decline may result in increased pumping costs and or dry wells.	Groundwater Level Monitoring	Groundwater levels will be compared with well screen construction and pump depth settings
Groundwater storage is reduced to less than minimum threshold affecting future supplies for use.	Groundwater Level Monitoring	Data will be incorporated into the Subbasin model to quantify and monitor storage outlooks and minimum thresholds and interim milestones.
Land subsidence due to overdraft results in infrastructure damage and loss in aquifer storage.	Groundwater Level and Land Subsidence Monitoring	Groundwater levels and land subsidence data will be evaluated against minimum thresholds and interim milestones.
Groundwater quality is degraded and is not suitable for use without additional treatment costs.	Groundwater Quality Monitoring	Data from all water quality reporting sources will be evaluated for the Subbasin to compare against minimum thresholds and objectives.

3.6.5 Coverage of Sustainability Indicators

As mentioned previously, the monitoring plan for Kern Subbasin addresses all pertinent sustainability indicators of the Subbasin: chronic lowering of groundwater levels, reduction in groundwater storage, degraded water quality, and land subsidence. Figure 3-4 provides the current distribution of representative monitoring wells for water elevations included in the monitoring network for the KGA. Based on the BMP for monitoring networks, the well density goal is to be between 4 to 10 wells per 100 square miles (DWR, 2016c). In the Subbasin, the KGA covers approximately 1,980 square miles of which approximately 83% (or ~1,650 square miles) is reliant on some level of groundwater production and has active groundwater wells. Based on DWR's BMP recommended density goal, the KGA monitoring network should contain between 66 to 165 monitoring wells base in the area that is reliant on groundwater. The KGA's proposed monitoring network includes 118 well locations for groundwater elevation and storage.

3.6.6 Scientific Rational for Site Selection

The monitoring network for the KGA member agencies was designed using the following scientific rational for site selection:

- Aquifer representation –Per DWR's Emergency Regulations CCR § 354.34 (c) (1), monitoring wells were chosen to adequately represent each underlying aquifer within the KGA.
- Potential impacts to beneficial users of groundwater
- Availability of site-specific historical data and technical information
- Spatial and vertical representation of the underlying aquifers
- Precedence of dedicated monitoring wells over production wells
- Site accessibility
- Coordination with the other GSAs in the Kern subbasin

While this outlines the general procedure followed by the KGA member agencies to identify their respective monitoring networks, the detailed scientific rational for each monitoring network can be found in the respective management area plan.

3.6.7 Monitoring Protocols for Data Collection and Monitoring

3.6.7.1 Groundwater Level Monitoring Network Protocol and Standards

The existing monitoring network in the KGA includes production wells and dedicated monitoring wells. Until enough dedicated monitoring wells are installed to fill data gaps, production wells will be used to expand the spatial coverage of the existing network.

As referenced in §352.4 of the regulations, monitoring sites/wells will conform to best management practices for geographic locations, identification, and details on well construction. Table 3-9 provides the requested standards.

Table 3-9 Standards for Required Monitoring Well Information

Well Identification	Use the CASGEM well identification number. If a CASGEM well identification number has not been issued, appropriate well information shall be entered on forms made available by DWR.
Well/Site Location	Geographic locations shall be reported in GPS coordinates by latitude and longitude in decimal degree to five decimal places, to a minimum accuracy of 30 feet, relative to NAD83, or another national standard that is convertible to NAD83. Reference point elevations shall be measured and reported in feet to an accuracy of at least 0.5 feet, or the best available information, relative to NAVD88, or another national standard that is convertible to NAVD88, and the method of measurement described.
Well Type and Construction Details	A description of the well use/type, whether the well is active or inactive, and whether the well is a single, clustered, nested, or other type of well. Casing perforations, borehole depth, and total well depth shall be reported. Well completion reports will be provided, if available, from which the names of private owners have been redacted. Geophysical logs, well construction diagrams, or other relevant information will be provided, if available, including any other relevant well construction information, such as well capacity, casing diameter, or casing modifications.
Monitoring Zone	Identification of principal aquifer or aquifer zones monitored.

Requirements for well selection

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation
- Monitoring location should also track all modifications to the site in a modification log

Monitoring Protocols

As referenced in §352.4 of the GSP regulations, "monitoring protocols shall be developed according to BMP. Monitoring protocols shall be reviewed at least every five years as part of the periodic evaluation of the Plan and modified as necessary." As mentioned above, the Kern Subbasin developed and coordinated the monitoring protocols as well as the monitoring locations.

As per DWR's Monitoring Protocol BMP (DWR, 2016c) and the Subbasin's Coordination Agreement for Groundwater Elevation Data:

- Groundwater level data shall be sufficient to produce seasonal maps of potentiometric surfaces or water table surfaces throughout the basin that clearly identify changes in groundwater flow direction and gradient.
- Use the Kern Subbasin Well Data form.
- Groundwater level data shall be collected from each principal aquifer in the basin.
- Collection of data between the approved time frames only.
    - January 15th to March 30th
    - September 15th to November 15th
- If attempts have been made and a measurement cannot be collected from a representative monitoring well during the approved timeframe, one of the following is to occur:
    - A measurement from a nearby well with similar water level trends can be used as a proxy.
    - If no substitute well is available, the static water level can be estimated based on trending for Spring and Fall levels from the previous four or more bi-annual measurements; estimates are used for purposes of comparing to the established thresholds for each Management Area only.
    - If the water level is estimated, the entry must be flagged with a DWR No Measurement Code using the DWR pull-down menu options and described in the Water Level Measurements Comments field as "Estimated groundwater level based on trending for Spring or Fall levels from the previous four or more bi-annual measurements."
- If an existing representative monitoring well cannot be measured during two bi-annual timeframes, a plan to replace or repair the well in the monitoring network shall be made prior to the subsequent monitoring period or annual report, whichever occurs first.
- A weighted water level meter will be used to measure the depth to groundwater.

- Depth to groundwater must be measured relative to an established Reference Point on the well casing. If no mark or reference point is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The elevation of the Reference Point of the well must be surveyed to the North American Vertical Datum of 1988. The elevation must be accurate to within 0.1 foot.
- Each well's Reference Point will be cataloged to ensure identical procedures are followed for subsequent measurements.
- The data collector should remove the appropriate cap, lid or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to an accuracy of 0.1 foot below the Reference Point.
- The water level meter shall be decontaminated after measuring each well.
- The data collector shall calculate the groundwater elevation as:
    - GWE = RPE – DTW
    - GWE = Groundwater Elevation
    - RPE = Reference Point Elevation
    - DTW = Depth to Water
- The data collector must ensure that all measurements are consistent units of feet, tenths of feet or hundredths of feet. Measurements and Reference Point Elevations should not be recorded in feet and inches.
- Seasonal measurements must be submitted to the Kern Data Management System, reviewed for Quality Control, and approved by the management area administrator for upload to the SGMA Portal.

Pressure Transducers

As per DWR's Monitoring Protocols BMP (DWR, 2016c), groundwater levels and/or calculated groundwater elevations may be recorded using pressure transducers equipped with data loggers installed in monitoring wells. When installing pressure transducers, care will be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The following general protocols will be followed when installing a pressure transducer in a monitoring well:

- The sampler will use an electronic sounder or chalked steel tape and follow the protocols listed above to measure the groundwater level and calculate the groundwater elevation in the monitoring well to properly program and reference the installation.
- The sampler will note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers will be able to record groundwater levels with an accuracy of at least 0.1 foot. Consideration of the battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers will be included in the evaluation.

- The sampler will note whether the pressure transducer uses a vented or non- vented cable for barometric compensation. Vented cables are preferred, but non- vented units provide accurate data if properly corrected for natural barometric pressure changes. This requires the consistent logging of barometric pressures to coincide with measurement intervals.
- Follow manufacturer specifications for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy to assure that data quality objectives are being met for the GSP.
- Secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.

The transducer data will periodically be checked against hand measured groundwater levels to monitor electronic drift or cable movement. This will happen during routine site visits, at least annually or as necessary to maintain data integrity.

The data will be downloaded as necessary to ensure no data is lost and entered into the basin's DMS following the QA/QC program established for the GSP. Data collected with non-vented data logger cables will be corrected for atmospheric barometric pressure changes, as appropriate. After the sampler is confident that the transducer data have been safely downloaded and stored, the data will be deleted from the data logger to ensure that adequate data logger memory remains.

As mentioned above, for specific details regarding the monitoring network for groundwater level and change in groundwater storage for each management area, please refer to the respective individual management area plans. The data gaps and steps for improvement of the respective monitoring networks have also been identified in those management area plans.

3.6.7.2 Water Quality Monitoring Network Protocol and Standards

Groundwater Quality Monitoring Network Protocol and Standards

The existing monitoring network in the KGA includes production wells and dedicated monitoring wells. Until enough dedicated monitoring wells are installed to fill data gaps, production wells will be used to expand the spatial coverage of the existing water quality network.

As referenced in §352.4 of the GSP emergency regulations, monitoring sites/wells will conform to best management practices for geographic locations, identification, and details on well construction.

Requirements for Well Selection

- A long-term access agreement that includes year-round site access to allow for increased monitoring frequency
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact, type of information to be collected, latitude, longitude and elevation

- Monitoring location should also track all modifications to the site in a modification log
- The use of existing water quality data within the basin should be done to the greatest extent possible
- Monitoring network should consist largely as a supplemental monitoring locations where known groundwater contamination plumes are under existing regulatory management

Monitoring Protocols

The monitoring protocols will follow, at a minimum, the sampling guidelines as provided in DWR's *Groundwater Monitoring Protocols, Standards, and Sites BMP* (2016c).

Groundwater quality sampling protocols will ensure that:

- Groundwater quality data are taken from the correct location,
- Groundwater quality data are accurate and reproducible,
- Groundwater quality data represent conditions that inform appropriate basin management and are consistent with the data quality objectives,
- All important information is recorded to normalize, if necessary, and compare data, and
- Data are handled in a way that ensures data integrity.

The following points are general guidance in addition to the techniques presented in the previously mentioned USGS *National Field Manual for the Collection of Water Quality Data.*

Standardized protocols include the following:

- Monitor groundwater quality data from each principal aquifer in the basin.
- Data should be sufficient for mapping movement of degraded water quality.
- Data should be sufficient to assess groundwater quality impacts to beneficial uses and users.
- Data should be sufficient to evaluate whether management activities are contributing to water quality degradation.
- All analyses should be performed by a laboratory certified under the State Environmental Laboratory Accreditation Program.
- Samples will be collected according to the standards listed in the Standard Methods for the Examination of Water and Wastewater, USGS National Field Manual for the Collection of Water Quality Data.
- Prior to sampling, the sampler must contact the laboratory to schedule laboratory time, obtain appropriate sampler containers, and clarify any sample holding times or sample preservation requirements.
- Each well used for groundwater quality monitoring must have a unique identifier. This identifier must appear on the well housing or the well casing to avoid confusion.
- In the case of wells with dedicated pumps, samples should be collected at or near the wellhead. Samples are not to be taken/collected from storage tanks, at the end of long pipe runs or after any water treatment infrastructure.

- Samples will be taken/collected only after the appropriate volume of water has been purged from the casing and field parameters have stabilized.
- Sampler will clean the sampling port and/or sampling equipment. The sampling port and/or sampling equipment must be free of any contaminants.
- Groundwater elevation in the well should be measured following the protocols described in the groundwater level measuring protocols.
- Field parameters of pH, electrical conductivity and temperature should be collected for each sample. Lab pH analysis are typically unachievable due to short hold times.
- All field instruments should be calibrated daily and evaluated for drift throughout the day.
- Sample containers should be labeled prior to sample collection. The sample label must include:
    - Sample ID (well ID)
    - Sample date and time
    - Sample personnel
    - Sample location
    - Preservative used
    - Analytes and analytical method
- Samples shall be collected under laminar flow conditions. This may require reducing pumping rates prior to sample collection.
- Samples requiring preservation must be preserved as soon as practically possible.
- Samples to be analyzed for metals should be field-filtered prior to preservation. Do not collect an unfiltered sample in a preserved container.
- Samples will be chilled and maintained at 4 C to prevent degradation of the sample
- Samples will be shipped under a chain of custody documentation to the appropriate laboratory promptly to avoid violating holding time restrictions.
- Custody Seal will be used by the field technician if a third-party transportation service is used.
- A Field Sampling Log will be maintained for each sampling event and will include:
    - Sampler’s identification
    - Well identification
    - Climatic conditions
    - Depth to water prior to purging
    - Type of purging and sampling device
    - Purging rate and volume

- Relative well yield volume
- Field parameter measurements (pH, temperature, EC, DO)
- Type and number of samples collected
- Date and time collected

As mentioned above, for specific details regarding the monitoring network for groundwater quality for each management area, please refer to the respective individual management area plans. The data gaps and steps for improvement of the respective monitoring networks have also been identified in those chapters.

3.6.8 Reduction of Groundwater Storage

The reduction of groundwater storage provides an estimate of the change in annual groundwater storage. Since the groundwater storage is not a directly measurable condition, it relies heavily on the collection of accurate groundwater level data. The changes in groundwater levels reflect changes in storage and can thus be estimated with assumptions of thickness of subsurface geologic units, porosity, and connectivity. These observations will be essential for use in calculating the water budget.

A water budget is a foundational tool used to compile water flows (supplies) and outflows (demands). It is an accounting of the total groundwater and surface water entering and leaving a basin or user-defined area. The difference between flows and outflows is a change in the amount of water stored.

Coordination of water budget data to comply with groundwater storage include:

- Surface water supply
- Total water use
- Water budget
- Sustainable yield

The change in the annual volume of groundwater storage between seasonal high conditions shall be quantify in the water budget calculations.

3.6.9 Land Subsidence Monitoring Network

The current regional subsidence monitoring network includes regional subsidence screening by InSAR conducted by the USGS and monitoring points at existing continuous GPS (CGPS) stations and available data from SOPAC, as described in the basin setting. These monitoring points include: P544, P545, P563, P564, P565, BFLD, ARM1/2, TAFT, and BVPP. In addition, local extensometers for Semitropic Water Storage District (25S22E35B001M) and Kern Water Bank (30S25E16L) and benchmark monuments of North Kern Water Storage District are included in the network. Data from leveling surveys of the California Aqueduct and Friant-Kern Canal are also valuable points that have some historical data, but which have not been formally incorporated into the local Subbasin network.

3.6.9.1 CA Aqueduct Monitoring Plan

Subsidence will be assessed in a five-mile-wide monitoring corridor (i.e., 2.5 miles on either side of the Aqueduct). Since physical access to surveying benchmarks along the Aqueduct for independent parties is limited, the Aqueduct subsidence monitoring reports produced by DWR will be one of the sources to identify the rate and magnitude of subsidence (i.e., change in freeboard) on the Aqueduct. The DWR reports provide complete coverage of each Pool within the Subbasin and represent one method to monitor subsidence for the Aqueduct. Below, Table 3-10b provides the latest range of available freeboard by pool using the latest DWR survey data through 2022. The amount of remaining concrete liner was calculated relative to the original as-built liner elevations or subsequent liner raises where applicable.

As a supplement to the DWR subsidence monitoring reports, InSAR data will, at a minimum, be reviewed on an annual basis to inform Management Areas of whether subsidence rates could lead to an undesirable result. InSAR data will be ground-truthed by comparison to NOAA CORS station P545, SOPAC CGPS location P544, and available local existing extensometers in or adjacent to the subsidence monitoring corridor for the Aqueduct, in addition to any future CORS, CGPS, extensometer, or other pertinent facilities that may be constructed in the future in or adjacent to the monitoring corridor discussed below in coordination with DWR-CASP staff.

3.6.9.2 Monitoring Corridor

The subsidence monitoring corridor for the Aqueduct will include lands within 2.5 miles on either side of the Aqueduct (i.e., total of five miles wide centered on the Aqueduct). The width of the monitoring corridor was based on a review of Subbasin hydrogeology, historical InSAR datasets, the 2019 DWR-CASP report, and current land use along the Aqueduct.

3.6.9.3 Areas of Interest (AOIs)

Pools that have experienced subsidence which has significantly reduced freeboard and, in some cases, impacted flow capacity will be identified as “Areas of Interest” and be subject to focused monitoring by the collection and ground-truthing of InSAR data on an annual basis and the preparation of focused studies or investigations to assess the cause of subsidence in consultation with the adjacent Management Areas and DWR. If it is determined that the sole or principal cause of subsidence in a particular AOI is groundwater extraction for SGMA-related beneficial use, these sites will be identified for additional Subbasin monitoring stations in the future and/or management actions based on the data. Current AOIs for the Subbasin include the Kern bowl (a portion of Pool 23, all of Pools 24, 25 and a portion of Pool 26), Maricopa bowl (a portion of Pool 30, all of Pools 31 and 32), and Pleito bowl (a portion of Pool 34 and all of Pool 35). Studies conducted by the Management Areas on the west side have concluded that subsidence between Aqueduct Mile Post 195 to approximately 214 (i.e., Pools 23 through 25) is attributable to oil and gas activities. As such, the subsidence attributable to oil and gas activities at the Kern Bowl is beyond the ability of the Subbasin to control or mitigate. Further, additional study of the Maricopa and Pleito bowls is required to more fully understand potential causes of identified subsidence.

3.6.9.4 Watch Areas (WAs)

The 2019 DWR-CASP Report and 2022 CASP survey data show that subsidence in several pools has been minimal with top of concrete liner elevations in 2017 being comparable to those measured when the Aqueduct was constructed over 50 years ago, accordingly, neither freeboard nor capacity has been significantly impacted (i.e., undesirable results have not been experienced). Any significant loss of conveyance capacity from design specifications was found to be caused from aging concrete liner with increased hydraulic roughness and other factors. Pools that have experienced minimal subsidence historically will be identified as “Watch Areas”. Watch Areas will be monitored utilizing annual ground-truthed InSAR data and the most current DWR-CASP Aqueduct report. In the event that future monitoring determines that conditions have changed, the subject Watch Area may be redesignated as an AOI. Table 10a summarizes the Pool specific Monitoring Classification, and Management Areas associated with each Pool.

3.6.9.5 Friant-Kern Canal Monitoring Plan

Kern Subbasin is in contact with the FWA and will continue to work with FWA on filling data gaps as well as coordinate on a monitoring network. The Friant Water Authority (in conjunction with the Bureau of Reclamation) is developing a system-wide Friant-Kern Canal Capacity Correction Program (Program). Both entities have already begun the correction phase of the Middle Reach, which experienced significant capacity loss (over 40 percent) as a result of regional subsidence. The proposed monitoring program includes identifying impacts to water supplies from the loss of flow capacity in the Lower Reach. Several Kern Subbasin representatives are involved in the Program and will continue to monitor the Program with respect to SGMA compliance and implementation.

In addition to FWA’s subsidence monitoring reports, InSAR data will, at a minimum, be reviewed on an annual basis to inform Management Areas of whether subsidence rates could lead to an undesirable result. InSAR data will be ground-truthed by comparison to NOAA CORS station P564 (at Wasco-Kern County Airport) and P565 (at Delano Municipal Airport). In addition to any future CGPS, extensometer, or other pertinent facilities that may be constructed in the future in or adjacent to the monitoring corridor.

Table 3-10a. CA Aqueduct Pools in Kern Subbasin and Associated Management Areas

CA Aqueduct Pool	Management Area Within 5-Mile Corridor	Pool Monitoring Classification
Pool 23	KGA (WDWA)	AOI/WA
Pool 24	KGA (WDWA, SWSD), BVGSA	AOI
Pool 25	KGA (WDWA), BVGSA	AOI
Pool 26	KGA (WDWA), BVGSA	AOI/WA
Pool 27	KGA (WKWD), BVGSA	WA
Pool 28	KGA (WKWD, KWB), BVGSA	WA
Pool 29	KGA (WKWD, KWB), HMGSA	WA
Pool 30	KGA (WKWD), HMGSA	AOI/WA
Pool 31	KGA (WKWD), HMGSA, SOKR	AOI
Pool 32	KGA (WKWD), SOKR	AOI
Pool 33	SOKR, KGA	WA
Pool 34	SOKR, KGA	AOI/WA
Pool 35	SOKR, KGA	AOI

Table 3-10b. CA Aqueduct Pools in Kern Subbasin and Monitoring Classification Extent

CA Aqueduct Pool	2022 Range of Available Freeboard by Pool (Ft)[4]	Watch Area Mile Post (MP) Extent	Area of Interest Mile Post (MP) Extent
Pool 23	1.48 to 3.74	MP-184.5 to MP-194	[1]MP 194 to MP 197
Pool 24	0 to 2.19	N/A	[1]MP-197 to MP 208
Pool 25	0 to 3.43	MP-216 to MP-218	[1]MP-208 to MP-216
Pool 26	1.67 to 4.01	MP-216 to MP-222.5	[2]MP-222.5 to MP-223.5
Pool 27	3.62 to 4.32	MP-223.5 to MP- 231.5	N/A
Pool 28	1.51 to 4.35	MP-231.5 to MP-238	N/A
Pool 29	2.18 to 2.92	MP-238 to MP-244.5	N/A
Pool 30	2.65 to 8.11	MP-249.5 to MP-251	[2]MP-244.5 to 249.5
Pool 31	0.97 to 4.61	N/A	[3]MP-249.5 to MP-256.5
Pool 32	3.20 to 4.86	N/A	[3]MP-256.5 to MP 261.5
Pool 33	5.72 to 6.53	MP-261.5 to 267.5	[3]N/A
Pool 34	5.07 to 6.01	MP- 267.5 to 269.5	[3]MP-269.5 to MP- 271.5
Pool 35	3.59 to 6.64	N/A	[3]MP- 271.5 to MP- 278.5

[1]Vicinity of Lost Hills Oil Field; [2]Potential geotechnical effects; [3]Potential oil and other effects;
[4] California Aqueduct Adjusted NGVD29 Kettleman-Edmonston+Lat Long (CASP) Report, June 2022

3.6.9.6 Monitoring Corridor

The subsidence monitoring corridor for the FKC will include lands within 2.5 miles on either side of the FKC (i.e., total of five miles wide centered on the FKC). The width of the monitoring corridor was based on a review of Subbasin hydrogeology, historical InSAR datasets, and current land use in the area.

3.6.9.7 Areas of Interest (AOIs)

The Subbasin was recently awarded a $7.6 million DWR grant that includes funding for basin-wide proposals includes subsidence monitoring in 2 areas of interest along the FKC, which are identified as AOI-1 and -3.

- AOI-1 is situated east-northeast of the City of McFarland, along the FKC between Mileposts 120 and 130. The lithology presented on the cross sections indicate the presence of multiple clay layers below the water table. The completion report for a nearby well (approximately 1 mile west of the FKC) indicates there is a roughly 50-foot-thick clay layer at a depth of approximately 350 feet and two other clay layers at depths between approximately 900 to 1,000 feet.
- AOI-3 is situated west-southwest of the community of Famoso, along the FKC between Mileposts 130 and 137. Geologic cross sections show substantive clay units are present beneath the majority of AOI-3 at depths of approximately 250 to 300 feet (referred to as the 300-Foot Clay) and 750 to 800 feet (referred to as the 700-Foot Clay).

Data from DWR's California Groundwater Live website will be used to determine the annual subsidence rate and reporting purposes.

Subsidence monitoring is needed to understand the causes of subsidence, the potential risk of damaging critical infrastructure, and how to set minimum thresholds to avoid significant impacts to critical infrastructure in the Subbasin. Regional coordination of monitoring is key to the design of the network in the Subbasin because regional groundwater extraction is a main driver for regional-scale subsidence, along with subsurface geologic conditions. In addition, if significant impacts to critical infrastructure due to subsidence associated with oil and gas activities identified through regional monitoring, they will be communicated to DOGGR to address as appropriate pursuant to Public Resources Code 3315.

The basis for the design of land subsidence monitoring in the Subbasin is CWC 23 CCR § 354.34. Below are excerpts of the code with pertinent requirements to the Subbasin monitoring network.

Based on 23 CCR § 354.34, the following are some of the key criteria considered for Subbasin monitoring:

- The monitoring will collect sufficient data for seasonal, short-term, and long-term trends in groundwater and related surface conditions.

- The monitoring network will focus on collecting subsidence data (rate and extent) to avoid undesirable results, which for subsidence is defined as "…the point at which significant and unreasonable impacts, as determined by a subsidence rate and extent in the basin, affects the surface land uses or critical infrastructure…".
- The monitoring network will be based on scientific rationale.

§ 354.34. Monitoring Network

(a) Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.

…

(c) Each monitoring network shall be designed to accomplish the following for each sustainability indicator:

…

(5) Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.

…

(g) Each Plan shall describe the following information about the monitoring network:

(1) Scientific rationale for the monitoring site selection process.

….

(j) An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.

3.6.9.8 Monitoring Protocols

The preliminary monitoring network is based on the following decision-making process (Figure 3-10), which represents continuous screening for land subsidence in the Subbasin by InSAR and ground truthing where necessary. Where critical infrastructure is potentially susceptible to regional subsidence and subsidence is evident, then a determination is needed as to whether groundwater extraction is causing the subsidence. If groundwater extraction is causing the subsidence, then the following actions should be taken:

1. groundwater level monitoring,
2. additional ground-truthing of subsidence, and
3. monitoring of the critical infrastructure.

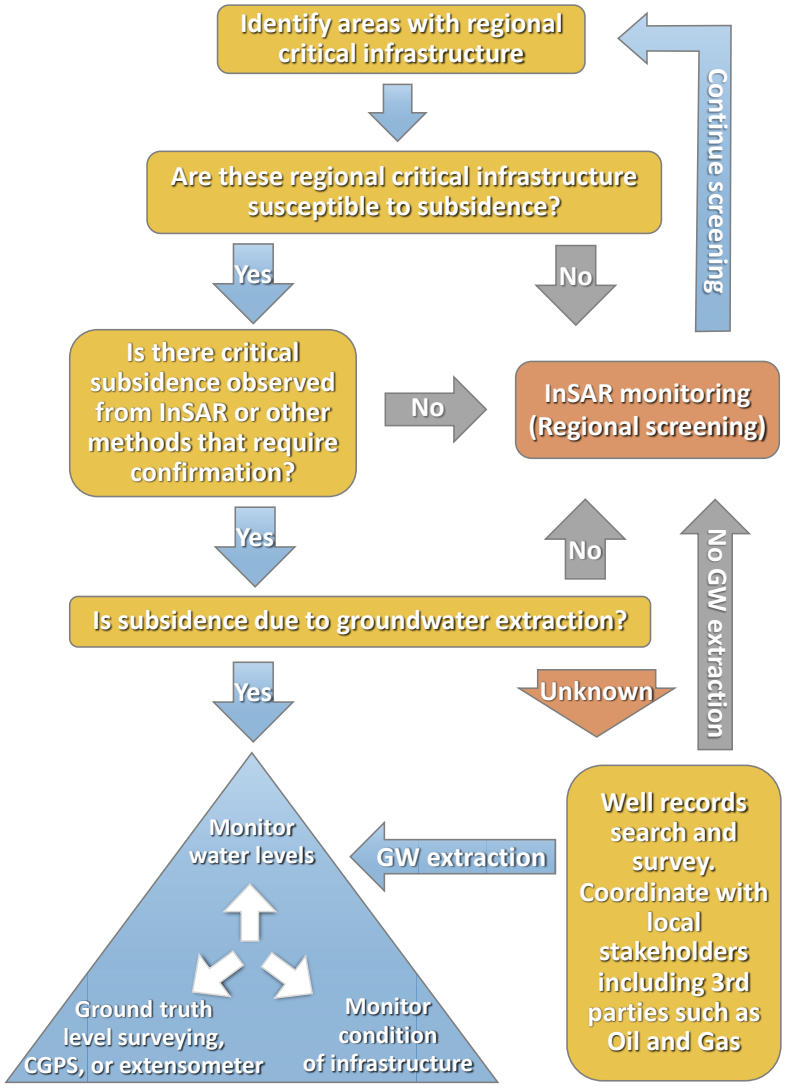


Figure 3-10. Subsidence Monitoring Design Approach

Subsidence Monitoring Network within Areas of Interest

The subsidence monitoring network areas of interest (AOI) are shown in Figure 3-11. Five AOIs were identified, in order of priority, to improve the subbasin monitoring network (AOI-1 to AOI-5). Two of these areas are located along the Friant-Kern Canal, two are along the California Aqueduct, and one area is for monitoring changes in land surface elevation along the northern boundary of the subbasin where a significant amount of subsidence has been reported in the InSAR data.

Water Level Elevations

The collection of water level elevations should be coordinated with subsidence monitoring points. If no wells within the water level monitoring network of the Subbasin are located near AOIs then monitoring wells at these locations will be identified for installation.

Five Areas of Interest

Based on the above monitoring design approach and recent InSAR and level surveying data from State Water Project, Central Valley Project, and North Kern Water Storage District as scientific rationale, four subsidence AOIs associated with critical infrastructure have been identified. In addition, a fifth AOI has been identified at the north boundary of the Subbasin. These AOIs will be covered by the monitoring network. Of these five, the stretch along CA Aqueduct MP 196 to 215 and MP 267 to 271 will be investigated to confirm if groundwater extraction is the cause of subsidence.

Where groundwater extraction is not causing subsidence in an AOI, groundwater management will not be a mitigating factor; therefore, the area will be removed from the AOI list for subsidence monitoring.

Friant-Kern Canal (AOI 1)

This high priority area is located along the Friant Kern Canal between Mileposts 120 to 130, east-northeast of the City of McFarland. The purpose of this AOI is to monitor subsidence along the Friant Kern Canal and its related infrastructure. At times, InSAR monitoring has reported up to 5 inches per year of subsidence in areas surrounding this segment of the Friant Kern Canal. At present, no significant impacts to the Friant Kern Canal have been reported along this portion of the canal's alignment. According to leveling survey data from Friant Water Authority (FWA, 2019), the Friant Kern Canal invert may have subsided from 2 ft to 3 ft below original as-built elevations between mileposts 120 to 135. Continued lowering of the canal invert can decrease freeboard from the original as-built conditions, which may contribute to reduction in emergency storage capabilities and delivery options of the Canal.

In contrast, beyond the Subbasin's northern boundary, subsidence has caused significant impacts to the Friant Kern Canal conveyance capabilities between mileposts 101 to 108.

Existing Monitoring

Currently, this area is screened by InSAR, and previous level surveying was performed by Friant Water Authority at mileposts 120 to 135. There are no other active monitoring points except for InSAR along this stretch.

New Monitoring Approach

A new CGPS station that monitors at the ground surface any subsurface subsidence, regardless of the depth interval, is recommended in this area. Monitoring at this location will assist in the KGA and its member to determine the causes of subsidence. If is it is reasonability determined that local agricultural extractions are the cause of subsidence at this location, the appropriate management area will work towards establishing appropriate measurable objectives and

minimum thresholds. This CGPS data will complement any manual level surveys that may incorporate the Friant Water Authority reported measuring points. CGPS data may also provide on-demand data as needed.

Coordination of Monitoring

Subsidence monitoring along the Friant Kern Canal benefits local stakeholders, CVP contractors, and the Friant Water Authority. It is anticipated that this monitoring can be coordinated with Friant Water Authority to share data as well as potentially share resources and cost.

Any level surveying along the canal from the United States Bureau of Reclamation Friant-Kern benchmarks will require coordination with the Friant Water Authority.

CA Aqueduct Milepost 196 to 215 (AOI 2)

This high priority area is the segment of the California Aqueduct where an embankment failure occurred at Milepost 208 in June 2011 (DWR, 2017c). This failure is partially attributed to subsidence. The cause of this subsidence is unknown and is therefore a subject of monitoring at this location. This area is along the Aqueduct between Mileposts 196 to 215 in the western central subbasin (Figure 3-11). In addition to embankment failure, other consequences of subsidence include loss in freeboard in the Aqueduct. This area has experienced at least 2 feet of subsidence since the Aqueduct was constructed.

This Page is Intentionally Blank

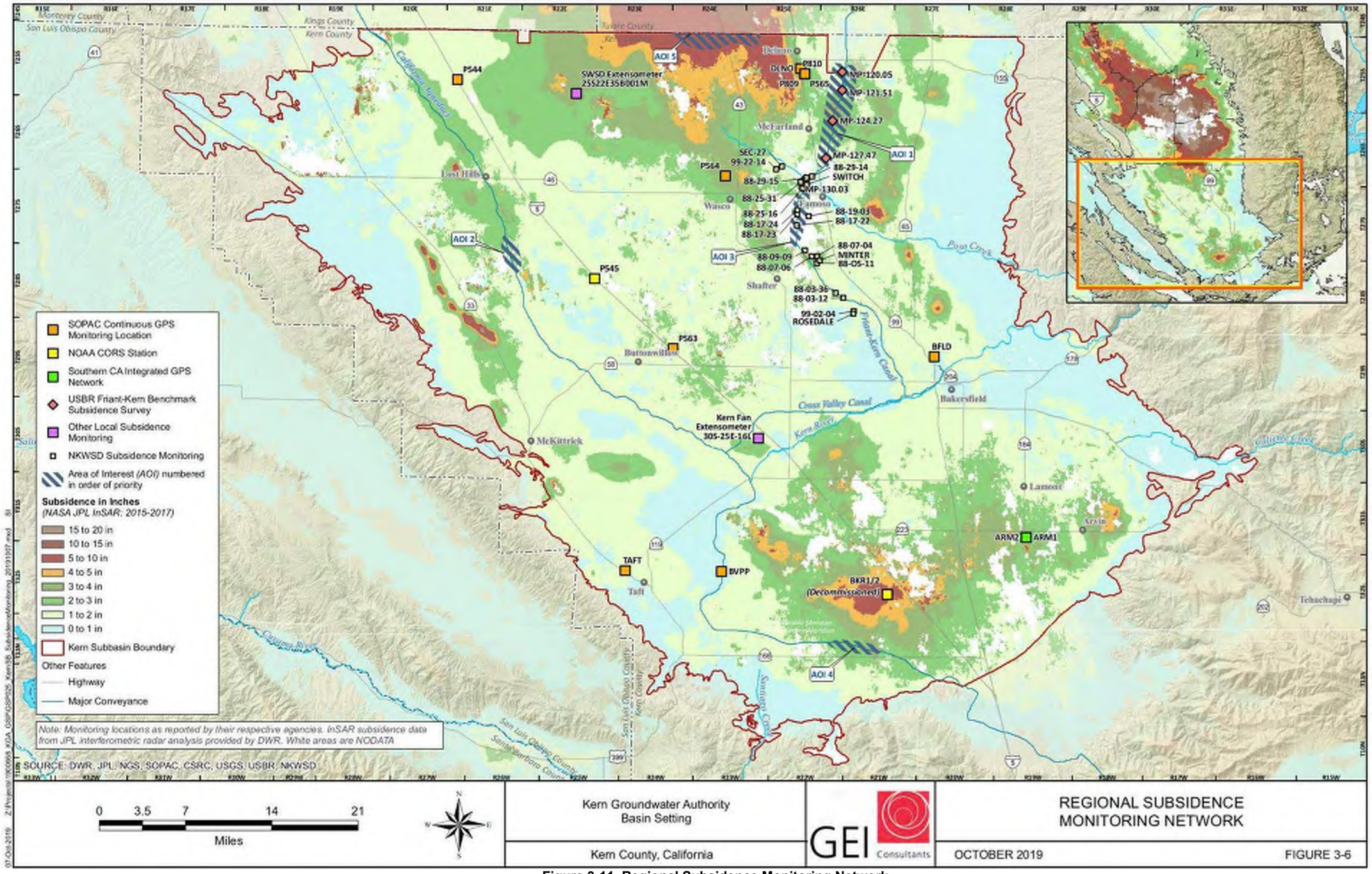


Figure 3-11. Regional Subsidence Monitoring Network

This Page is Intentionally Blank.

Existing Monitoring

Currently, this area is screened by InSAR and is monitored with level surveys every three to seven years by the DWR's DOE. There are no other active monitoring points along this stretch.

New Monitoring Approach

The source of subsidence, either by groundwater extraction activities or oil activities, will be investigated by performing well records searches from DWR well completion records, the Kern County Public Health Department well permit records, and the DOGGR's databases. If necessary, a field well survey may be performed. Coordination may be needed with local stakeholders to confirm the magnitude of groundwater extracted within 1 mile of this portion of the Aqueduct's alignment and the volume of fluids extracted and injected by oil and gas activities within 1 mile of this alignment. A third potential source for subsidence in this area could be hydrocompaction, which was identified during the initial design and construction of the Aqueduct. Pre-consolidation of soil was performed during initial construction so hydrocompaction is likely not significant, however, it cannot be ruled out at this time.

If it is determined that groundwater extraction is playing a role in subsidence for this area, a monitoring point should be installed away from the footprint of the Aqueduct to avoid potential signatures of hydrocompaction if any exist. If there is question of whether some of the subsidence is related to nearby oil and gas activities, then an extensometer should be installed in the interval where groundwater production occurs. An extensometer will provide data of subsidence pertaining to intervals with groundwater production, whereas a CGPS would capture any subsidence regardless of the depth interval.

Coordination of Monitoring

Subsidence monitoring along the Aqueduct benefits local stakeholders, State Water Project (SWP) contractors, and the DWR's DOE. It is anticipated that this monitoring can be coordinated with DWR to share data as well as potentially share resources and cost.

Friant-Kern Canal Milepost 130 to 137 (AOI 3)

This medium priority area is located along the Friant Kern Canal between Mileposts 130 to 137, southwest of Famoso and Poso Creek. The purpose of this AOI is to monitor subsidence along the Friant Kern Canal infrastructure where InSAR and local stakeholders have reported subsidence in the surrounding area. As with AOI-1, no significant impacts to the Friant Kern Canal have been reported along this stretch. According to leveling survey data from the Friant Water Authority (2019), the Friant Kern Canal invert may have subsided from 2 ft to 3 ft below original as-built elevation between Mileposts 120 to 135. Continued lowering of the canal invert can decrease freeboard from the original as-built conditions, which may contribute to reduction in emergency storage capabilities and delivery options of the Canal.

Existing Monitoring

Currently, this area is screened by InSAR, and previous level surveying was performed by the Friant Water Authority at Mileposts labeled on Figure 3-11. Local districts monitor this stretch regularly. Currently there are no continuous monitoring points along this stretch.

New Monitoring Approach

A CGPS station that monitors from the ground surface, any subsurface subsidence regardless of the depth interval, is recommended because the only known cause of subsidence in this area is attributed to groundwater extraction. This CGPS data will complement manual level surveys from local district surveys. CGPS data will also provide nearly on-demand data as needed.

Where possible, this station should be tied in to benchmark surveys performed by local districts.

Coordination of Monitoring

Subsidence monitoring along the Friant Kern Canal benefits local stakeholders, CVP contractors, and the Friant Water Authority. It is anticipated that this monitoring can be coordinated with Friant Water Authority to share data as well as potentially share resources and cost.

Any level surveying along the canal from the Friant-Kern Canal benchmarks will require coordination with the Friant Water Authority.

CA Aqueduct Milepost 267 to 271 (AOI 4)

This medium priority area is located along the Aqueduct between Milepost 267 to 271 near Old River Road. InSAR data report subsidence southwest and along I-5 and southwest toward the Aqueduct along Old River Road. A former CGPS station (BKR1/2) located about 5 miles north of the Aqueduct along Old River Road also reported significant subsidence; however, this station has since been decommissioned (2016).

Existing Monitoring

Currently, this area is screened by InSAR, and is monitored by level surveying every three to seven years by the DWR's DOE. There are no other active monitoring points along this stretch.

New Monitoring Approach

Groundwater extraction is potentially the source of subsidence, so a continuous monitoring station such as a CGPS or extensometer will be installed. Other potential sources could be oil and gas extraction and hydrocompaction. A DOGGR records search may provide sufficient information to understand the extent of oil and gas extraction in this area. Although hydrocompaction may not be significant because of pre-consolidation practices during Aqueduct construction, nonetheless, in order to avoid potential signatures of hydrocompaction, a monitoring point should be installed away from the footprint of the Aqueduct. If feasible during the siting study, the site location may be selected to the north between the Aqueduct and former BKR1/2.

Where possible, this station should be tied to benchmark surveys performed by local districts.

Coordination of Monitoring

Subsidence monitoring along the Aqueduct benefits local stakeholders, SWP contractors, and the DWR's DOE. It is anticipated that this monitoring can be coordinated with DWR to share data as well as potentially share resources and cost.

North Boundary of Subbasin (AOI 5)

This medium priority area is in the northern quarter of T25S-R24E and T25S-R25E. Currently, this AOI does not have recognized susceptible critical infrastructure. It has significant subsidence reported both historically (USGS level surveys) and recently (InSAR). A CGPS station in this area will provide a needed ground truthing point to confirm InSAR readings and will act as a useful monitoring point to gauge progress of groundwater management along the border of the subbasin in relation to neighboring subbasins to the north.

Existing Monitoring

Currently, this area is screened by InSAR. There are no other active monitoring points along this stretch.

New Monitoring Approach

Monitoring at this location will assist in the KGA and its members to determine the causes of subsidence. If is it is reasonability determined that local agricultural extractions are the cause of subsidence at this location, the appropriate management area will work towards establishing appropriate measurable objectives and minimum thresholds. If local groundwater extraction is determined to be the source of subsidence more detailed subsidence monitoring will be undertaken. a CGPS or extensometer monitoring station should be installed. Where possible, this station should be tied in to benchmark surveys performed by local districts.

Coordination of Monitoring

Subsidence monitoring along the subbasin boundary benefits local stakeholders in Kern County subbasin and adjacent subbasins. In the future, data may be shared with neighboring GSAs for coordination.

3.6.10 Assessment and Improvement of Monitoring Network

The following section describes data gaps and improvements for groundwater elevations, groundwater quality, and land subsidence. While this section provides the overall data gaps observed within the KGA, details for each management area can be found in the respective management area plan.

3.6.10.1 Groundwater Elevation and Storage

As referenced in § 352.4 of the regulations, "*If an Agency relies on wells that lack casing perforations, borehole depth, or total well depth information to monitor groundwater conditions as part of a Plan, the Agency shall describe a schedule for acquiring monitoring wells with the necessary information, or demonstrate to the Department that such information is not necessary to understand and manage groundwater in the basin."*

Well types and construction details will need to be determined to improve on the monitoring network. Downhole well surveys and desktop surveys will be utilized for existing wells to fill in the well construction details gap. New dedicated monitoring wells and converted monitoring wells from production wells will be utilized to fill in the monitoring network spatial extent and density. Plans for improvement will be developed during the next few years to be ready for proposal.

Currently, groundwater elevation and sampling measurements are not scheduled according to the 1 to 2-week period during the middle of Spring and middle of Autumn, as recommended by DWR's Monitoring Protocol BMP. Consequently, groundwater elevations and hydraulic gradients in the Subbasin are reported according to a broader range of time between Spring and Fall.

To minimize the effects of a temporal data gap in the future, it will be necessary to coordinate the collection of groundwater elevation data such that it occurs within a two-week window during the key reporting periods of mid-March and mid-October.

3.6.10.2 Groundwater Quality

New dedicated monitoring wells and converted monitoring wells from production wells will be utilized to fill in the monitoring network spatial extent and density. Plans for improvement will be developed during the next few years to be ready for proposal.

3.6.10.3 Land Subsidence

As described above, the Subbasin has agreed to a joint effort of monitoring subsidence at critical location in the Subbasin. The proposed monitoring program is to understand the causes of subsidence, the potential risk of damaging critical infrastructure, and how to set minimum thresholds to avoid significant impacts to critical infrastructure in the Subbasin.

3.6.11 Monitoring Summary

The monitoring networks as described above will leverage existing networks for groundwater elevations and storage, groundwater quality, and land subsidence. The networks will be improved upon with data reported semiannually to meet the objectives of this plan. The networks will be evaluated as often as possible to consider improvements and adjustments, and at a minimum, every 5 years, the network reports will summarize the results against measurable objectives. The network improvement plan is provided below.

4 Projects and Management Actions

4.1 Proposed Projects and Management Actions

Projects and management actions for the KGA have been developed at the management area level. Table 4-1 (provided at the end of this section) provides a summary list of all projects and management actions being considered for implementation by each member agency, including the project title, implementation status, a brief description of the project, and benefits associated with the project. The details of each proposed project and management action can be found in each member agency's management area plan.

In addition to the projects and management actions that are proposed by the KGA members, the KGA has identified projects and management actions that it will implemented to further the coordination of groundwater management in the Subbasin. Table 4-2 list these proposed projects and management actions. These efforts will be managed by the KGA and will be cost share through agreements with KGA members, other GSAs in the Subbasin, and grants, as appropriate.

Table 4-2: Kern Groundwater Authority Projects and Management Actions

Project Name	Project Description
Subsidence Monitoring (basin-wide)	Improve the understanding of the causes and impacts of subsidence in the Subbasin. Installation of subsidence monitoring stations in 2023 with funding from the Budget Act of 2021 Sustainable Groundwater Management (SGM) Grant Program SGM Act Implementation – Round 1 Grant. Work with the DWR CA Aqueduct staff and Friant staff to continue the studies and exchange of data to improve the sustainable management criteria for each critical regional infrastructure Implementation Period: 2020 to 2025
Groundwater Modeling (basin-wide)	Improve the understanding of groundwater reactions to the implementation of projects and management actions, relationship to minimum thresholds and measurable objectives, determination of the native yield of the Subbasin, and subsurface flow within and out of the Subbasin. Continue the development of the Kern subbasin data management system that will assist in improving the understanding as well as provide access to the data to stakeholders and beneficial users. Enhancing the transparency of the data as well as addressing any minimum threshold exceedances. Implementation Period: 2020 to 2025. Funding provided through the Budget Act of 2021 Sustainable Groundwater Management (SGM) Grant Program SGM Act Implementation – Round 1 Grant.
Study of Native Yield of the Subbasin	Studies to refine the understanding and allocation of the available native groundwater yield within the Subbasin. Implementation Period: 2020 to 2025. Funding provided through the Budget Act of 2021 Sustainable Groundwater Management (SGM) Grant Program SGM Act Implementation – Round 1 Grant.
Kern County Subbasin, Basin-wide Study	• **Basin Study:** Basin Study to develop a systematic technical analysis to better represent and understand the flow of groundwater and surface water into, through and out of the Kern Subbasin. • **Evapotranspiration Analysis & Study:** Field by Field Project compliments the Basin Study by groundwater truthing the water demand part of SGMA. The Component will provide data on the soil types and farming methods to further investigate the different crops planted and best way to meet water demands, providing a more accurate account of water usage.

Project Name	Project Description
	• **Subsidence Investigation and Study:** Priority Area #1 Data collection: Data to set the SMC for Kern subsidence. Strategically placed extensometers would provide the data necessary to set SMC as well as considering the other activity of extractions occurring in the basin, oil extractions. • **New or Converted Monitoring Wells**: Improve existing monitoring network throughout the Kern subbasin. Implementation Period: 2022 to 2005. Funding provided through the Budget Act of 2021 Sustainable Groundwater Management (SGM) Grant Program SGM Act Implementation – Round 1 Grant.
Subbasin Wide Consumptive Use Monitoring	Development of basin-wide consumptive use data to support water budget analyses, basin-wide modeling, groundwater native yield analysis and allocation, and annual reporting requirements Implemented in 2023. Funding provided through the Budget Act of 2021 Sustainable Groundwater Management (SGM) Grant Program SGM Act Implementation – Round 1 Grant.
Managing to Measurable Objectives	KGA members manage to checkbook water budgets as well as implement projects and management actions within their respective management areas to sustain water levels at or above the established measurable objectives. Implementation: 2020 to ongoing
Domestic Well Mitigation Program	A Domestic Well Mitigation Program will be developed and implemented by all KGA members. The purpose of this program is to mitigation the potential impact of declining groundwater elevations resulting from groundwater management actions. Implementation Period: 2020 to ongoing. Funding will be determined by individual members within their respective management areas.
KGA Monitoring Network Improvement Program	The KGA will work with its member entities, and other Subbasin GSAs, to continue to improve and reach SGMA compliance for identified representative monitoring sites. The KGA will work to identify joint projects and programs to ensure efficient installation and/or rehabilitation of monitoring wells and data collection and reporting efforts. Implementation Period: 2020 to 2025.
Basin-wide Coordination	Continuation of the Kern Subbasin Managers Group to coordinate water management activities in the Subbasin, including technical analysis, project management and coordination, identification of joint management opportunities and coordination of SGMA reporting requirements to DWR. Implementation Period: 2020 to ongoing
Annual Reporting	Coordination and facilitation of annual SGMA reporting requirements. The Kern subbasin to continue to address minimum threshold exceedances in the annual report. Implementation Period: 2020 to ongoing

The Subbasin includes a complex environment of various local and imported surface water supplies; variable access to groundwater supplies based on quantity and quality; water management authorities; extent and capacity of water management infrastructure; and fiscal relationship with local landowners for participation in water management programs. Each of the member agencies within the KGA has identified projects and management actions best suited to meet the conditions of sustainability within their respective management areas within the water management and authorities of its entity. Collectively these projects and management actions are designed to maintain or achieve sustainability and the avoidance of undesirable results, first within the management area and then collaboratively throughout the Subbasin. The KGA, the

KGA/GSA Managers Group and the Kern SGMA Coordination Committee will monitor the progress of project and management action implementation against reported groundwater conditions and performance to measurable objectives and interim milestones. Through this coordination effort opportunities will be explored for collaboration in implementing projects and management actions, as has been historically accomplished in the Subbasin, for joint conveyance as well as recharge and banking projects, as an example.

Table 4-1 list more than 140 projects and management actions either planned for, underway, or completed as of 2022. This includes management projects ranging from expansion of local and regional conveyance and recharge facilities to take advantage of surplus supplies; new conveyance and recharge projects; and participation in the Delta Conveyance Project or other thru-Delta improvement projects. Management actions range from implementing district level fee structures to incentive reduced groundwater pumping; participation in local, regional, and state-wide water markets; and setting allocation for groundwater use by landowner, based on the sustainable yield of the management area.

Table 4-1 also demonstrates the tremendous capacity of the entities in the Subbasin to implement projects and management actions to manage the Subbasin sustainably. As the KGA and the other Subbasin GSAs progress to 2040, the implementation of projects and management actions will be adaptively managed to ensure that the proper mix of projects or management actions are developed to avoid undesirable results. Each management area plan as developed its own adaptive management strategy, which often entails some level of groundwater pumping reductions if proposed project or management action are not realized or are not as effective as anticipated.

4.2 Projected Future Water Budgets with SGMA Implementation

Projected water budgets with implementation of the projects and management actions described in the previous section were developed using the C2VSimFG-Kern to evaluate the performance with respect to achieving groundwater sustainability. Proposed projects and management actions were simulated under Baseline conditions, 2030 Climate Conditions and 2070 Climate Conditions using the C2VSimFG-Kern. Detailed description of proposed SGMA projects, and management actions are provided in *Attachment H: Historical and Projected Future Water Budget Development with C2VSimFG-Kern*.

4.2.1 Future Baseline Water Budget with SGMA Implementation

The Baseline Scenario with Projects simulates the implementation of proposed projects and management actions applied to the Baseline Scenario. No other changes were made except for the addition of the projects to provide a direct comparison of the relative benefits of the over 400,000 AFY of proposed SGMA projects and management actions. The change in groundwater storage for projected future baseline with SGMA Projects improves by about 409,904 AFY. This change results in a net gain in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 85,578 AFY.

Figure 4-1 shows the comparison of the average annual water budget components for the two different Baseline Scenarios. Over this period, the average groundwater pumping of 1,354,000 AFY for the Baseline Scenario with SGMA Projects (which includes agricultural pumping, urban pumping and exported water) is over 270,000 AFY less than the Baseline Scenario.

4.2.2 2030 Climate Change Water Budget with SGMA Implementation

The 2030 Climate Scenario with SGMA Projects simulates the implementation of proposed projects and management actions applied to the 2030 climate change conditions. No other changes were made to this scenario. A comparison of the average annual water budget components for the two 2030 Climate Scenarios is presented in Figure 4-2. The change in groundwater storage for projected 2030 Climate Scenarios condition with SGMA Projects improves by about 418,949 AFY. This change results in a net deficit in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 46,829 AFY. Over this period, the average groundwater pumping of 1,444,300 AFY for the 2030 Climate Scenario with SGMA Projects, which includes agricultural pumping, urban pumping and exported water, is over 290,000 AFY less than the 2030 Climate Scenario without SGMA Projects.

4.2.3 2070 Climate Change Water Budget with SGMA Implementation

The 2070 Climate Scenario with SGMA Projects simulates the implementation of proposed projects and management actions applied to the 2070 climate change conditions. No other changes were made to this scenario. A comparison of the average annual water budget components for the two different 2070 Climate Scenarios is presented in Figure 4-3. The change in groundwater storage for projected 2070 Climate Scenarios condition with SGMA Projects improves by about 426,367 AFY. This change results in a net deficit in groundwater in aquifer storage over the WY2041 to WY2070 sustainability period of about 45,969 AFY. Over this period, the average groundwater pumping of 1,559,000 AFY for the 2070 Climate Scenario with SGMA Projects, which includes agricultural pumping, urban pumping and exported water, is over 307,000 AFY less than the 2070 Climate Scenario without SGMA Projects.

A comparison of the annual change in groundwater storage over the 50-year hydrologic period for the baseline conditions, 2030 and 2070 climate condition for with and without projects is presented in Figure 4-4. The time series shows that change in groundwater storage has stabilized to slightly increasing over the period from WY2041 to WY2070 for with Projects condition.

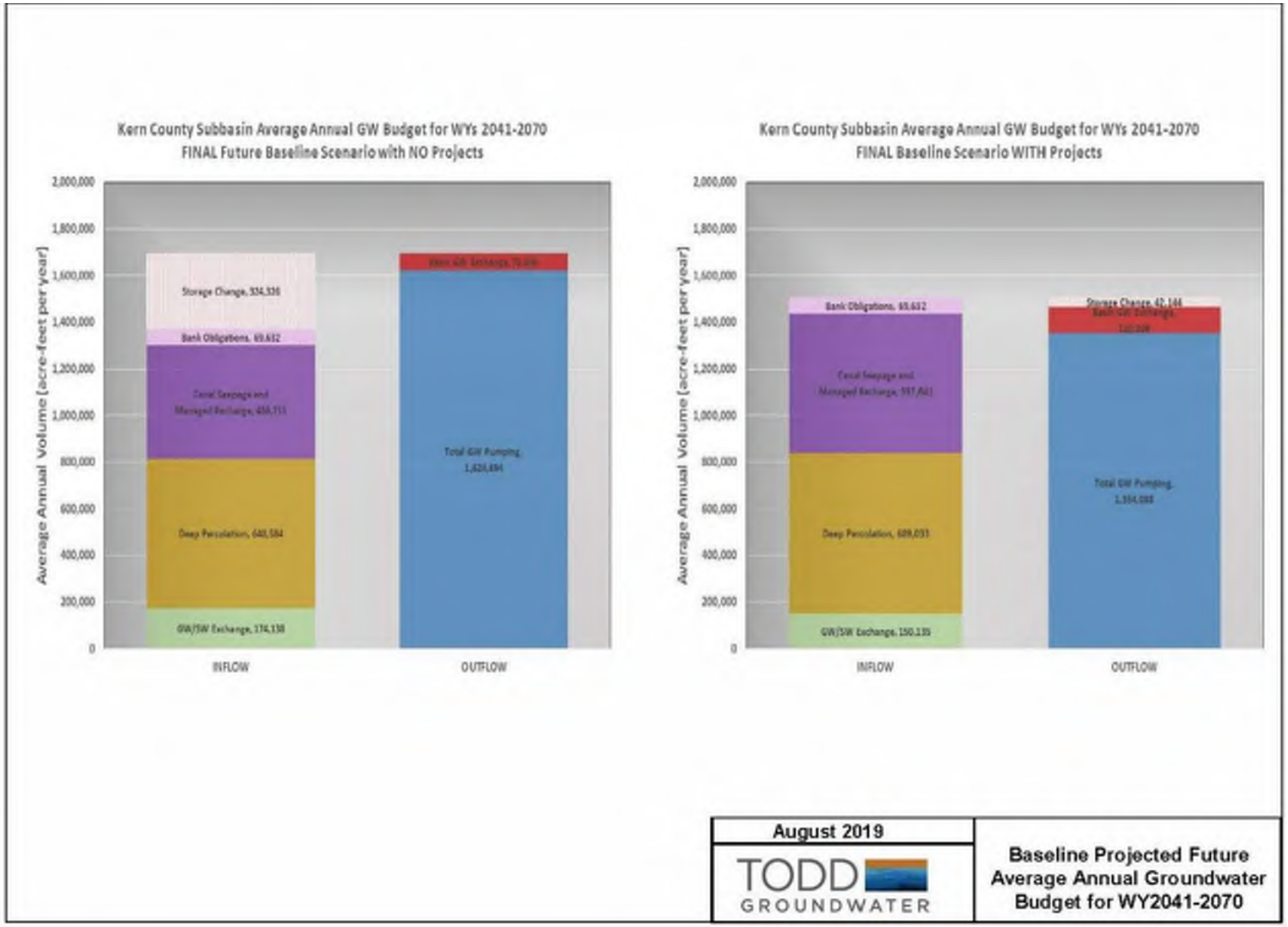


Figure 4-1. Baseline Projected Future Average Annual Groundwater Budget for WY2041-2070

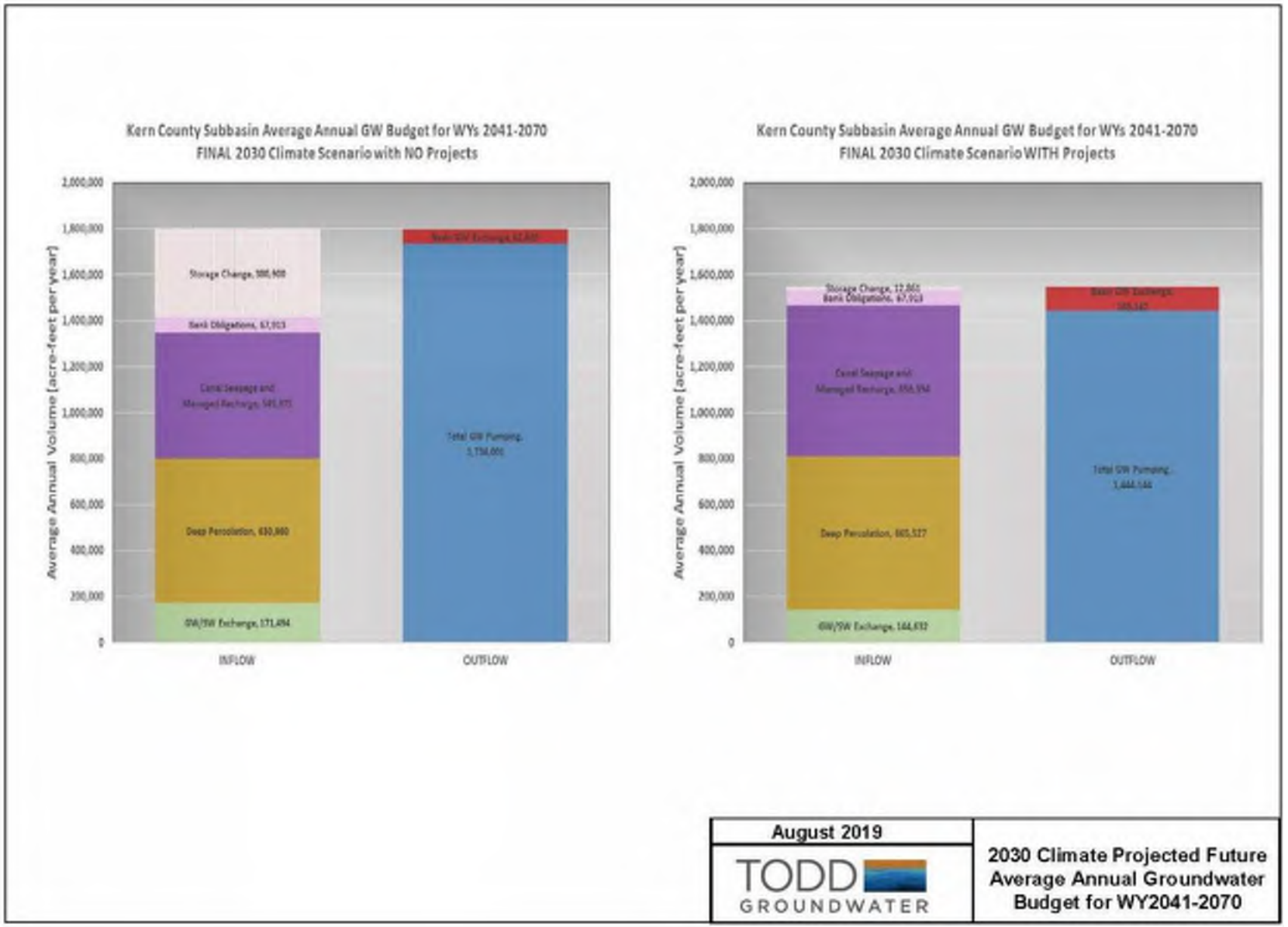


Figure 4-2. 2030 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070

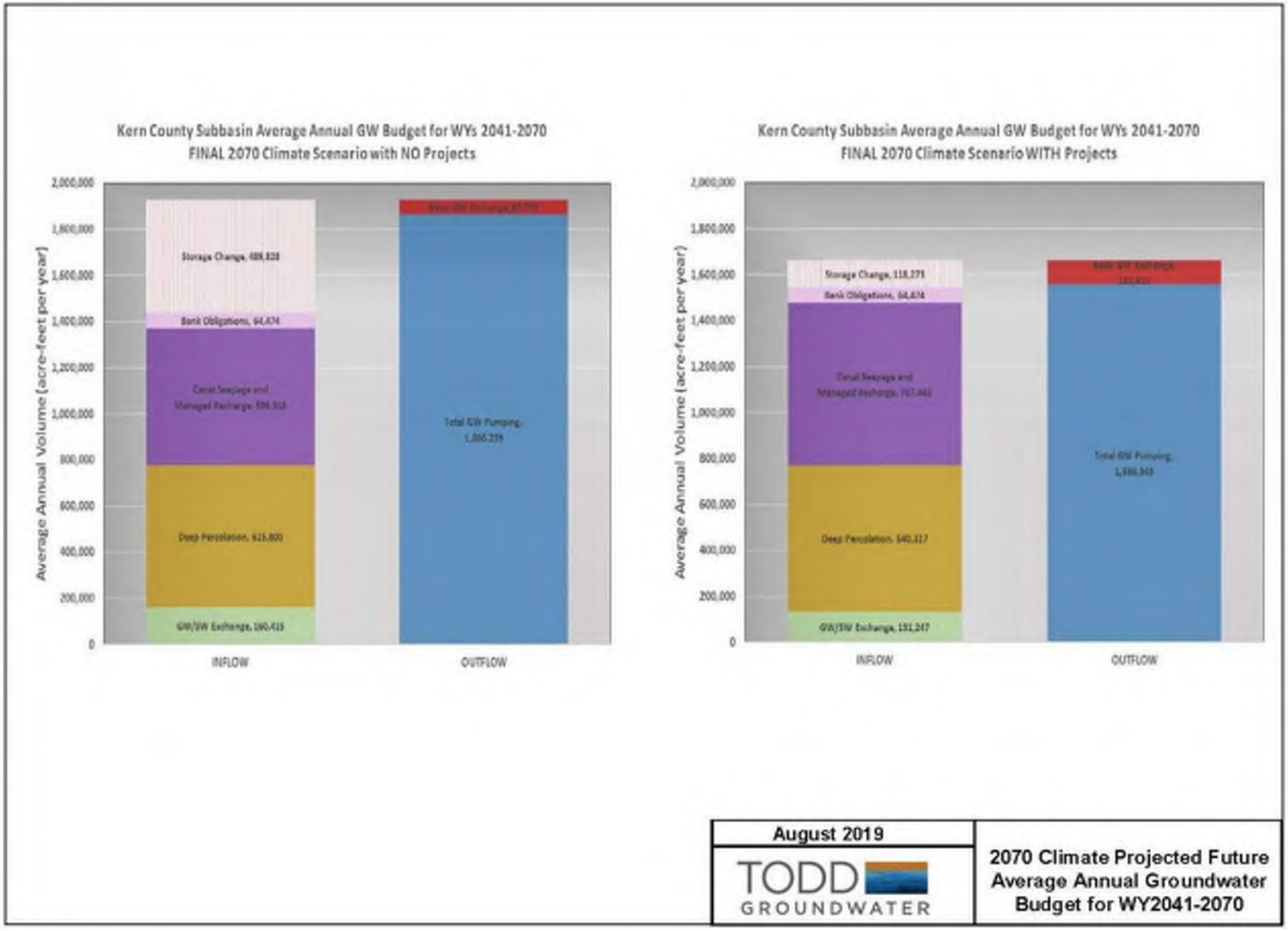


Figure 4-3. 2070 Climate Projected Future Average Annual Groundwater Budget for WY2041-2070

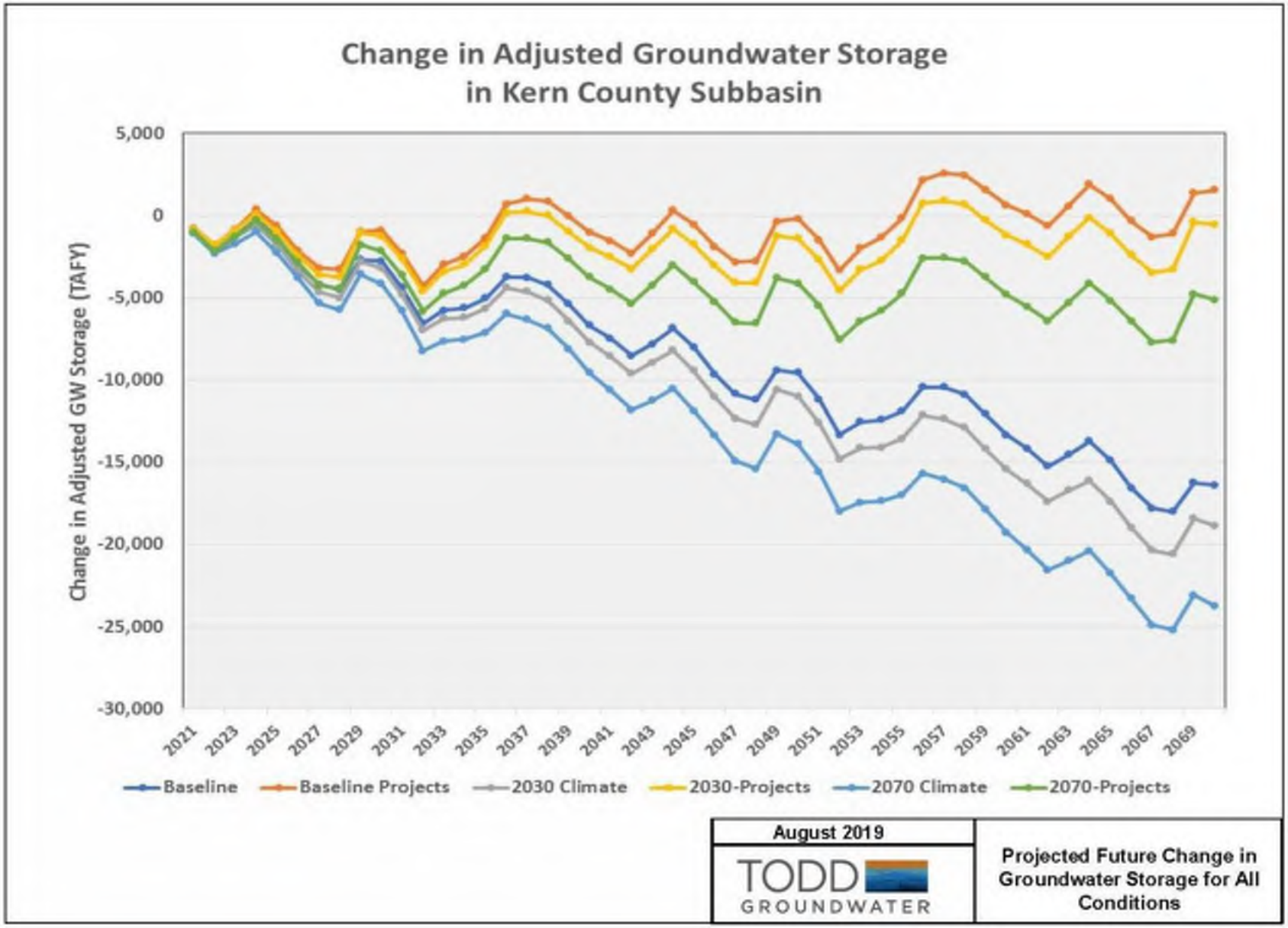


Figure 4-4. Projected Future Change in Groundwater Storage for all Conditions.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions

Entity	Project Title	Implementation Status	Description	Benefits
Cawelo Water Storage District				
CWD	NEW Management Action #1: Kern Groundwater Authority Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater	2020 to 2040 Implementation	The Cawelo GSA has adopted the Kern Groundwater Authority Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater Levels (Action Plan). Under the Action Plan, the Cawelo MAP will assess the cause of any single minimum threshold (MT) exceedance to better understand whether the underlying cause may be a potential precursor to an undesirable result or if it is the result of temporary or localized conditions. This proactive approach will provide an opportunity for the early implementation of other management actions or projects, as necessary, to address a potential emerging undesirable result.	The Action Plan allows for a proactive approach to assess the cause of any single MT exceedance providing an opportunity for the early implementation of other management actions or projects, as necessary, to address a potential emerging undesirable result.
CWD	NEW Management Action #2: Domestic Well Mitigation Program	2020 to 2040 Implementation	The Cawelo GSA Board will consider, if deemed necessary and appropriate, to adopt a Domestic Well Mitigation Program to assist in offsetting costs for domestic well issues related to dewatering of pumps or dewatering of well screens to the point of significant reduction in production. The Domestic Well Mitigation Program may be developed whereby a potential remedy will be provided to the domestic well owner in the event that the domestic wells are demonstrably unreasonably impacted by groundwater conditions, as defined within the program. Funding for such a program may be sourced from the CWD general funds or from a Cawelo GSA fund supported by a fee on owners of agricultural and industrial supply wells. The program may be modeled after similar programs developed elsewhere in the Kern Subbasin or around the state (e.g., Joint Operations Plan on the Kern Fan), and may include, but not limited to, remedies such as lowering pumps, deepening of wells, drilling new wells, and support for access to alternative water sources. The program will be developed in coordination with and in consideration of the interests of local stakeholders within the Cawelo GSA.	The domestic well mitigation program will benefit potentially effected beneficial users in the instance their domestic well is demonstrably unreasonably impacted by groundwater conditions.
CWD	Management Action #3: Voluntary Land Conversion	2020 to 2040 Implementation	The Cawelo GSA will develop a program to incentivize landowners to reduce their total crop demand by converting farmed land to groundwater recharge areas. This would reduce demands and the increased recharge capability could increase supplies. It could also reduce the potential of currently fallow land being used for future crops. This Management Action could be implemented conjunctively with Project #2: Increase GW Recharge and Banking Capacity	Range of annual benefit is 2,000 AFY with an average annual benefit at 2040 of 2,000 AFY.
CWD	Management Action #4: Crop Conversion and Irrigation Efficiency	2020 to 2040 Implementation	The Cawelo GSA will evaluate potential programs to incentivize growers to convert from relatively high water demands crops to crops that require less water and to improve the efficiency of irrigation practices. The Cawelo GSA will partner with Federal, State and local organizations such as the California Department of Food and Agriculture, U.S. Department of Agriculture, and Natural Resources Conservation Service to provide landowners information and access to conservation programs. The programs would educate the landowners on the potential economic savings from conversion to lower water demand crops and increased irrigation efficiencies and incentivize them to seek improved economically viable agricultural operations.	Range of annual benefit is less than 2,000 AFY with an average annual benefit at 2040 of 3,8000 AFY.
CWD	Management Action #5: Land Acquisition	2020 to 2040 Implementation	The Cawelo GSA will evaluate and potentially implement a program to acquire land that is actively farmed to reduce irrigated acreages within the Cawelo GSA. This would directly eliminate demands and free up the associated water supplies to meet other demands. This could be a very long-term program seeking to acquire appropriate land when available or to reduce the financial burden. Another method for pot ential conservation programs will be developed that could place certain easements on land that would minimize potential future increased water demands. These programs could also be implemented by contracts or other types of agreements.	Range of annual benefi is 2,500 AFY with an average annual benefit at 2040 of 2,400 AFY.
CWD	Management Action #6: Secure Access to Additional Monitoring Locations	2023 to 2025	The Cawelo GSA will continue to pursue an access agreement for a monitoring well location in the southeastern portion of the GSA. At the time of the completion of this GSP, access to the eighth location had not been secured, so it is listed as To-Be-Determined (TBD). Negotiations are ongoing for this location in the southeastern part of the GSA.	This management action would provide a monitoring location in the southeastern portion of the GSA where Cawelo GSA does not currently have a monitoring location. However, the regional monitoring network does include monitoring locations south of this area in the Kern River GSA area.
CWD	Project #1: New Water Supply Purchases	Begin program in 2020.	The Cawelo GSA would implement programs that will acquire long-term new water purchase contracts and/or establish a water purchase fund if contracts are difficult to secure because of high demand and competition and resulting high costs. The main goal would be to secure long-term new water contracts but compliance with SGMA will impact future water management practices and could make the availability of new long-term contracts scarce. If long-term contracts can't be secured then a new water fund would be established to build funding reserves for water purchases. These purchases could occur during favorable times such as hydrologically wet years when water will be more readily available at lower costs. While the Cawelo GSA would likely not need this water in wet years, these types of purchases could be in the form of banked water that the Cawelo GSA could request at a future date. Alternatively, the funds could be used to make annual water purchases and the revenue for the fund would be consistent from year to year regardless of the hydrological conditions. Therefore, during wet or average hydrologic years the water would cost less and reserves would be built up for more costly water purchases during the drier years. It is estimated that an additional 5,000 AFY to 23,000 AFY of water could be imported into the Cawelo GSA area through new long-term contracts or establishing a new water purchase fund or both.	Securing new long-term contracts or establishing a water purchase fund or both could result in an additional 5,000 AFY to 23,000 AFY of water that could be imported into the Cawelo GSA area. This additional water would increase the amount of water in the basin and decrease overdraft.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
CWD	Project #2: Increase Groundwater Recharge and Banking Capacity	Target 2030 Implementation	The Cawelo GSA will implement projects or programs to increase recharge capacity to capture and recharge additional wet year high flow waters to store for future use. The Cawelo GSA has limited groundwater recharge facilities and has not been able to capture and recharge all available water under wet hydrological conditions. This project would entail building additional Cawelo GSA-owned recharge facilities and/or improve the distribution system to increase the capacity to capture more water, especially during wet hydrologic events. Some facilities could be strategically located to capture storm runoff that may otherwise leave the Cawelo GSA area. It is estimated that approximately 200 to 570 acres of new recharge and banking facilities could be developed. Additionally, the Cawelo GSA will consider implementing a program to incentivize landowners to use their land for recharge. This could provide an opportunity for landowners to bank their privately-owned water for future recovery and possibly allow the Cawelo GSA access to their lands for additional recharge. This program would not only increase recharge capacities during wet years but could also reduce water demand by replacing crops with recharge facilities. The privately-owned water could be purchased under Project #1, New Water Supply Purchases, described above.	There are significant regions within the Cawelo GSA with soil properties that could achieve percolation rates of up to 0.5 AF per day. Assuming an average percolation rate of 0.35 AF/day and approximately 200 to 570 acres of potential new recharge and banking land, about an average of 500 AFY to 1,500 AFY of new water could be recharged for future recovery. It is not clear what magnitude landowner-owned recharge facilities would have on importing additional waters into the Cawelo GSA area. It could be anywhere between an average of 50 AFY to 500 AFY.
CWD	Project #3: New Cawelo GSA Banking Partners	Begin program in 2020.	The Cawelo Water District benefits from a banking program partnership with the Zone 7 Water Agency. Located in the Livermore-Amador Valley, which is outside of the Kern County Subbasin. The District stores water for Zone 7 and keeps half of the water that it stores. For example, for every 2 AF feet of water delivered to District recharge facilities, the District is obligated to only return 1 AF. The currently banking program with Zone 7 could be modified to increase the amount of water stored for Zone 7 and/or a new banking programs and partners could be considered to fund the construction of new facilities and/or to improve existing facilities. It is estimated this could increase the annual average water supply up to 500 AFY.	The expansion of the existing banking contract with Zone 7 and/or the development of additional banking partners would be a beneficial way the Cawelo GSA could increase its groundwater supply by the portion of water each partner agrees to essentially leave in the Cawelo GSA area. Zone 7 has agreed to leave 50 percent of all that is spread. It is estimated that this program would generate about 500 AFY.
CWD	Project #4: Water Treatment Facilities	Begin program in 2020.	The Cawelo GSA is currently evaluating projects to install water treatment facilities that will allow the Cawelo GSA to acquire wastewater and treat it to a level that is safe for crop irrigation. Wastewater is exempt from SGMA regulation and the treated wastewater would be considered new water. There is a substantial volume of oilfield produced water (OPW), a byproduct of oil production, available in the vicinity of the Cawelo GSA. The salinity of OPW can range from moderate to high, although even the best quality still requires some level of blending with fresh water before it can be used on crops. Reverse osmosis or distillation would generally be needed to remove enough salts to make the OPW usable for irrigation. Near the Cawelo GSA, approximately 20,000 AFY of wastewater is injected into exempt groundwater aquifers well below the base of fresh water. The Cawelo GSA is evaluating potential projects to treat anywhere from 7,500 AFY to 20,000 AFY of OPW.	The treated OPW would be a new source of about 7,500 AFY to 20,000 AFY of water for irrigation.
CWD	Project #5: Friant Pipeline Project	Construction in 2019.	The Cawelo GSA is currently developing the Friant Pipeline Project that would increase water importation capacity into the Cawelo GSA area. Currently, the amount of imported water that the Cawelo GSA can import into the area is limited by conveyance capacity, not by irrigation demand or recharge basin capacities. The Friant Pipeline Project would increase the total capacity by 100 cubic feet per second (cfs) and connect Cawelo's Famoso Recharge Basins directly to the Friant-Kern Canal. The increased capacity would allow greater access to high flow water and support banking programs with Friant Contractors. The Friant Pipeline Project would result in an additional 1,500 AFY to 2,500 AFY of water brought into the Cawelo GSA area on an average annual basis.	The Friant Pipeline Project would increase the total capacity into the Cawelo GSA by 100 cfs and increase access to CVP high flow waters and allow for banking programs with Friant Contractors. It would result in an additional 1,500 AFY to 2,500 AFY of water brought into the Cawelo GSA area on an average annual basis.
CWD	Project #6: Poso Creek Flood Water Capture	Target 2030 Implementation	The CWD has appropriative rights to divert water from Poso Creek, an ephemeral stream, when there are flows into the Cawelo GSA area. Additionally, there are downstream districts that also have subsequent appropriative rights and certain adjacent landowners that exercise their riparian rights. CWD also has additional diversion rights to divert supplementary water when high flows occur. The Poso Creek Flood Water Capture Project would consist of the construction of additional facilities to take advantage of those additional rights and divert supplementary water from the creek during times of high flow. In addition to making more water available to the Cawelo GSA, this capture of additional high flows could reduce potential downstream flooding impacts. Participation from downstream right holders would be needed due to potential water right impacts. The estimated net water gain is up to 150 AFY on average.	The Poso Creek Flood Water Capture Project would provide up to 150 AFY on average of additional water and could reduce potential downstream flooding impacts.
CWD	Project #7: Surface Water Storage	Target 2030 Implementation	The Cawelo GSA has several existing reservoirs with a combined storage capacity of 800 AF. This project would consist of constructing a new 5,000 AF reservoir within the Cawelo GSA boundary. This would provide additional storage capacity to bring more water into the Cawelo GSA area during wet years. It is estimated that this new reservoir would provide approximately 500 AFY on average. This program would likely only be implemented conjunctively with other water management programs.	A new reservoir would provide approximately 500 AFY on average.
CWD	Project #8: Out of Cawelo GSA Banking	Begin program in 2020.	The Cawelo GSA will evaluate groundwater banking projects that are outside the Cawelo GSA but within the Kern County Subbasin and also groundwater banking projects outside of the Kern County Subbasin. Potential banking projects outside of the Cawelo GSA are likely to have multiple participants and therefore offer a limited share of project benefits.	This Project could yield an average annual benefit of 500 AFY to 4,000 AFY through out of Cawelo GSA banking programs.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
Eastside Water Management Area				
EWMA	Project-1	Not yet initiated; Timetable TBD.	Development of oilfield produced-water supplies to potentially reduce groundwater demand.	Potential additional external source of water for the basin (annual volume TBD).
EWMA	Project-2	Not yet initiated; Timetable TBD.	Construction of aquifer-specific monitoring wells in locations with data gaps, to better understand hydraulic heads and gradients.	Improved ability to monitor groundwater conditions in specific aquifers or areas.
EWMA	Project-3	Not yet initiated; Timetable TBD.	Installation of pressure transducers in selected wells of the monitoring network, to collect high-resolution cost-effective data.	Improved ability to monitor groundwater conditions in EWMA.
EWMA	Project-4	Not yet initiated; Timetable TBD.	Surface runoff capture and enhanced infiltration in impoundments.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-1	Not yet initiated; Timetable TBD.	Exceedence Policy (see GSP Section 16.2)	Actionable information regarding causes and effects of MT exceedance
EWMA	Management Action-2	Not yet initiated; Timetable TBD.	Reduction of irrigated acreage, or modification of irrigation techniques or crop types to reduce water usage.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-3	Not yet initiated; Timetable TBD.	Assess fees for groundwater use to encourage reduced pumping or curtailment.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
EWMA	Management Action-4	Not yet initiated; Timetable TBD.	Establish a system of transferrable water credits.	Reduced groundwater pumping (annual volume TBD) to meet sustainability goals, as needed.
Kern Water Bank Authority				
KWB	Operations Plans	Ongoing	KWB operations can cause a temporary lowering of groundwater levels in adjacent areas toward the end of extended droughts. In order to mitigate the potential impacts that might arise from those temporary changes, DWR has developed mitigation measures for the project, which have now been coordinated with other adjacent water banking projects and incorporated into a Joint Operations Plan. The Joint Operations Plan designates measures to prevent, eliminate or mitigate significant adverse impacts resulting from project recovery operations.	Potential impacts from project operations on adjoining domestic, small community, and agricultural groundwater wells are avoided.
KWB	Groundwater Storage Improvement	Ongoing	Water recovered by KWB provides water supplies to KWB participants in dry years significantly reducing their need to pump groundwater. KWB also provides up to 4% of the water stored to adjoining Management Areas to reduce overdraft in those areas. KWBA cannot recover water beyond those volumes previously stored less appropriate losses.	KWB operations help both our members and adjoining management areas reduce groundwater pumping thereby minimizing the potential for a reduction of groundwater storage in those areas. KWB recovery operations will also never result in a reduction of groundwater storage because recovery ceases when stored water accounts reach zero.
KWB	Water Quality Protection	Ongoing	Groundwater monitoring from 1994 through 2018 indicates groundwater quality is not being degraded by KWB water banking activities, and in fact the removal of salts is benefitting the aquifer. DWR developed mitigation measures to ensure that continued KWB operations do not degrade groundwater quality.	Historical KWB operations have removed salts from the Kern Fan aquifer and provided improvements to water quality for some constituents in the California Aqueduct. These benefits will continue.
KWB	Subsidence Monitoring	Ongoing	The KWB supports the repair and continued monitoring of the extensometer located on KWB property.	The KWB extensometer provides important subsidence data for the Kern Fan region.
KWB	KWB Recharge Enhancement Project	Completed	KWBA has constructed an additional 1,025 acres of recharge basins.	Project will allow KWBA capture more water in the future, furthering the conservation goals of SGMA.
Kern Tulare Water District				
KTWD	Action 1: Modify District Pricing Structure	ction 1 could be executed during the first 5 years of implementing the Plan (2020-2025).	The most affordable way to reduce groundwater pumping is to provide a pricing mechanism that causes groundwater to cost more than surface water. This could be accomplished by implementing a "groundwater charge" for every acre-foot pumped. Water Code §35533 provides the District the authority to collect groundwater charges. Revenue from the groundwater charge could be used to implement management actions or to reduce the cost to deliver surface water from the District.	5,580 AF/yr reduction in groundwater pumping.
KTWD	Action 2: CRC Pipeline Project - Produced Water Project	The District and CRC are in the process of acquiring permits, preparing an anti-degradation analysis and acquiring a WDR from the Regional Board. Project pipelines have been designed and plan and profile drawings have been prepared. The District is negotiating an agreement with CRC and obtaining rights-of-way. The pipeline construction is expected to be completed prior to 2025.	The District has historically accepted produced water to provide surface water to the District and is in the process of obtaining an additional source of produced water from California Resources Corporation (CRC). Produced water from CRC will be transported through 12 miles of 15-inch pipeline to the Guzman Reservoir. From the Guzman Reservoir, water will be transported through 1.8 miles of 30-inch pipeline to the District's existing Big 4 Reservoir, from which it will be blended with water from the Friant-Kern Canal and distributed in existing facilities to existing irrigated agriculture located within the District.	3,000 AF/yr of additional surface supplies (results in a reduction of 1,440 AF/yr in groundwater pumping).

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
KTWD	Action 3: In-District Surface Storage	The project is still in the preliminary design phase and will require additional steps before construction. The District has selected two potential reservoir sites, completed exploratory borings, and conducted a geotechnical evaluation of the two potential sites. The District has yet to acquire land and rights of way, permits, environmental documentation, or project financing. It is estimated that these facilities will be constructed between 2025 and 2030 if they are determined to be feasible and found to be necessary.	There are times when affordable water supplies are available, but the District has little to no irrigation demand and no available spreading capacity in its existing out-of-district banking programs. Construction of off-stream surface storage will allow the District to acquire water when it is available and store it to meet future irrigation demands. The District has selected two potential reservoir sites with a total capacity of 8,000 AF to capture wet year water. The sites are located to the east of the District in both the north and south portions. A location map of facilities and detailed description is not provided due to the confidential nature of the property and rights of way acquisition.	Based upon annual water supply modeling herein, the project yields only 530 AF/yr. However, a monthly analysis will need to be conducted to provide a better estimate of project yield, which could be as much as 2,000 AF/yr (assumes the reservoirs are used once every 4 years).
North Kern Water District & Shafter-Wasco Irrigation District				
NKWSD	Calloway Canal Improvements: Lining Snow Rd. to 7th Standard Rd.	Calloway Canal Lining is an ongoing project. NKWSD is in the process of acquiring adequate funding to complete the next one-mile lining of the project. The proposed project schedule includes a start date of October 2019 and completion within 36-months.	Calloway Canal Improvements is part of NKWSD's continued effort of the recently completed 1.1-mile long canal lining. The first phase of this project consists of concrete lining approximately 2,200 LF of currently unlined portion of the Calloway Canal to increase surface water reliability and prevent seepage.. Phase two of this project includes water delivery improvements (WDI) that consist of installing magnetic flowmeters (or magmeters) at a total of 50 of the District owned production wells. Each magmeter will include a totalizer capable of measuring the volume of groundwater pumped through the wells. Further, water level sensors will also be installed in each of the 50 production wells and four additional monitoring wells to quantify the depth-to-water data. Additionally, the District proposes to implement telemetry upgrades at each of the production well sites, each of the monitoring well sites, and 14 remote Terminal Unity (RTUs-used to measure canal levels) sites. The final part of the water delivery improvements integrating these sites with NKWSD's Supervisory Control and Data Acquisition (SCADA) setup.	Lining the canal will reduce the irrecoverable losses that result when high quality surface water seeps to poor quality groundwater, which cannot be recovered for later use without substantial treatment. Reducing these losses enhances NKWSD's capability to deliver increased volumes of water from the Kern River to irrigators for existing demand. The integration of the telemetry system with the SCADA setup will enable the District to control well operation and access their groundwater pumping data remotely. Water conserved by lining the canal and implementing WDI is estimated at 1,576 AFY.
NKWSD	Expanded Water Banking Program	This program is an expansion of the District's ongoing groundwater banking program. Environmental documents are being prepared to carry out the program in a timely manner.	Due to historically low groundwater levels, requirements under SGMA, and potential reductions in its historical water supplies, NKWSD is proposing a new program to increase its existing conjunctive use (or water banking) facilities and subsequently expand these facilities. Phase I of this program would primarily rely on unused capacity in existing facilities which is available from time to time (with some additional conveyance) and would seek to increase the utilization of the District's proven recharge and recovery assets. Phase II would involve the construction of additional direct recharge and recovery facilities to further expand water banking in the District. Both the District and District landowners will receive water supply benefits from this program.	Implementation of this program would bring additional water supplies that would help offset potential losses of the District's historical supplies, support the District's mission of maintaining economic pumping lifts for its landowners, and maintain supplies to be used for municipal and industrial purposes by the city of Shafter. Quantitative benefits include 50,000 AFY (Phase I) and 72,000 AFY (Phase II) for a total of 122,000 AFY of water for the District.
NKWSD	Groundwater Banking Conveyance Improvements to NKWSD Recharge and Recovery	NKWSD is in the process of acquiring adequate funding to complete this project. The proposed project schedule includes a start date of October 2019 and completion by the end of 2021.	The proposed project involves the drilling and equipping of three replacement wells and connecting two other deeps wells (five total) to NKWSD's existing network to improve return capacity of recharged water for the District's neighbors. Proposed project is to construct the necessary pipelines to connect five deep wells to the District's recovery network system that improves the capacity to return water supplies multiple districts in the region during dry years.	Implementation of this project is anticipated to return previously stored water into the FKC and NKWSD's conveyance system at a rate of approximately 27 cfs. This equates to a total estimated average of 1,680 acre-feet per month, or an annual capacity of 9,961 acre-feet per year for the seasonal use of the wells (six months in a year) to improve the return capacity for the Poso Creek IRWM CVP Contractors to meet irrigation demands during a critically dry year. Two of the five wells will discharge into the District's canals and the remaining three will connect to the District's manifold pipeline, which ultimately discharges to the FKC.
NKWSD	Beneficial Reuse of Oilfield Produced Water	This is an ongoing project. NKWSD is interested in expanding the amount of oilfield produced water being brought into the district; however, no decision has been made at this time.	Since 2015, NKWSD has made beneficial reuse of oilfield produced water by blending produced water with other surface supplies for irrigation use. The California Resources Corporation (CRC) discharges 58 acre-feet per day of produced water from CRC's Kern Front Oil Field to NKWSD. The blended water is used directly for irrigation or is discharged to spreading basins in NKWSD for groundwater recharge.	Currently, this project has an important beneficial impact on water resources in the local area. One impact of the project is the annual recycling of up to 11,000 AF of oilfield produced water to the District. This flow is blended with other water sources and used for irrigation and groundwater recharge. Produced water increases the District's water supply and partially replaces groundwater that would otherwise be pumped. During the winter season, produced water is discharged to the Rosedale Spreading Basins along with any available Kern River water to recharge groundwater supplies. This has the added benefit of decreasing the rate of groundwater decline and lowering pumping costs.
NKWSD	SCADA Automation and Evapotranspiration Measurement Improvements	This is an ongoing project. The District is in the process of switching from SCADA to Wonderware Software and plans to implement upon approval from Reclamation.	The proposed project includes the installation of Supervisory Control and Data Acquisition (SCADA) Automation software along with Evapo-transpiration (ET) measurement stations. This project is divided into two components, the purpose of the first component is to remotely monitor and control the District owned and operated groundwater wells and Canal level transmitters. The second component of this project is to install evapo-transpiration (ET) stations in strategic locations within the District. The District anticipates that the crop specific ET measurements will help the District and its growers to correlate the ET and the applied water with the crop yield.	With these modernization efforts, the District can automatically record the instantaneous groundwater pumping rate, depth to groundwater, canal level, water quality parameters, and ET data.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
NKWSD	Poso Creek Weir	Currently, this project is in preliminary stages. This project is part of the projects planned to meet the sustainability goal of the District by 2040. NKWSD may implement this at any time over the planning horizon to reach its sustainability goal.	NKWSD plans to construct a weir on the Poso Creek Flood channel to divert water into their facilities. The District currently has an earthen plug that works to divert water; however, the plug is not reliable and has proven to be inefficient for the District. Implementation of this project will provide a more reliable management of flows, allow water to be measured as it is diverted, and reduce the velocity and sediment loading prior to diversion. Diverted water will be used to increase groundwater banking activities in NKWSD to help prevent further lowering of groundwater levels.	Construction of a weir will provide the ability to drop out sediment prior to flood water entering the District's distribution system or direct spreading facility. By slowing the velocity and allowing sediment to drop out, higher water quality is diverted into the district.
NKWSD	Spreading Pond Facility	No Data	No Data	No Data
RRID	Expanded Recharge	Project is in the conceptual phase; however, the pre-existing conveyance pipeline allows for swift project implementation if needed.	RRID will expand their recharge to include on-farm spreading to maximize recharge capability. To ensure adequate delivery of supplies, water delivery infrastructure improvements will be included in this project. Improvements to the CRC pipeline will be made before on-farm recharge occurs.	An estimated 6,000 AFY would be added to the already 5,000 AFY provided by CRC for the purposes of beneficial reuse.
RRID	Allocation of Available NKWSD Supplies	This project is ongoing as NKWSD already allocates produced water to their facility; however, water spread in the Rosedale facility will now exclusively benefit RRID.	Oilfield produced water will be allocated to North Kern's Rosedale spreading facility for RRID's exclusive benefit.	
SWID	Diltz Intertie Lateral Piping and WMI	Design plan specifications have been completed for the proposed later improvements coinciding with the Diltz Intertie mainline design. Project is in its pre-construction phase and will be fully implemented in 2020.	The proposed project includes installing pressurized pipe laterals to connect the Diltz Intertie mainline to serve 380 acres of irrigated land. Project will consist of a 1.5-mile long, 30 cfs, 36- inch diameter, bi-directional, intertie pipeline, which will allow for the efficient conveyance of surface water supplies to spreading ground facilities located in SWID.	Component 1 is expected to decrease groundwater pumping in the SWID by providing growers with pressurized surface water deliveries at a greater capacity and frequency. Decreased groundwater pumping in SWID will all for the recovery of groundwater elevations. This project will save 1,927 AFY of water following project completion.
SWID	Bell Recharge Project	Project is currently in planning phase and still requires final pipeline alignment selection to begin other project components such as easement acquisition, final design, and bidding.	Implementation of this project includes the construction of a 12 cfs conveyance improvement along SWID's existing distribution system that will allow CVP-Friant supply to be delivered from the FKC to the Bell Recharge site. Bell project will allow for delivery of surface water to the new Bell Recharge facilities form the CVP, for increased water storage.	Proposed Bell Project pipeline connection is anticipated to convey CVP wet period water into SWSD at a rate of 12 CFS with estimated annual benefits of 1,728 AFY.
SWID	Kimberlina Recharge Project	Already being implemented. To be completed by 2022.	Construction of a 285-acre recharge site for CVP surface water.	Water suuply augmentation of approximately 19,000 AFY
SWID	Leonard Avenue Conveyance Improvement Project	Project is currently in planning phase and still requires final pipeline alignment selection to begin other project components such as easement acquisition, final design, and bidding.	This project involves the construction of 1.5 miles of pipeline to connect SWID with Semitropic Water Storage District (SWSD). Implementation of a new pipeline will provide SWID with the operational flexibility to absorb surface water when it is available for delivery to SWSD's distribution system, connecting the supply to in-lieu and direct recharge facilities in SWSD, generally during wet periods, so that water delivered can later be recovered for irrigation in peak demand months, or dry periods.	When implemented, this project will provide added capacity to absorb surplus water from the CVP during wet periods. It is estimated that this project will capture 2,880 AFY of surface supply, predominately from the CVP surface floodwater conveyed via the FKC, through SWID and into SWSD. Additional water absorbed into the groundwater basin will be split 50/50 between SWID and SWSD. The total average annual water saving to SWID is 1,440 AFY. Captured water will directly offset SWID's reliance on San Joaquin River supplies to the Bay-Delta and help conserve local groundwater supplies.
SWID	Improved Water Level Measurement of District Recharge Facility	This project is in the planning phase. Implementation of this project may begin as soon as 2020.	Proposed project includes the construction of a 400 to 500-feet deep, 8-inch diameter PVC monitoring well and the conversion of an existing older well to an 800-feet deep, 6-inch diameter monitoring well both equipped with both water level sensors and located within the District's recharge facility. Both monitoring wells will help manage and collection information on groundwater levels which can be used to document site performance as well as monitor the effects on the groundwater aquifer levels.	Implementation of this project will contribute to improving the district's drought resiliency and preserving groundwater levels by monitoring groundwater levels in the facility and improving efficiency of recharge operations.
SWID	Expanded Water Banking Program	Ongoing	The expanded water banking program will optimize of the district's existing conjunctive use program that recharges groundwater during wet-periods (banked water) and recovers the banked water during times of need (typically dry periods). The expanded banking program consists of various projects that will increase use of existing facilities and development of additional recharge and recovery facilities. Associated projects will involve the construction of direct recharge facilities and on-farm spreading to maximize recharge capability. To ensure adequate delivery of supplies, water delivery infrastructure improvements will be needed.	Implementation of this program would bring additional water supplies that would help offset potential losses of the District's historical supplies, support the District's mission of maintaining economic pumping lifts for its landowners, and maintain supplies to be used for municipal and industrial purposes.
NKWSD	Refinement of Water Budget Components	Ongoing	Improvement of monitoring and measurements to refine the accuracy of measurement or calculation of inflow and outflow components of district level water budget. Will also refine Subbasin Model and water budget.	This management action is conceptual; a volume of water associated with this management action has not been calculated.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
NKWSD/SWID	"Surface Water First" Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	Both NKWSD and SWID have access to imported surface water to supply their respective jurisdictional areas. However, there instances in which growers have historically opted to pump groundwater, rather than receiving deliveries of surface water from the district which services their properties. When this occurs, the district must either use that water for groundwater recharge or enter into exchanges with other districts (either in the KCS or in another basin). While this may be an economic decision for the grower, it has the potential to cause local impacts to groundwater in the district over the long-term. To prevent local impacts to groundwater due to the use of groundwater over available surface water, the districts may explore a fee structure in which growers with access to surface water may be assessed for the use of groundwater when surface water is available for use. The fees collected for such activities would be applied to the expansion of existing recharge projects or the development of new recharge projects to accommodate the additional surface water that would be brought into the district to replace the additional groundwater pumped.	A reduction of groundwater extraction would result from the implementation of this incentive program. The fees collected in this incentive program have not been quantified but would also provide a source of funding for the expansion of existing recharge or the development of new recharge projects within the districts.
NKWSD/SWID	On-Farm Efficiency/Deficit Irrigation Practices Incentive Program	The provisions of the conservation laws are being complied with by both NKWSD and SWID. Ag water management plans, as required by SB 7, are being regularly updated by these districts for submittal to DWR. Plans will be updated to include the applicable requirements of AB 1668 and SB 606.	As agricultural water service providers, both NKWSD and SWID comply with all provisions of SB 7 (amending Division 6, Part 2.55 of the Water Code) passed into law in November 2009 regarding agricultural water conservation and management. Efficient management practices in the law, related to SGMA objectives, include volumetric water pricing, incentives for conjunctive use and increased groundwater recharge, and development of an overall water budget. AB 1668 and SB 606 passed in 2018 did not materially add to these objectives, save for those districts serving between 10,000 and 25,000 acres who must now prepare water management plans under the newer laws.	There are no direct benefits to be derived and quantified from compliance with the aforementioned agricultural conservation laws at the present time. The districts will continue to divert for beneficial use all local and imported water supplies to which it is entitled. Should agricultural demands for irrigation water diminish as a result of some of the conservation provisions, a larger portion of diverted supplies will be devoted to groundwater recharge in the future.
NKWSD/SWID	On-Farm Recharge Activities Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	In wet years, when the districts have utilized the full capacity of their respective recharge basins and spreading grounds, it may be necessary for the districts to seek other locations for the application of available surface water for groundwater recharge. The districts will develop an incentive program to encourage landowners to take delivery of available water that is in excess of customer demand and the districts' capacity for recharge projects for application to fallow land and/or over-irrigation of crops to facilitate further groundwater recharge. Landowners will receive a groundwater credit in exchange for participation in this program, for their use within the district which has provided the water for on-farm recharge activities.	A increase of groundwater recharge would result from theimplementation of this incentive program.
NKWSD/SWID	Subsurface Recharge Feasibility Study	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	Both NKWSD and SWID have been approached by landowners within their respective districts about the efficacy and use of subsurface recharge methods. While subsurface recharge is being tested in neighboring districts, neither NKWSD nor SWID have taken an official position on the use of such methods. Before the implementation of any program which would supply water to landowners for use in subsurface recharge practices, the districts will conduct a feasibility study to evaluate whether or not these practices are appropriate for the hydrogeologic conditions and/or land uses within their respective jurisdictions. The scope of the feasibility study is yet to be determined, but it will include an evaluation of subsurface recharge methods, the soil types located within each district, the effectiveness of subsurface recharge compared to other recharge methods, and its compatibility with existing land uses.	No benefits have been quantified for this Management Action at this time. Potential benefits gained through the use of subsurface recharge will be determined as a result of this Management Action.
NKWSD/SWID	Land Conversion from Agricultural Use to Urban Use	The conversion of land use from agricultural to urban is an ongoing process, the pace of which is determined by external factors such as the demand for land based on each city's growth and need for additional housing and/or property to support business, industrial, or municipal use. The projected growth for each city is based upon the current General Plans and may be subject to change when the cities update their respective plans.	As described in the General Plans for the cities of Shafter and Wasco, anticipated population growth is expected to lead to changes in land use within the limits of each city and in the Sphere of Influence for each city. The conversion of land use from agricultural to urban use generally leads to an overall reduction in groundwater use due to the decreased demand, in terms of volume per unit area.	For NKWSD's jurisdiction, there is an anticipated reduction of water by 2030, based on the conversion of land use as the city of Shafter expands. In SWID's jurisdiction, the anticipated reduction of water by 2030 reflects the anticipated growth of both Shafter and Wasco.
NKWSD/SWID	Urban Water Conservation Program	The cities of Shafter and Wasco are currently evaluating their respective compliance measures for indoor use and are awaiting additional information and guidelines concerning regional outdoor and landscape compliance measures. The cities presently are complying with the 2020 mandates contained in SB 7X-7 and as embodied in their respective UWMPs. As the SWRCB establishes its compliance deadlines for both indoor and outdoor usage, anticipated to occur by 2025, the municipal KGA Members will have a clearer picture of an implementation schedule.	As referenced in the Umbrella Basin Setting (Chapter 2), urban water usage in the future is expected to comply with the conservation mandates contained in SB 606 and AB 1668, both bills signed into law in May 2018. Based on that legislation, indoor residential use is to be capped at 55 gpcd in 2019 and ramp down to 50 gpcd by 2030, and outdoor residential use is to be capped in the future based on local climate and size of landscaped areas. Standards for outdoor usage are to be defined in a SWRCB rule-making process to be completed by June 2022.	Given the early implementation stages of AB 1668 and SB 606, its benefits in terms of reduced groundwater pumping by Shafter and Wasco can only be roughly approximated. The Pacific Institute, in its 2014 report "Urban Water Conservation and Efficiency Potential in Calif." estimated that indoor usage could be reduced by 33-40 gpcd, and that outdoor/landscape usage could be reduced by 20-50 gpcd. These values are on a statewide basis and likely unrealistic in some regions; however, the report postulates that total urban water usage could be reduced by as much as 30-60%. Savings of this magnitude would represent a significant reduction in groundwater pumping by both cities. The Measurable Objectives to be partially met with additional urban conservation include groundwater level stabilization and, by proxy, groundwater storage stabilization.
SWID	Mitigation Program for Potential Impacts to Domestic Wells	Upon implementation of the law.	In coordination with other KGA members, develop a mitigation program to offer financial assistance for the replacement of domestic wells which are impacted by groundwater management to the proposed SMCs. Coordinate development of eligibility criteria for participation in mitigation program.	Since this management action is conceptual, a volume of water associated with this management action has not been calculated.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
NKWSD/SWID	In-District Allocation Structure	This Management Action is in the conceptual stages, having been discussed with various stakeholder groups. However, an actual structures and fee schedules have yet to be devised for either district.	At the time of this draft of the GSP, neither NKWSD nor SWID have an established allocation structure and fee schedule for groundwater extraction. As SGMA is implemented throughout the KCS, the districts are required to manage to the Sustainable Management Criteria (SMCs). One of the ways to manage for the SMCs is to allocate the Sustainable Yield for their respective districts to the landowners within their districts. While the specifics of such an allocation structure may vary between the districts, a baseline groundwater extraction volume would be allocated to each parcel based on its size and the Sustainable Yield for the district. If a landowner were to extract more water than the baseline volume for that parcel or for the aggregate of all of their parcels within the district, they would be required to pay an extraction fee which would be applied toward projects and programs implemented by the district to reach and/or maintain sustainability.	The benefits to sustainable groundwater management have not been quantified at this time. However, the development and implementation of an allocation structure for each district would allow for the districts to utilize their Sustainable Yield as a management tool for reaching and maintaining their SMCs.
NKWSD/SWID	Voluntary Land Fallowing	At this time, this Management Action is conceptual. The districts will develop their respective fallowing programs during the SGMA implementation period.	In the event of a drought, the districts may not be able to entirely meet in-district demand by increasing the volume of imported water. The combination of decreased availability in surface water to supply to the district and decreased recharge from other sources in the subbasin has the potential to lead to violations of SMCs at the Representative Monitoring Sites, in the absence of decreased demand. To facilitate the districts' ability to maintain sustainability at their respective monitoring sites, the districts will develop and implement their own voluntary land fallowing programs for their jurisdictions.	The decrease in water demand will be dependent upon the land being fallowed and its existing land use at the time of fallowing. Agricultural demand for water is generally estimated to be 3 AF/acre. Fallowing or land retirement would reduce the demand to zero for the lands participating in the program.
NKWSD/SWID	Pumping Restrictions	At this time, this Management Action is conceptual. The districts will develop their respective processes to implement pumping restrictions within their jurisdictions.	In the event that the districts or the entire subbasin are nearing a condition where they are at risk of triggering an Undesirable Result, even with the implementation of the projects and management actions described in this Plan, it may be necessary for the districts to limit groundwater pumping. The volume of groundwater extraction permitted under this Management Action would be determined by the districts based on the Sustainable Yield for the district and the SMCs at the Representative Monitoring Sites.	Pumping restrictions based on the Sustainable Yield of the district, could decrease groundwater demand if applied to NKWSD. If applied to SWID, pumping restrictions could decrease groundwater demand.
NKWSD/SWID	Coordinate with Existing Water Quality Programs	NKWSD and SWID are actively participating in the ILRP and CV-SALTS programs.	NKWSD and SWID are actively participating in the ILRP and CV-SALTS programs; coordination and data sharing will continue to facilitate improved groundwater management and to mitigate degraded water quality attributable to SGMA implementation. As requested, NKWSD/SWID will also coordinate with the SAFER program and its projects.	A coordinated approach to managing water quality for groundwater dependent communities.
NKWSD/SWID	NEW Domestic Well Survey	NKWSD and SWID intend to conduct a domestic well survey before the 2025 Management Area Plan is updated	NKWSD and SWID will conduct a domestic well survey to verify wells in the District and validate the Well Impact Study completed using DWRs well completion report database	Develop an accurate count of domestic wells in each Management Area, status of each well, and potential impacts of water level declining to the MT.
NKWSD/SWID	NEW KGA Exceedance Policy	The KGA Exceedance Policy has been adopted by the Board of Directors.	A standard policy to address the exceedance of minimum thresholds for the chronic lowering of groundwater levels sustainability indicator. This Policy, "KGA Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater" (referred to as Exceedance Policy) was adopted by the KGA Board of Directors in April 2022.	Coordinated action to address an MT exceedance at a single representative monitoring well.
NKWSD/SWID	NEW Ongoing Evaluation of Groundwater Levels and Water Quality Trends	Implemented in 2020 at each Regional Monitoring Well	Groundwater quality samples are collected for the constituents of concern in the Management Areas within 2 weeks of seasonal water level measurements. If a correlation develops indicating that declining water levels are causing unmitigated impacts to beneficial users, stakeholders will be consulted, and appropriate corrective actions or mitigation will be considered.	Mitigate degraded water quality caused by declining groundwater levels.
Pioneer Groundwater Sustainability Agency				
Pioneer	Project 1: Install Monitoring Well in North Pioneer	Implementation of this project entails planning, permitting, design and currently, construction of the monitoring well cluster. KCWA and/or its consultants will secure necessary permits and plan, design and construct the wells. KCWA will monitor the wells as part of normal Pioneer Project operations.	A data gap for groundwater monitoring north of the Kern River was identified during development of this Chapter GSP, and a monitoring well cluster is being constructed in the northwest triangle-shaped parcel of the Pioneer Project (i.e., the area of the GSA north of Kern River). The triangle shaped parcel is in the northwest portion of the North Pioneer Area, and does not include a recharge pond. This area is in the southeast quarter of section 6, T 30S/R26E. The monitoring well cluster will allow groundwater monitoring at multiple depths using three separate boreholes.	The new monitoring well cluster will address an identified data gap in the Pioneer GSA Area. The monitoring well cluster will also help Pioneer GSA evaluate maintenance of its sustainability goals and monitor groundwater conditions in that portion of the Pioneer GSA Area.
Pioneer	Management Action 1: Continued Balanced Pumping and Recharge	This management action would be accomplished through continuation of existing groundwater recharge and recovery operations. Surplus water would be banked either for overdraft recovery or future use. Banked groundwater would be used to supplement water supplies in dry years or during years of shortages	Continued balanced pumping and recharge is the standard operating procedure for the Pioneer GSA. Under this management action, long-term pumping would be balanced by long-term recharge activities in the Pioneer GSA Area. Pioneer GSA would continue to closely monitor water that is pumped from the Subbasin and water that recharges the Subbasin with the goal of a balanced groundwater budget over the long term.	The Pioneer Project is operated in a manner that results in more water being recharged than recovered from the Subbasin in the Pioneer GSA Area. Therefore, continuing operation of the Pioneer Project in the same manner would provide a net positive increase of groundwater volume in the Pioneer GSA Area. Full benefits of this management action would be evaluated through accounting of water recharge volumes compared to groundwater pumping.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
Pioneer	Management Action 2: Continued Participation in Basin-Wide Coordination with other GSAs	This management action would be accomplished through continued attendance at KGA coordination meetings and by arranging periodic coordination meetings with the Kern River GSA, the Henry Miller GSA, the WKWD GSA and the Buena Vista GSA. Meetings would be attended by one or more representatives of Pioneer GSA and may include the GSA manager or their designated staff. Decisions made in coordination meetings would not be binding until approved by the appropriate authority, such as the Pioneer GSA manager or by KCWA's Board of Directors.	Pioneer GSA is one of several GSAs in the Subbasin. Sustainable management of the Subbasin as a whole requires coordination among GSAs and their respective GSPs. During development of the GSPs in the Subbasin, GSAs have been discussing sustainability thresholds, potential projects and management actions and specific issues and concerns. The KGA is a JPA composed of member agencies that was established in 2014 to develop and implement a groundwater management plan in the Subbasin and the neighboring Tulare Lake Groundwater Basin (KGA, 2017). This management action would involve attending monthly KGA manager and coordination meetings, as well as KGA stakeholder meetings, which are held as needed. Quarterly coordination meetings would be held with the Kern River GSA, and annual coordination meetings would be held with the Henry Miller GSA, the WKWD GSA and the Buena Vista GSA.	This management action would continue existing coordination activities between GSA managers, and help to build and maintain relationships with neighboring GSAs. Through coordination activities and ongoing communication, potential conflicts among GSAs regarding groundwater management would be mitigated because GSAs would better understand the challenges facing each other and how these challenges are being addressed. It will also provide an opportunity for GSAs to inform each other of potential issues that may require intra-Subbasin coordination, and to inform neighboring GSAs of management actions and projects under way that may affect decisions of other GSAs.
Pioneer	Adaptive Management Strategy: Increase Surface Spreading Losses from 6 to 10 Percent	Coordination would be initiated by KCWA with the Pioneer Project Participants.	Under the *Pioneer Project Participation Agreement*, all surface water diverted to the Pioneer Project for spreading is assessed a 6 percent loss factor. All losses assessed are non-recoverable. This provision was set up to "prevent, eliminate or mitigate significant adverse impacts" resulting from project recovery operations. The intent of losses assessed is to assist in mitigating impacts to adjoining entities. This adaptive management strategy would explore feasibility of increasing the fixed loss rate from 6 percent to a fixed loss rate of 10 percent.	This adaptive management strategy would provide KCWA and the Pioneer Project Participants an understanding of the feasibility of increasing lossess assessed to diverted surface water. If increasing losses is deemed feasible, it would provide the Pioneer Project and the opportunity to mitigate and avoid undersirable results and support the for sustainability indicators relevant to the Pioneer GSA as follows: chronic lowering of groundwater levels (direct), reduction of groundwater storage (proxy), degraded water quality (proxy), and subsidence (proxy).
Rosedale Rio Bravo Management Area				
RRBMA	West Basin Improvements	RRBWSD purchased the properties in 2009-2015. Project construction was completed in 2016	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.	This project has the potential to recharge up to 5,000 AF of water in wet years. This could provide the RRBWSD with up to 1,000 AFY.
RRBMA	Stockdale East Groundwater Storage and Recovery Project	RRBWSD purchased the property in 2010. Project is 90% complete, it will be operational by 2020.	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.	This project has the potential to recharge up to 25,000 AF of water in wet years. This could provide the RRBWSD with up to 4,000 AF per year on average.
RRBMA	Pilot Projects	These continued GRAT projects could be on-line as early as 2025.	In 2017 the RRBWSD developed four pilot recharge projects under which it leased properties for temporary recharge activities. Since that time the District has invested in a Groundwater Recharge Assessment Tool (GRAT) in order to identify similar projet sites in the future.	Approximately 10,000 AF was recharged during that year of implementation in these four projects. The GRAT implementation could provide RRBWSD up to 2,000 AF per year.
RRBMA	Onyx Ranch	The project is currently undergoing a feasibility and environmental analysis. The project could be on-line as early as 2025.	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 AF per year.
RRBMA	James Groundwater Storage and Recovery Project	Rosedale and Buena Vista Water Storage District jointly purchase the property in 2011. Current project status is feasibility and environmental analysis. This project could be online as early as 2025.	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).	This project has the potential to recharge up to 150,000 AF of water in wet years. This could provide the RRBWSD with up to 3,000 AF per year.
RRBMA	Kern Fan Groundwater Storage Project.	Project status is feasibility analysis. This project could be on-line as early as 2030.	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 twophased 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.	This could provide the RRBWSD with up to 10,000 AFY.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
RRBMA	Western Rosedale In-Lieu Service Area	Project status is shovel ready; feasibility and environmental analysis is complete. This project could be on-line as early as 2035.	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 provide surface water to agricultural water users within the portion of RRBWSDs service area located westerly of Interstate 5 in close proximity to Buena Vista Water Storage Districts East Side Canal.	This could provide the RRBWSD with up to 1,000 AFY.
RRBMA	Ten Section Water Recharge Project	No implementation date is known at this time.	The owners of Ten Section located within the South of the River Monitoring Zone are currently studying the feasibility of a 200+ acre groundwater recharge, storage and recovery project.	It is estimated that approximately 2,200 AF/month could be recharged into the aquifer.
RRBMA	Water Charge Demand Reduction	This management action could be on-line as early as 2025.	The Water Charge 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 AF per year we conservatively expect a 5% demand reduction as a result of the water charge which results in about 4,000 AFY of reduced demand
RRBMA	RRBWL (White Land) Water Supplies and Demand Imbalance Reduction	This management action could be on-line as early as 2020.	White Lands (non-RRBWSD lands) within the RRBMA that are not used for groundwater banking 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 0.15 AF/acre. The total annual demand for white lands in the RRBMA is about 10,307 AFY with a water supply imbalance (or deficit) of 3,818 AFY. The average agricultural demand is 2.6 AF/acre according to METRIC studies. While agricultural demands in the White Lands range from 1.4-4.9 AF/acre the initial allowable demand will be the average demand of 2.6 AF/acre. It is expected that white lands would seek to acquire water supplies for in-lieu and direct groundwater recharge via banking agreements with RRBWSD or others to offset demands.	Demand reduction will occur as follows over the 2020-2040 period; the imbalance will be reduced by 1/20 of the current imbalance each year (5%). This approach will result in about 217 AF of imbalance reduction each year and 2,170 AFY by 2030 and a total of 4,335 AFY by the 2040 sustainability planning period.
RRBMA	RRBWD 3rd Party Recharge and Storage Program	This management action could be on-line as early as 2020.	The RRBWSD will assist 3rd parties (white lands, districts, and private parties) in recharging water supplies for use in the RRBMA or other down gradient areas in the Kern Sub-basin. RRBWSD would offer existing conveyance and recharge facilities in exchange for a portion of the imported water supply and payments of yet-to-be developed costs and/or fees.	It is expected that the RRBWSD would provide this service in exchange for 20-33% of the imported water supply and that an average amount of 5000 AFY would be imported. This management action could bring an additional supply of 1,250 AFY to RRBDL lands.
RRBMA	NEW Emergency Domestic Water Response	This management action could be on-line as early as 2020.	Deployment of emergency water services to assist domestic well users that is dispatched within 24 hours of notification of a well issue. Financial assistance for bottled drinking water is also offered.	Protects domestic water users from pump and well failures allowing time for employing longterm solution.
RRBMA	NEW Coordination with State Regulatory Programs	waiting on KGA language	waiting on KGA language	waiting on KGA language
RRBMA	NEW KGA Action Plan Related to Exceedance of MT's for Chronic Lowering of Groundwater	This management action could be on-line as early as 2022.	Five-step action plan is proposed to address a minimum threshold exceedance for the chronic lowering of groundwater levels at a single representative monitoring well (RMW), including coordination between KGA member districts.	Protect beneficial users from an undesirable results.
RRBMA	NEW Unmitigated Domestic Well Replacements	Adaptive Management Action	Approximately 3 of the approximately 149 domestic wells in the RRBMA could require replacement if levels drop to the established Minimum Threshold. Should that occur and the Long-term Operations Plan not addressed per its routine mitigation process the RRBWSD will establish a similar well mitigation program to the Long-term Operations Plan so that potential impacts are addressed.	Protect beneficial users from an undesirable results.
Southern San Joaquin Municipal Utility District				
SSJMUD	REVISED In-District Spreading and Recovery Facility	The district has purchased land, secured funding for construction, and is expected to begin construction in July 2022.	This project will include construction of 80-acres of spreading ponds and the installation of one recovery wells within district boundaries. The proposed recharge ponds have an anticipated annual capacity of 3,240 AFY. Prior to this project, the district has not had any in-district direct recharge facilities. Implementation of this project will allow SSJMUD the opportunity to capitalize on wet period storage of CVP supplies and allow them to bypass less favorable out-of-district banking agreements to store water that would increase the District's and the subbasin's water reliability and drought resiliency.	The proposed recharge ponds have an anticipated annual capacity of 3,240 AFY. Estimated amount of water to deliver to recharge is at least 4,200 AFY. If the available surplus is delivered to an out-of-district facility, it is expected that North Kern will keep one-third of the water as part of banking agreements and SSJMUD will realize an average water benefit of 2,800 AFY. Captured water will directly offset the District's reliance on the San Joaquin River supplies to the Bay-Delta and help conserve local groundwater.
SSJMUD	NEW Regan Recharge Facility	Implementation of project upon completion of CEQA. Construction is expected to begin at the end of 2022 with implementation in 2023.	This project will include construction of 75-acres of spreading ponds with the recovery through an existing recovery well within the district boundaries. The proposed recharge ponds have an anticipated annual capacity of 6,120 AFY.	The proposed recharge ponds have an anticipated annual capacity of 6,120 AFY.
SSJMUD	SSJMUD and Semitropic Schuster Intertie	This project is in the conceptual stage of development and is included in the 2019 Poso Creek IRWM Plan Update.	The proposed project is to construct an intertie in coordination with SWSD. This pipeline will allow for SSJMUD to bank or return water to Semitropic previously delivered to Semitropic's groundwater banking program. SSJMUD could deliver wet period water from the FKC for groundwater banking to Semitropic or return water for irrigation purposes during dry years. This Project removes the need to involve a third-party in an agreement with Semitropic for banking since it establishes a direct connection to return water to SSJMUD from Semitropic, thereby increasing operational flexibility and reliability to deliver previously stored water from groundwater storage at times of drought.	Considering the frequency of surplus 'Other Water' in the Central Valley Project and the existing design limit of 50 cfs, the Project will allow for an expected average annual amount of 3,622 AF to be put into storage with 1,811 AF credited to SSJMUD for return. Given that recently the District became a member of the Poso Creek Integrated Regional Water Management Group (IRWM) in spring 2016, interties such as this pipeline were identified as the first step in the District's efforts towards banking water with their neighboring districts to add drought resiliency.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	SSJMUD and CWD Intertie Pipeline	This project is in the conceptual stage of development and is included in the 2019 Poso Creek IRWM Plan Update.	SSJMUD and CWD propose to construct a bidirectional intertie connecting their respective water conveyance systems. This pipeline is a regional opportunity to improve flexibility, reliability, and conjunctive use of water supplies.	The estimated annual yield of this project is approximately 50 to 500 AF, depending on the selected project size. Project size will be determined by greatest benefit yielded that is economically feasible and sustainable.
SSJMUD	SSJMUD and North Kern WSD 9-28 Intertie Pipeline	This project is in the planning stage of development, in conjunction with NKWSD, and is defined in the Poso Creek IRWM Plan.	Project proposal includes the construction of the 9-28 Intertie pipeline with NKWSD. This pipeline will allow for the return of CVP Class I, Class II, and surplus floodwater that was previously delivered to the District's groundwater banking partner (NKWSD) from the FKC for groundwater banking or irrigation purposes during wet years. The pipeline is the conveyance mechanism for return of previously stored water to the District during dry years. This project removes the need to involve a third-party in an agreement with North Kern for banking since it established a direct connection to return water to SSJMUD from NKWSD, thereby increasing operational flexibility and reliability to deliver previously stored water from groundwater storage during times of drought.	This project would allow for SSJMUD to better capture and utilize wet period supplies by increasing the District's capacity to return banked wet period water during dry periods. Considering the frequency of surplus Other Water in the Central Valley Project, the Project will allow for an expected annual amount of 10,000 AF to be put into storage with 6,667 AF credited to SSJMUD for return. The pipeline capacity to return water from North Kern to SSJMUD is 4,284 AFY, which will require roughly 1.5 years to return the water for each 10,000 AF of water banked and 6,667 AF credited.
SSJMUD	Southeast Delano Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes the purchasing of land holdings, with possible partnering agencies (to be identified later), in and around the eastern most portion of the District. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class I contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano (which qualifies as a DAC), and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the Friant Kern Canal or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	REVISED City of Delano Spreading Grounds	Implementation upon completion of design. Consturction expected to being in Fall 2022.	SSJMUD proposes identifying and evaluating potential land suitable for developing recharge basins, with possible purchase with private and/or public partnering agencies within the City of Delano. The purpose of this project is to capture surface water deliveries that are delivered through the FKC. Excess available surface supply, or those flows beyond the quantity of water that satisfies immediate water demand within a service area, typically occurs in wet years when precipitation in contributing watersheds is large enough to induce surface water available above Friant Class 1 contract supplies. Potential flows to capture consists of water which is currently discharged during wet years, during flood conditions and for water that needs to be delivered due to changes in timing to meet environmental water management goals for the San Joaquin River Restoration.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano (which is classified as DAC), and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus surface water to this banking facility from the FKC or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	Pond Road Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes identifying and evaluating potential land holdings to be purchased, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the Friant-Kern Canal. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	In District Spreading Grounds	This project is in the planning stage of development. SSJMUD has already begun the process of developing a CEQA document to assess the potential impacts of the construction and operation of spreading grounds in the areas identified by the district.	SSJMUD proposes identifying and evaluating potential land holdings to be purchased, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	Conversion of Dairy to Recharge Facility	This project is in the conceptual stage of development, with potential sites being evaluated based on data available through the RWQCB's GAMA Geotracker program, the district's recharge feasibility study, and other state and local agencies.	SSJMUD proposes identifying and evaluating potential purchase of a dairy, with possible private and/or public partnering agencies. The District is currently exploring the potential for capturing excess surface water deliveries in the FKC. Excess surface supply, or those flows beyond the quantity of water that satisfies immediate water demand, typically occur in wet years where precipitation in applicable watersheds is large enough to induce surface water available above Class 1 contract supplies. Potential captured flows consist of water which is currently discharged during wet year and flood conditions.	Implementation of this project has the potential for contributing water supplies to SSJMUD, the City of Delano, and Poso Creek IRWM water users. Specifically, SSJMUD will use a portion of these captured flows to offset their groundwater use in dry years by moving the surplus water to this banking facility using either the California Aqueduct or other existing infrastructure. Wet year water supplies captured in the spreading grounds and storage locations will be utilized by SSJMUD, City of Delano, and potentially other Poso Creek stakeholders, during years where other water supplies are limited.
SSJMUD	"Surface Water First" Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	SSJMUD has access to imported surface water to supply its jurisdictional area. However, there instances in which growers have historically opted to pump groundwater, rather than receiving deliveries of surface water from the district which services their properties. When this occurs, the district must either use that water for groundwater recharge or enter into exchanges with other districts (either in the KCS or in another basin).	An estimated reduction of 1,800 AFY of groundwater extraction would result from the implementation of this incentive program. The fees collected in this incentive program have not been quantified but would also provide a source of funding for the expansion of existing recharge or the development of new recharge projects within the districts.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	On-Farm Efficiency/Deficit Irrigation Practices Incentive Program	The provisions of the conservation laws are being complied with by both NKWSD and SWID. Ag water management plans, as required by SB 7, are being regularly updated by these districts for submittal to DWR. Plans will be updated to include the applicable requirements of AB 1668 and SB 606.	As an agricultural water service provider, SSJMUD complies with all provisions of SB 7 (amending Division 6, Part 2.55 of the Water Code) passed into law in November 2009 regarding agricultural water conservation and management. Efficient management practices in the law, related to SGMA objectives, include volumetric water pricing, incentives for conjunctive use and increased groundwater recharge, and development of an overall water budget. AB 1668 and SB 606 passed in 2018 did not materially add to these objectives, save for those districts serving between 10,000 and 25,000 acres who must now prepare water management plans under the newer laws.	There are no direct benefits to be derived and quantified from compliance with the aforementioned agricultural conservation laws at the present time. The districts will continue to divert for beneficial use all local and imported water supplies to which it is entitled. Should agricultural demands for irrigation water diminish as a result of some of the conservation provisions, a larger portion of diverted supplies will be devoted to groundwater recharge in the future.
SSJMUD	On-Farm Recharge Activities Incentive Program	This Management Action is in the preliminary stages of consideration by the districts. It has not been formally adopted but is under consideration.	In wet years, when the district has utilized the full capacity of their respective recharge basins and spreading grounds, it may be necessary for the districts to seek other locations for the application of available surface water for groundwater recharge. The district will develop an incentive program to encourage landowners to take delivery of available water that is in excess of customer demand and the district's capacity for recharge projects for application to fallow land and/or over-irrigation of crops to facilitate further groundwater recharge. Landowners will receive a groundwater credit in exchange for participation in this program, for their use within the district which has provided the water for on-farm recharge activities.	An estimated increase of 1,200 AFY of groundwater recharge would result from the implementation of this incentive program.
SSJMUD	Conversion of Agricultural Land to Urban Use	The conversion of land use from agricultural to urban is an ongoing process, the pace of which is determined by external factors such as the demand for land based on each city's growth and need for additional housing and/or property to support business, industrial, or municipal use. The projected growth for each city is based upon the current General Plans and may be subject to change when the cities update their respective plans.	As described in the General Plans for the cities of Delano and McFarland, anticipated population growth is expected to lead to changes in land use within the limits of each city and in the Sphere of Influence for each city. The conversion of land use from agricultural to urban use generally leads to an overall reduction in groundwater use due to the decreased demand, in terms of volume per unit area. The City of Delano and the surrounding areas have a projected increase of 2,100 acres in urban use; the City of McFarland and its surrounding areas have a projected increase of 1,100 acres.	For SSJMUD's jurisdiction, there is an anticipated reduction of 900 AF of water by 2030, based on the conversion of land use as the cities of Delano and McFarland expand. By 2040, the projected reduction is 1750 AF.
SSJMUD	Urban Water Conservation Program	The cities of Delano and McFarland are currently evaluating their respective compliance measures for indoor use and are awaiting additional information and guidelines concerning regional outdoor and landscape compliance measures. The cities presently are complying with the 2020 mandates contained in SB 7X-7 and as embodied in their respective UWMPs. As the SWRCB establishes its compliance deadlines for both indoor and outdoor usage, anticipated to occur by 2025, the municipal KGA Members will have a clearer picture of an implementation schedule.	As referenced in the Umbrella Basin Setting (Chapter 2), urban water usage in the future is expected to comply with the conservation mandates contained in SB 606 and AB 1668, both bills signed into law in May 2018. Based on that legislation, indoor residential use is to be capped at 55 gpcd in 2019 and ramp down to 50 gpcd by 2030, and outdoor residential use is to be capped in the future based on local climate and size of landscaped areas. Standards for outdoor usage are to be defined in a SWRCB rule-making process to be completed by June 2022.	Given the early implementation stages of AB 1668 and SB 606, its benefits in terms of reduced groundwater pumping by Delano and McFarland can only be roughly approximated. The Pacific Institute, in its 2014 report "Urban Water Conservation and Efficiency Potential in Calif." estimated that indoor usage could be reduced by 33-40 gpcd, and that outdoor/landscape usage could be reduced by 20-50 gpcd. These values are on a statewide basis and likely unrealistic in some regions; however, the report postulates that total urban water usage could be reduced by as much as 30-60%. Savings of this magnitude would represent a significant reduction in groundwater pumping by both cities. The Measurable Objectives to be partially met with additional urban conservation include groundwater level stabilization and, by proxy, groundwater storage stabilization.
SSJMUD	Coordinate with Existing Water Quality Programs	SSJMUD is actively participating in the ILRP and CV-SALTS programs.	SSJMUD is actively participating in the ILRP and CV-SALTS programs; coordination and data sharing will continue to facilitate improved groundwater management and to mitigate degraded water quality attributable to SGMA implementation. As requested, SSJMUD will also coordinate with the SAFER program and its projects.	A coordinated approach to managing water quality for groundwater dependent communities.
SSJMUD	NEW KGA Exceedance Policy	The KGA Exceedance Policy has been adopted by the Board of Directors.	A standard policy to address the exceedance of minimum thresholds for the chronic lowering of groundwater levels sustainability indicator. This Policy, "KGA Action Plan Related to Exceedance of Minimum Thresholds for Chronic Lowering of Groundwater" (referred to as Exceedance Policy) was adopted by the KGA Board of Directors in April 2022.	Coordinated action to address an MT exceedance at a single representative monitoring well.
SSJMUD	REVISED Domestic Well Mitigation Program	Upon final adoption by the SSJMUD Board of Directors, the Domestic Well Mitigation Program will be implemented. The Program Guidelines are currently in draft (included in management area plan) and is expected to be adopted and implemented by the end of 2022.	A domestic well mitigation program to mitigate the potential impact of declining groundwater elevations resulting from SSJMUD's groundwater management actions	There are no quantifiable benefits to sustainable groundwater management. This is a mitigation based management action to be implemented if SSJMUD groundwater management activities impact a domestic well.
SSJMUD	In-District Allocation Structure	This Management Action is in the conceptual stages, having been discussed with various stakeholder groups. However, an actual structures and fee schedules have yet to be devised for either district.	At the time of this draft of the GSP, SSJMUD does not have an established allocation structure and fee schedule for groundwater extraction. As SGMA is implemented throughout the KCS, the districts are required to manage to the Sustainable Management Criteria (SMCs) established in Section 5 of this Chapter GSP. One of the ways to manage for the SMCs is to allocate the Sustainable Yield for their respective districts to the landowners within their districts. The allocation structure would allow for the transfer of groundwater pumping credits within each district's jurisdiction, provided that it does not lead to localized impacts to at the Representative Monitoring Sites defined in Sections 4 and 5 of this Chapter GSP.	The benefits to sustainable groundwater management have not been quantified at this time. However, the development and implementation of an allocation structure for each district would allow for the districts to utilize their Sustainable Yield as a management tool for reaching and maintaining their SMCs.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
SSJMUD	Voluntary Land Fallowing	At this time, this Management Action is conceptual. The district will develop its fallowing program during the SGMA implementation period.	In the event of a drought, the district may not be able to entirely meet in-district demand by increasing the volume of imported water. The combination of decreased availability in surface water to supply to the district and decreased recharge from other sources in the subbasin has the potential to lead to violations of SMCs at the Representative Monitoring Sites, in the absence of decreased demand. To facilitate the district's ability to maintain sustainability at its monitoring sites, the district will develop and implement a voluntary land fallowing program.	The decrease in water demand will be dependent upon the land being fallowed and its existing land use at the time of fallowing. Agricultural demand for water is generally estimated to be 3 AF/acre. Fallowing or land retirement would reduce the demand to zero for the lands participating in the program.
SSJMUD	Pumping Restrictions	At this time, this Management Action is conceptual. The district will develop its process to implement pumping restrictions within the plan area.	In the event that the districts or the entire subbasin are nearing a condition where they are at risk of triggering an Undesirable Result, even with the implementation of the projects and management actions described in this Plan, it may be necessary for the district to limit groundwater pumping. The volume of groundwater extraction permitted under this Management Action would be determined by the district based on the Sustainable Yield for the district and the SMCs at the Representative Monitoring Sites.	The benefits of mandatory pumping restrictions have not yet been quantified, as the guidelines for such a management action have not been established.
Shafter-Wasco Irrigation District - 7th Standard				
SWID - 7th Standard	Evaluation of Potential to Utilize SWID Kimberlina Ponds for Recharge or other Facilities	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: Ongoing Accrual of Benefits: Annual-basis	SWID operates the Kimberlina Ponds groundwater recharge facility. The Annex Area will evaluate opportunities with SWID to utilize Kimberlina Pond storage capacity for recharge. The Annex Area will evaluate opportunities to purchase non-SWID water for recharge in the Kimberlina Ponds facilities, when the Ponds have unused capacity (i.e., likely in nonwet and non-drought years).	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	Evaluation of Potential to Partner in Kern Fan Groundwater Storage Project	Status: Conceptual, have begun initial discussions with RRBWSD; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 years after construction	The Kern Fan Groundwater Storage Project is under development by RRBWSD and 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. The Annex Area could potentially become a funding partner in this project and have access to recharge and storage capacity in the Project.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	7th Standard Annex Management Area Storage Pond Project	Status: Conceptual, have begun initial discussions with RRBWSD; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 years after construction	This project would improve water supply reliability and groundwater conditions in the Management Area. Benefits of developing a groundwater recharge facility within the Mangement Area include effective conveyance of surface water supplies when they are available, facilitation of water banking and exchange arrangements, and avoidance of direct water quality impacts. A conveyance mechanism, such as the Flat Rocks Canal would be necessary to bring such water to the Mangement Area.	Up to 1,463 AFY of recharge capacity for purchased surface water within the Management Area (assumes 320-acre basin). Increased groundwater levels.
SWID - 7th Standard	Identify Opportunities to Utilize Existing Infrastructure	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: ongoing Accrual of Benefits: annual	Several entities in the vicinity of the Annex Area have existing groundwater recharge infrastructure, which have unused capacity, particularly in nonwet years. The Annex Area will evaluate potential opportunities with these entities to utilize the unused capacity for recharge of purchased water.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	On-Farm Groundwater Recharge	Status: Conceptual, have begun initial discussions; Initiation: 2020-2024 Completion: ongoing Accrual of Benefits: annual	In May 2019, the SWID Board adopted a new Buried Recharge policy that will allow for on-farm water banking, which will allow Annex Area landowners to purchase and recharge non-SWID water on their own properties, as well as those within the original SWID boundary.	Up to 4,500 AFY of imported supply, in combination with other recharge projects. Increased groundwater levels.
SWID - 7th Standard	Flat Rock Canal Extension	Status: Conceptual, have begun initial discussions; Initiation: 2030 Completion: 2035 Accrual of Benefits: 50 year period following construction	The Management Area will assess the feasibility of this project and seek partnership with other interest entities. This project would provide connection from the Annex Area to the Kern Water Bank Canal, Cross Valley Canal, and Goose Lake Slough. Phase 1 of this project is to distribute Kern River water to the north using gravity from Goose Lake Slough.	Improve ability to delivery surface water supplies to the District for irrigation or recharge. Benefits to neighboring entities, who would be key partners in this regional project.
SWID - 7th Standard	Develop New Interconnections Within SWID's Conveyance System (and Improve "Bottleneck" Issues)	Status: Conceptual, will require evaluation of options and benefits; Initiation: TBD Completion: TBD Accrual of Benefits: TBD	The Annex Area can work with SWID to increase the capacity and flexibility of SWID's current conveyance system, to allow access to additional supplies.	Improve operational flexibility within the SWID conveyance system to allow for increased capacity to accept surface water supplies when available.
SWID - 7th Standard	Increased Recycled Water Deliveries and Recharge	Status: In discussions for increased purchases; Initiation: In progress Completion: Anticipated 2019-2020 Accrual of Benefits: Annual	Secondary-treated municipal wastewater is from the North of the River Sanitary District is currently used for irrigation and infiltrated into groundwater within the Annex Area. The Annex Area is discussion options to increase recycled water deliveries and recharge of groundwater with secondary-treated wastewater within the Annex Area. Growth rate is projected at 2% and output expected to increase to 14,000 AFY.	Up to 8,180 AFY of treated effluent (based on project increased WWTP flows), to be used for irrigation to offset groundwater demand.
SWID - 7th Standard	On-farm Water Conservation	Status: not yet initiated; Initiation: Upon stakeholder interest Completion: TBD Accrual of Benefits: 1-3 years after initiation	The NRCS is offering landowner incentive programs to assist in implementing various conservation activities, including but not limited to: irrigation system improvements, water/nutrient/pest management, and pump engine replacement. Interested landowners can call (661) 336-0967 or visit the website (www.ca.nrcs.usda.gov) for more information.	Reduce on-farm water demands.
SWID - 7th Standard	Voluntary Rotational Land Fallowing Program	Status: not yet initiated; Initiation: Upon approval of funding mechanism Completion: Anticipated 2020-2024 Accrual of Benefits: 1 years after initiation	In order to reduce demand within the Management Area, this project would incentivize landowners to fallow their previously farmed lands voluntarily on a rotational basis. This potential project would be implemented on a voluntary rotational basis. Incentives have not yet been established, but would be anticipated to be funded by the Annex Area landowners through the same funding mechanism used for other SGMA related activities.	Up to 1,443 AFY of reduced water demand (assumed 430 acres fallowed per year).

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
SWID - 7th Standard	Education of Groundwater Use per Acre	Status: not yet initiated; Initiation: Upon GSP implementation Completion: Until overdraft ends/other programs initiated Accrual of Benefits: 1 year after initiation	This program would provide groundwater users an expected groundwater volume, as an education tool, prior to enforcement actions on groundwater allocations, with the goal of providing awareness of overdraft conditions. This information would be provided in an annual letter, along with average crop demand, GSA average extraction, GW overdraft, and reminders of GSA powers and authorities.	Reduce on-farm water demands.
Semitropic Water Storage District				
SWSD	Landowner Water Budgets	Implemented	Establish individual water budget for landowners by landowner classes	Water demand reduction of an estimated 60,000 af total (3,000 af/yr to 2040)
SWSD	Tiered Pricing for Groundwater Pumping	Under development with adoption in 2022	Develop pricing structure to incentize groundwater users to manage groundwater extractions to MA1 water Budgets	Water demand reduction consistent with MA1 (Landowner Water Budgets)
SWSD	District Fallowing Program	Not yet started; to be implemented in 2020 after implementation of MA 1	Support land fallowing as a District action and by individual landowners or groups of landowners.	Water demand reduction consistent with MA1 (Landowner Water Budgets)
SWSD	Enhanced Groundwater Recharge	Status is ongoing and expected to be initiated in 2020 upon adoption of Semitropic GSP.	Development of surface and subsurface recharge projects underlying developed agricultural lands to increase groundwater recharge capacity	Water supply augmentation up to 20,000 af average annual
SWSD	Monitoring Network Improvement Plan	Ongoing, initiated planning.	Assess and identify monitoring network requirements for full compliance with SGMA and development of an implementation plan for achieving full compliance.	Improved groundwater monitoring in support of SGMA
SWSD	Evaluation and Assessment of GDEs within the Semitropic Area	Not yet started; Expected to be initiated in 2020 upon adoption of Semitropic GSP.	Conduct additional analysis to verify the presence and extent of GDE's in the Semitropic and, if present, develop appropriate monitoring protocols.	
SWSD	Brackish Water Desalination	Initiated planning; expected to be initiated in 2022 upon completion of environmental and regualtory requirements.	Development of a brasackish water treatment facility to treat locally sourced brackish water for District use.	Expected water supply augmentation of 1,800 af/year
SWSD	In-District Water Markets and Transfers	Not yet started; Expected to be initiated in 2022 upon adoption of Semitropic GSP.	District will allow for the development of market for in-district transfers	Water supply augmentation TBD.
SWSD	Poso Creek MAR	Upon completion of feasibility and permitting requirements; Expected initiation in 2020	Development of floodwater capture and recharge program ffrom Poso Creek flood flows	Water supply augmentation of 1,200 af average annual
SWSD	Tulare Lake Project	Under Development since 2018; Initiated upon completion of water rights determination	Development of conveyance facilities to divert Kings River flood flows for direct use and recharge in the SWSD	Water supply augmentation of 70,000 af average annual
SWSD	Water Market Acquitions	Status is ongoing and expected to be initiated in 2020 upon adoption of Semitropic GSP.	Increased participation in state-wide water markets for spot market and long-term water transfers	Water supply augmentation of 4,000 af average annual
SWSD	Stored Water Recovery Unit	Initiated; 2025 Upon approve by SWSD BOD and identification of funding	Development of water storage to expand in-lieu service areas	Increases capacity & flexibility of conveyance for recharge
SWSD	Pond-Poso Spreading Grounds, Phase II	Initiated; Upon adotion of Semitropic SWSD; 2020.	Development of spreading facilities to increase groundwater recharge capacity	Increases groundwater recharge capacity
SWSD	Pond-Poso Entrance Ponds	Initiated; 2024 upon approval by SWSD BOD and identification of funding.	Development of spreading facilities to increase groundwater recharge capacity	Increases capacity & flexibility of conveyance for recharge
SWSD	Multi-District Conveyance (CA to Friant-Kern Canal)	Ongoing; Implementation upon approval by SWSD BOD and identification of funding.	Development of a conveyance system to deliver surface water for groundwater recharge and irrigation	Increases capacity & flexibility of conveyance for recharge
SWSD	Schuster Spreading Grounds	Initiated; Expected initiation 2023 upon approval by SWSD BOD and identification of funding	Development of spreading facilities to increase groundwater recharge capacity	Increases groundwater recharge capacity
SWSD	Leonard Avenue System	Initiated 2019; Upon adotion of Semitropic SWSD. To be completed by 2023.	Development of an intertie system to provide east to west surface water conveyance to for supply in groundwater dependent areas	Increases capacity & flexibility of conveyance for recharge
SWSD	Diltz Intertie	Completed	Connection of an intertie to provide surface water converyance for agricultural irrigation	Increases capacity & flexibility of conveyance for recharge
SWSD	Cox Canal	Completed	Developed canal for the conveyance of surface water for groundwater recharge	Increases capacity & flexibility of conveyance for recharge
SWSD	Stored Water Recovery Unit- XYZ	Completed		Increases capacity & flexibility of conveyance for recharge

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
West Kern Water District				
WKWD	Project 1: Automatic Meter Reading Project	The circumstance of implementation for this project would be current conditions, once funding is secured or committed and the project approved by WKWD's Board of Directors, it could be implemented.	In 2015, WKWD began installing AMR systems for all industrial and outlying customers. To further achieve sustainability goals, WKWD would install AMR systems on the remainder of its primarily residential customer meters. The AMR system selected by WKWD for its industrial and outlying customers uploads data every 24 hours to a website where customers can access their accounts and view water use data, compare their current water use to their historical water use, and receive leak alerts.	AMR provides potential water savings through early leak detection and increased awareness of water use among customers. Upgrading meters also reduces unaccounted-for losses related to accuracy degradation in older meters. WKWD estimates that AMR will save an average 8 percent of water for each metered connection, based on savings experienced by nearby agencies. The City of Sacramento had an average 4 percent water savings based on a pilot AMR project, while the Golden Hills Community Services District realized 12 percent in average savings (WKWD, 2014). WKWD's 2015 UWMP shows residential water use ranges between 2,169 AF in 2015 to a projected high of 2,597 AF in 2040, and applying the projected 8 percent conservation, anticipated water savings from this project is estimated to be 173 to 208 AFY (WKWD, 2016). Conservation achieved by the AMR project would be measured by the reduction in water deliveries to customers with AMR meters.
WKWD	Project 2: Participation in California WaterFix	Long-term	California WaterFix is intended to address the challenges of pumping water from the Delta by diverting water upstream of the current diversion points and conveying it to existing pump stations for the SWP and the Central Valley Project (CVP). Under current operation, the SWP and CVP are unable to consistently deliver state and federal water contractors their full contract supplies. California WaterFix is intended to address some of the conditions that impact the ability to export water from the Delta.	The primary benefit of this project would be the increased reliability of imported water supplies and to expand groundwater banking opportunities to meet customer demands. Additional supplies could be 1) banked in WKWD's recharge facilities, 2) used for GWE protection if monitoring shows unexpected declines in elevation, or 3) transferred to neighboring agencies to help offset groundwater pumping in the Subbasin.
WKWD	Project 3: Buena Vista Recreation Area Water Supply Management Coordination	Implementation of this project is already underway and is likely to remain an ongoing project until such time as the BVARA no longer requires water from the GSA area.	BVARA is in and adjacent to the WKWD GSA area. The 1,585-acre BVARA is home to two manmade lakes, Lake Webb and Lake Evans, boating facilities, playgrounds and volleyball courts, camp sites, and picnic areas. The lakes lie outside of the GSA area but the park facilities such as picnic areas, restrooms, and parking areas are within the GSA area. When constructed, the lakes had a combined storage capacity of over 6,800 AF. Shoreline camping and picnic areas are landscaped with grass and are irrigated during the dry season (County of Kern Parks and Recreation Department, 2019). With no outlet, water from the lakes either evaporates or percolates into the groundwater basin. Kern County pumps groundwater from wells located within the GSA area to supplement losses at the lake. Supplemental water delivered to the lakes is not metered and is not included in WKWD GSA's water balance.	Managing water supply for the BVARA would include a focused effort on monitoring pumping in that portion of the GSA area, and identifying which projects or management actions are needed to eliminate undesirable results in the Subbasin. Securing additional supplemental supplies would reduce the potential impacts to groundwater levels, storage, and water quality for this portion of the GSA area. Improved management of the BVARA water supply would also support ongoing use of the BVARA, a popular recreation area. The project does not have a directly measurable benefit unless implementation actions arise from these meetings.
WKWD	Management Action 1: Continued Balanced Pumping and Recharge	The circumstance of project implementation would be current conditions and would remain unless conditions indicated a different management approach was needed to achieve sustainability indicators.	Continued balanced pumping of groundwater and recharge of imported supplies has and will continue to be the operational norm for WKWD. Under this management action, recharge and recovery activity will continue to be monitored closely by WKWD to maintain balanced conditions.	This management action would allow WKWD to continue operating groundwater recharge and recovery in balance, resulting in a long-term net-zero balance in the Subbasin for the areas under WKWD's control.
WKWD	Management Action 2: Implement Water Shortage Response Plan	The circumstance of implementation for this project would be times of water shortage, supply interruption, or drought, as declared by WKWD's Board of Directors. Implementation would cease when shortages are no longer being experienced, and as approved by the WKWD's Board of Directors.	WKWD's Water Shortage Response Plan (WSRP) is incorporated into the 2015 UWMP and includes triggers for when the WSRP would be implemented. The WSRP describes management actions and use restrictions that would be implemented if water shortages were declared. Because current operation of groundwater recharge and recovery in the GSA area has shown a long-term increase in banked groundwater, and normal water years are projected to have a surplus of supply that can be banked, it is not expected that the WSRP would go into effect during normal or wet years. During extended dry periods, groundwater pumping would increase, and WKWD would use banked supplies to meet demands in excess of available imported and surface water supplies.	The WSRP is designed to reduce customers' overall water use by implementing restrictions on when and how water may be used. As a result, implementation of this management action would reduce overall demand, which offsets demand for imported water and groundwater. Each Response Level is designed to help achieve a specific conservation target, and would reduce overall demands between 0 and 6,900 AF (i.e., 0 to 50 percent conservation) (Table 8-3). Conservation achieved by this management action would be measured by the reduction in metered water deliveries after this management action is implemented.
WKWD	Management Action 3: Continued Participation in Basin-Wide Coordination	The circumstance of implementation for this project is ongoing.	The WKWD GSA is one of several GSAs in the Subbasin. Coordination among these GSAs is necessary for sustainable management of the Subbasin as a whole and has been ongoing during development of their respective GSPs. Coordination during GSP development has included regular in-person meetings and calls to discuss sustainability thresholds, potential projects and management actions, and to discuss specific issues and concerns. As described in this Chapter GSP, the KGA is developing an Umbrella GSP for the Subbasin, while the other GSAs in Kern County are developing Chapter GSPs.	This management action would continue existing coordination activities among GSA managers, helping to build and maintain relationships with neighboring GSAs. Potential conflicts between GSAs regarding groundwater management would be reduced because GSAs would better understand the challenges experienced in each GSA area, and how these challenges are being addressed. Coordination meetings will also provide an opportunity for GSAs to inform each other of potential issues that may require intra-Subbasin coordination to address, and to notify neighboring GSAs of management actions or projects that might affect a decision made by another GSA.
WKWD	Adaptive Management Strategy 1: Taft Recycled Water Program	This project would be implemented through an agreement between WKWD, the City of Taft, and FCTHSD.	The Taft Recycled Water Program would create up to 423 AFY of tertiary recycled water suitable for Title 22-approved applications for recycled water. This project would be implemented in partnership between WKWD, the City of Taft, and the Ford City-Taft Heights Sanitation District (FCTHSD). WKWD provides water within the WKWD GSA area, but sanitation services are provided by the City of Taft and FCTHSD, which jointly own the Taft Wastewater Treatment Facility (WWTF). The Taft WWTF currently produces undisinfected secondary effluent that is suitable for and applied to feed crops, specifically alfalfa. This effluent is not suitable for wider recycled water use, but through upgrade to tertiary treatment, it could be used more widely for non-potable applications, such as landscape irrigation, which currently use potable water to meet demands (WKWD, 2018).	The project would create up to 423 AFY of tertiary recycled water, offsetting an equal volume of potable water (WKWD, 2018). Available and unused potable water is currently banked for future use during imported and surface water supply shortages. This project would both reduce demand for groundwater pumping during dry years and allow for additional water to be banked during wet years. Tertiary recycled water would be a local supply with high supply reliability, even during drought years. The volume of water offset by this project would be measured by quantifying the amount of tertiary recycled water both produced and delivered.

Table 4.1R. REVISED Kern Groundwater Authority Member Entities List of Projects and Management Actions (CONTINUED)

Entity	Project Title	Implementation Status	Description	Benefits
WKWD	Adaptive Management Strategy 2: Shift Balance of Pumping between North and South Wellfields	Implementation would require easy-to-implement operational changes and could be implemented quickly once triggered.	In 2010, WKWD's North Wellfield (wells within the North Project Management Area) was constructed in response to falling groundwater levels at the South Wellfield (wells within the South Project Management Area). Despite a surplus of banked groundwater, local levels at the South Wellfield showed a trending decline associated with groundwater recovery activities. A single wellfield for recovery activities also limited WKWD's operational flexibility. To combat these two management challenges, the North Wellfield was constructed along with additional recharge basins. Under current operation of the two wellfields, 11,300 AFY are pumped from the South Wellfield and 12,700 AFY are pumped from the North Wellfield. The North Wellfield has an annual pumping capacity of 24,000 AFY (WKWD, 2010).	This adaptive management strategy would reduce groundwater pumping in a localized area, allowing water levels in that area to recover or to decline less sharply during times of drought. Minimizing groundwater level declines reduces the potential for localized subsidence and long-term decrease in groundwater storage capacity. It also helps to maintain well efficiency, allowing for improved wellfield longevity. Local recovery of GWEs would be determined by standard monitoring activities that are part of regular wellfield management. Local groundwater level recovery from this strategy would be measured by monitoring of groundwater levels in the vicinity of the two wellfields.
WKWD	Adaptive Management Strategy 3: Implement Permanent Demand Management Measures	As needed	According to the 2016 WSRP, Response Level 1 is ongoing, and all water use restrictions are strictly voluntary. These actions only become mandatory if a Response Level 2 is declared, which requires a declaration by the WKWD's Board of Directors. This adaptive management strategy would convert the Response Level 1 actions in the WSRP from voluntary to mandatory. These water restrictions would require a 25 percent reduction in large landscape watering from 2007 levels, prohibit water waste, and reduce non-contracted industrial water use by 15 percent from 2007 levels. WKWD may choose to implement these or a different set of permanent demand management measures as appropriate at the time this adaptive management strategy is approved.	Project benefits are expected to be like those achieved under Management Action 2 (Implement WSRP), though they will have long-term benefits because they are permanent measures rather than temporary ones under the WSRP. Conservation achieved by this management action would be measured by the reduction in metered water deliveries after this management action is implemented.
Westside District Water Authority				
WDWA	Collect Representative Hydrogeologic Data	The PMA No.1 will be implemented beginning with acceptance of the MNP, and directly support WDWA MT/MOs by providing foundational data to monitor and manage adaptive management projects that are designed and implemented to ameliorate the potential for significant reduction of ground water elevations and groundwater in storage	Historically, because of the brackish and naturally degraded quality of groundwater in the WDWA, growers have relied almost exclusively on surface water from the SWP for their irrigation needs. Groundwater is used primarily for blending when annual SWP deliveries are less than expected. As a result, there is currently little representative hydrogeologic data in the WDWA. This lack of data represents a significant data gap that must be addressed in order to refine the current understanding of the WDWA Conceptual Hydrogeologic Model, including key elements such as groundwater elevations, pumping and changes to groundwater in storage and the overall water budget. As a first step, the WDWA will conduct a review of groundwater wells to inventory their number, type, and location in relation to groundwater watch areas and critical regional and management area and infrastructure within the WDWA. In addition, the WDWA will find or install at least two additional representative monitoring wells by 2025.	The ability to generate representative data for use in updating water budget elements; Improved numerical groundwater modeling results; and Better forecasting and planning of adaptive management projects and management actions.
WDWA	Water Resource Coordination	The implementation of the disparate Water Resource Coordination Programs vary, some as described above are already in place and ongoing. Others, like a KCS-wide coordination program would likely begin with planning during the first five-year reassessment period after KCS Plan implementation. Coordination between the WDWA and its immediately adjacent GMAs would likely be structured to begin with meetings shortly after Plan approval.	The member growers in the WDWA have historically made significant investment in efficient irrigation technologies and methods that promote water conservation and sustainable management. They have also coordinated amongst themselves as individuals or via the various Water Districts to implement focused reduction demand measures, trade or purchase surplus water when deliveries from the SWP have been reduced. It is assumed that these effective ad hoc arrangements will continue after Plan implementation. In addition, the WDWA will work cooperatively and in close consultation with its members, the KGA and adjacent GMAs to coordinate water resource monitoring, testing and future water trading as part of its overall strategy for the sustainable management of all its available water resources.	More reliability and flexibility in water availability; Drought resiliency; and Sustainable water strategies for both short- and long-term planning horizons.
WDWA	Conjunctive Reuse of Naturally Degraded Brackish Groundwater	Preliminary planning for a Project Engineering FS for the first phase of the project has already begun. It is expected there will be at a minimum two phases of distributed treatment facility construction.	To further enhance the sustainable and adaptive management strategies for the Westside, the WDWA is evaluating the feasibility of an innovative phased project that will integrate the treatment and conjunctive reuse of naturally degraded brackish groundwater and oilfield produced water for multiple beneficial uses.	When operational, the Project will result in multiple potential beneficial uses, including many of the "One Water" concepts enumerated in the State's California Water Action Plan.

This Page is Intentionally Blank

5 References

AECOM. 2016. *Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)*. Draft Revised Environmental Impact Report.

Bartow J. Alan and Gardner M. Pittman, 1983. *The Kern River Formation. Southeastern San Joaquin Valley, California.* USGS Bulletin 1529-D.

Bartow, 1991. *The Cenozoic Evolution of the San Joaquin Valley.* United States Geological Survey Professional Paper 1501.

Burton, Carmen A; Shelton, Jennifer L; and Belitz, Kenneth. 2012. *Status and Understanding of Groundwater Quality in the Two Southern San Joaquin Valley Study Units, 2005–2006: California GAMA Priority Basin Project.* USGS Scientific Investigations Report 2011–5218.

California Aqueduct Subsidence Project. June 2022. *California Aqueduct Adjusted NGVD29 Kettleman-Edmonston+Lat Long.*

California Code of Regulations (CCR). 2018. MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants. January 2018.

California Department of Conservation. Division of Oil, Gas, and Geothermal Resources (DOGGR). 1998. *California Oil & Gas Fields.* Volume 1 – Central California.

California Department of Water Resources (DWR). 1981. *Depth to The Top of Corcoran Clay.* San Joaquin District.

California Division of Mines and Geology (DMG). 1955. Earthquakes in Kern County, California, During 1952: A Symposium on the Stratigraphy, Structural Geology, and Origin of the Earthquakes; Their Geologic Effects; Seismologic Measurements, Application of Seismology to Petroleum Exploration; Structural Damage and Design of Earthquake. ed. Gordon B. Oakeshott. California. Division of Mines. Bulletin 171

California Geological Survey (CGS), 2010a. *Fault Activity Map of California,* http://maps.conservation.ca.gov/cgs/fam/, Accessed March 12, 2018.

CGS, 2010b. *Geologic Map of California,* http://maps.conservation.ca.gov/cgs/DataViewer/index.html. Accessed March 12, 2018.

City of Arvin. 2012. *City of Arvin General Plan Update*. August 2012. http://www.arvin.org/wp-content/uploads/2015/08/ADOPTED_ARVIN_GP_UPDATE_Aug-21-121.pdf

City of Bakersfield, County of Kern. 2002. *Metropolitan Bakersfield General Plan*. December 2002. https://bakersfieldcity.us/civicax/filebank/blobdload.aspx?BlobID=31381

City of Delano. 2005. *City of Delano General Plan*. December 2005. http://www.cityofdelano.org/DocumentCenter/View/99/Delano_General_Plan_120505

City of Los Angeles Department of Water and Power (LADWP). 1974. *San Joaquin Nuclear Project. Early Site Review Report.* Vol. 1. February 28.

City of Maricopa. 2017. *City of Maricopa General Plan*. July 2017. https://www.maricopa-az.gov/departments/planning-maricopa-general-plan

City of McFarland. 1991. *City of McFarland General Plan*.

City of Shafter. 2005. *City of Shafter General Plan*. April 2005. https://www.shafter.com/DocumentCenter/View/242/City-of-Shafter-Draft-General-Plan?bidId=

City of Taft. 2009. *City of Taft General Plan*. July 2009.

Croft, M.G. 1972. *Subsurface Geology of the Late Tertiary and Quaternary Water-Bearing Deposits of the Southern Part of the San Joaquin Valley, California;* US Geological Survey Water Supply Paper 199H, 29p, and plates and maps.

Dale, R. H., James J. French, and G. V. Gordon. 1966. *Groundwater Geology and Hydrology of the Kern River Alluvial Fan Area, California*. US Geological Survey. Open-File Report 66-21.

Davis, G.H., Green, J.H., Olmstead, S.H., and Brown, D.W. 1959. *Ground Water Conditions and Storage Capacity in the San Joaquin Valley, California*; US Geological Survey Water Supply Paper No. 1469, 287 pp.

Davis, G. H., Lofgren, B. E., and Mack, Seymour. 1964. *Use of ground-water reservoirs for storage of surface water in the San Joaquin Valley, California.* U.S. Geological Survey Water-Supply Paper 1618, 125 p.

Department of Agriculture and Measurement Standards. 2018. *2017 Kern County Agricultural Crop Report.* September 2018.

Dubrovsky, N.M., Burow, K.R., Clark, G.M., Gronberg, J.M., Hamilton P.A., Hitt, K.J., Mueller, D.K., Munn, M.D., Nolan, B.T. Puckett, L.J., Rupert, M.G., Short, T.M., Spahr, N.E., Sprague, L.A., and Wilber, W.G. 2010. *The quality of our Nation's waters—Nutrients in the Nation's streams and groundwater, 1992–2004*. U.S. Geological Survey Circular 1350. https://pubs.usgs.gov/circ/1350/pdf/circ1350.pdf

DWR, 2003. *California's Groundwater.* Bulletin 118. Groundwater Basin Number: 5-22.14, Groundwater Quality. Updates available online.

DWR. 2006. *San Joaquin Valley Groundwater Basin, Kern County Subbasin, Groundwater Basin Number 5-22.14*, last update January 20, 2006.

DWR. 2009. *Present and Potential Drainage Problem Areas, San Joaquin Valley*.

DWR. 2014. *Historical, and Estimated Potential for Future Land Subsidence in California.*

DWR, 2016a. *California's Groundwater.* Bulletin 118. Interim Update 2016. December 22.

DWR. 2016b. *San Joaquin Valley Groundwater Basin, Kern County Subbasin, Groundwater Basin Number 5-22.14*, last update 2016. https://gis.water.ca.gov/app/bbat/. Accessed March 12, 2018.

DWR, 2016b. *Best Management Practices for the Sustainable Management of Groundwater. Water Budget.* December.

DWR, 2016c. *Groundwater Monitoring Protocols, Standards, and Sites Best Management Practices*. Accessed 2019.

DWR. 2017a. *Well Completion Report Map Application.* last update 2017. http://wdl.water.ca.gov/groundwater/wells/well_completion_reports.cfm. Accessed March 12, 2018.

DWR. 2017b. *Groundwater Information Center Interactive Map Application.* Last update June 2017. https://gis.water.ca.gov/app/gicima/. Accessed 2017.

DWR, 2017c. *California Aqueduct Subsidence Study. San Luis Field Division. San Joaquin Field Division.* June 2017.

DWR. 2018. *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development. Draft.* DWR Sustainable Groundwater Management Program. April.

DWR. 2019. *Natural Communities Dataset Viewer.* https://gis.water.ca.gov/app/ncdatasetviewer/sitedocs/. Accessed January 2019.

Dzurella, K.N., Medellin-Azuara, J., Jensen, V.B., King, A.M., De La Mora, N., Fryjoff-Hung, A., Rosenstock, T.S., Harter, T., Howitt, R., Hollander, A.D., Darby, J., Jessoe, K., Lund, J.R., & Pettygrove, G.S. (2012) Nitrogen Source Reduction to Protect Groundwater Quality. Technical Report 3 in: *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature.* Center for Watershed Sciences, University of California, Davis. http://groundwaternitrate.ucdavis.edu

Earth Consultants International (ECI). 2021. *Draft Report Differential Interferometric Synthetic Aperture Radar (DInSAR) Study of Subsidence in the Kern County Subbasin.*

Encyclopedia Britannica (EB). 2018. https://www.britannica.com/. Accessed May 2018.

Erler and Kalinowski, Inc. (EKI) 2016. *White Wolf Subbasin Technical Report.* March 2016.

Farr, T.G., C. Jones, Z. Liu, 2015, *Progress report: Subsidence in the Central Valley, California.* Submitted to California Department of Water Resources. Available at: http://www.nasa.gov/jpl/nasa californiadrought-causing-valley-land-to-sink.

Farr, T.G., C. Jones, Z. Liu, 2016, *Progress report: Subsidence in the Central Valley, California, March 2015 - September 2016.* Submitted to California Department of Water Resources. Digital raster data provided by JPL for mapping.

Faunt, C., R.T. Hanson, K. Belitz, W. Schmid, S. Predmore, D. L. Rewis, and K. McPherson, 2009, *Groundwater availability of the Central Valley Aquifer, California*. USGS Professional Paper 1766. Reston, Va.: United States Department of the Interior, Geological Survey. http://pubs.usgs.gov/pp/1766.

Friant Water Authority (FWA). 2018. *Subsidence-A Critical Challenge to Friant-Kern Canal Water Deliveries.* Accessed from: https://friantwater.org/fact-sheets. Accessed: September 2018.

FWA. 2019. Personal Communication with Engineer. May.

Galloway, Devin; Jones, David R.; and Ingebritsen, S.E. 1999. *Land Subsidence in the United States.* USGS Circular 1182.

Geomega. 2001. *Aera West Belridge Hydrogeology Study Report.* Prepared for Aera Energy, LLC. August.

Gillespie, Janice, David Kong, and Stephen D. Anderson. 2017. *Groundwater salinity in the southern San Joaquin Valley.* AAPG Bulletin. v. 101, no. 8, p. 1239-1261.

Graham, S.A., Carroll, A.R., and Miller, G.E. 1988. *Kern River Formation as a recorder of uplift and glaciation of the southern Sierra Nevada. in* Graham, S.A., and Olson, H.C., eds. *Studies of the geology of the San Joaquin Basin: Los Angeles*. Pacific Section. Society of Economic Paleontologists and Mineralogists, book 60, p. 319-331.

Heath, R.C. 1983. *Basic ground-water hydrology. U.S. Geological Survey Water-Supply Paper* 2220, 86p. WSP Paper 2220 https://pubs.er.usgs.gov/djvu/WSP/wsp_2220.pdf

Hem, J.D. 1985. *Study and Interpretation of the Chemical Characteristics of Natural Water. 3rd Edition.* US Geological Survey Water-Supply Paper 2254

Holzer, Thomas L. 1980. *Faulting Caused by Groundwater Level Declines, San Joaquin Valley, California*. Water Resources Research. Vol. 19. No. 6. pp. 1065-1070.

Ireland, R.L., J.F. Poland, and F.S. Riley. 1984. *Land Subsidence in the San Joaquin Valley, California as of 1980*. USGS Professional Paper 437-I.

Kennedy and Jenks Consultants. 2011. *Kern Integrated Regional Water Management Plan.* November.

Kenneth D. Schmidt and Associates (Schmidt and Associates). 2018. Biennial Groundwater Monitoring Report for the Semitropic Water Storage District Water Banking Project (2015-2016).

Kern County Public Health Department - Environmental Health Services Division. *Local Agency Management Program for Onsite Wastewater Treatment Systems*. Approved June 9, 2017. https://kernpublichealth.com/wp-content/uploads/KCEHD-LAMP_FINAL.pdf

Kern County Health Department (KCDEH), 1980, *Groundwater Pollutant Study, San Joaquin Valley, Kern County, California*. March.

KCDEH and Kern County Water Agency (KCWA). 1982, *Groundwater quality Report, San Joaquin Valley, Kern County, California*. March.

KCWA. 1976. *Shallow Water Table Survey Southern Lake Beds. Kern County, California.* December.

KCWA. 2012. *Water Supply Report.*

KCWA. 2016. *Kern Fan Operations Report.*

KCWA. 2018. *Kern Fan Operations Report.*

Kern County Planning Department. 2009. *Kern County General Plan*. September 2009. https://kernplanning.com/planning/planning-documents/general-plans-elements/

Kern River Watershed Coalition Authority. 2013. *Assessment of Potential for Nitrate Migration in Kern Sub-Basin*. April 2013.

Kern-Tulare Water District (KTWD). 2016. *Analysis of Groundwater Resources.* December 21st.

Klausmeyer, K., Howard J., Keeler-Wolf T., Davis-Fadtke K., Hull R., and Lyons A. (2018). *Mapping Indicators of Groundwater dependent ecosystems in California.* https://groundwaterresourcehub.org/gde-tools/mapping-indicators-of-gdes/

Kong, David. 2016. *Establishing the Base of Underground Sources of Drinking Water (USDW) Using Geophysical and Chemical Reports in the southern San Joaquin Basin, CA.* Master's Thesis. California State University Bakersfield.

Lawrence Berkley National Laboratory. 2022. *Lawrence Livermore Lab Report on the Rate of Subsidence in the Kern County Subbasin and in Four Sub-Domains within the Subbasin.*

Luhdorff & Scalmanini Consulting Engineers (LSCE), Borchers James W. and Carpenter, Michael. 2014. *Land Subsidence from Groundwater Use in California.* Full Report of Findings. April.

McCasland, M., Trautmann, N.M., Porter, K.S. *Nitrate: Health Effects in Drinking Water.* Cornell University Cooperative Extension, Center for Environmental Research Fact Sheets. http://psep.cce.cornell.edu/facts-slides-self/facts/nit-heef-grw85.aspx

McClelland, E.J. 1962. *Aquifer Test Compilation for the San Joaquin Valley, California.* United States Geological Survey Open-File Data Report.

Mendenhall, W.C., R.B. Dole, and Herman Stabler. 1916. *Ground Water in San Joaquin Valley, California.* U.S. Geological Survey Water-Supply Paper 398. 310p.

Morris, D.A. and A.I. Johnson. 1967. *Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey.* U.S. Geological Survey Water-Supply Paper 1839-D. 42p.

Metzger, Loren F, and Landon, Matthew K. 2018. *Preliminary Groundwater Salinity Mapping Near Selected Oil Fields Using Historical Water-Sample Data, Central and Southern California.* USGS Scientific Investigations Report 2018-5082.

Negrini, R., D. Baron, J. Gillespie, R. Horton, A. Draucker, N. Durham, J. Huff, P. Philley, C. Register, J. Parker, T. Haslebacher., 2009. *A middle Pleistocene lacustrine delta in the Kern River depositional system: Structural control, regional stratigraphic context and impact on groundwater quality*, submitted to Knauer, L., ed., Contributions to the Geology of the San Joaquin Basin, California, Pac. Sect. AAPG, v. MP 48, p. 95-111.

Nilsen, Tor H. and Campbell, Michael J. 1996. *Tulare Formation Core Display Santa Fe Energy Resources, Well 363-25 Midway-Sunset Oil Field, California. In Nilsen, T.H., Wylie, Jr., A.S., and Gregory, G.J., eds.* 1996, Geology of the Midway-Sunset Oil Field: AAPG Field Trip Guidebook, p. 303-313.

Ojha, C., Werth, S., & Shirzaei, M. (2019). *Groundwater loss and aquifer system compaction in San Joaquin Valley during 2012–2015 drought.* Journal of Geophysical Research: Solid Earth, 124.

Pacific Geotechnical Associates, Inc. (PGA). 1991. *Study of the Regional Geologic Structure Related to Groundwater Aquifers in the Southern San Joaquin Valley Groundwater Basin, Kern County, California.* Prepared for Kern County Water Agency. September.

Page, R.W. 1973. *Base of Fresh Ground Water (approximately 3,000 micromhos) in the San Joaquin Valley, California.* Hydrologic Investigations Atlas HA-489. Washington D.C.: United States Department of the Interior, Geological Survey.

Page, 1983. *Geology of the Tulare Formation and Other Continental Deposits, Kettleman City, San Joaquin Valley, California. Groundwater Management Considerations*. WRI-R 83-4000.

Page 1986. *Geology of the Fresh Groundwater Basin of the Central Valley, California with Texture Maps and Cross Sections.* Professional Paper 1401-C.

Poland, J.F.; Lofgren, B.E.; Ireland, R.L.; and Pugh, R.G. 1975. *Land Subsidence in the San Joaquin Valley, California, As of 1972.* United States Geological Survey Professional Paper 437-H.

Poso Creek Regional Water Management Group (RWMG). 2019. *Poso Creek Integrated Regional Water Management Plan, 2019 Update*. August 2019.

Provost and Pritchard, Inc. 2003. *Arvin-Edison Water Storage District. Groundwater Management Plan.* June 5th.

Provost and Pritchard, Land IQ, and Todd Groundwater. 2015. *Kern River Watershed Coalition Authority. Groundwater Quality Assessment Report.* February 2015.

Quad Knopf. 2002. *City of Wasco General Plan*. October 2002. http://www.ci.wasco.ca.us/wp-content/uploads/2012/10/GP-Title-Page.pdf

Rector, Michael R. 1983. *Westside groundwater study: Western Oil and Gas Association*. 246 p.

Samin, Ghufrana, and Janssen, Dick B. 2012. *Transformation and biodegradation of 1,2,3-trichloropropane (TCP).* Environmental Science and Pollution Research. 19(8):3067-78. September. https://link.springer.com/content/pdf/10.1007%2Fs11356-012-0859-3.pdf

Scheirer, Allegra Hosford and Magoon, Leslie B. 2007. *Chapter 5. Age, Distribution, and Stratigraphic Relationship of Rock Units in the San Joaquin Basin Province, California*. *In:*

Petroleum Systems and *Geologic Assessment of Oil and Gas in the San Joaquin Basin Province, California*. *Ed.* Allegra Hosford Scheirer. USGS Professional Paper 1713.

Semitropic Water Storage District (SWSD). *2012 Groundwater Management Plan*.

Schwartz, F.W. and Zhang, Hubao. 2003. Fundamentals of Groundwater. New York Wiley.

Shelton, J.L., Pimentel, Isabel, Fram, M.S., and Belitz, Kenneth, 2008. *Ground-water quality data in the Kern County subbasin study unit, 2006-Results from the California GAMA Program*: U.S. Geological Survey Data Series 337, 75 p. (http://pubs.usgs.gov/ds/337/)

Sierra Scientific Services. 2013. *The Geology and Groundwater Hydrology of the Buena Vista Water Storage District, Buttonwillow, Ca, including Descriptions of Relevant Facilities and Operations.* Prepared for Buena Vista Water Storage District. May 20.

Smith, Ryan; Knight, Rosemary; and Fendorf, Scott. 2018. *Overpumping leads to California groundwater arsenic threat.* Nature Communications. V. 9. No. 2089.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture (USDA). 2018. Web Soil Survey. Available online at https://websoilsurvey.nrcs.usda.gov/. Accessed [4/11/18].

State Water Resources Control Board (SWRCB). 1988. Resolution 88-63. Adoption of Policy Entitled "Sources of Drinking Water".

State Water Resources Control Board. 2016a. A Compilation of Water Quality Goals 17th Edition. January 2016. (https://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/docs/wq_goals_text.pdf).

State Water Resources Control Board, Groundwater Protection Section. 2016b. *GAMA Domestic Well Project Groundwater Quality Data Report – Tulare County Focus Area*. July 2016.

State Water Resources Control Board, Division of Water Quality GAMA Program. 2017. *Groundwater Information Sheet – Hexavalent Chromium*. Revised November 2017.

State Water Resources Control Board, Division of Drinking Water. 1,2,3-Trichloropropane. (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP_page.html).

Swanson, A. A. 1998. *Land subsidence in the San Joaquin Valley, updated to 1995*, in: Borchers, J.W., ed., Land subsidence case studies and current research, Proceedings of the Joseph F. Poland Symposium on Land Subsidence, Sacramento, Calif., 4–5 October 1995, Association of Engineering Geologists, Special Publication no. 8, 75–79, 1998.

Todd Groundwater. 2017. *Final Groundwater Impacts Assessment Report.* Kern River Water Allocation Plan. Kern Delta Water District. July 7.

Todd Groundwater. 2018. *Kern Fan Model Report for Kern Fan Monitoring Committee.* February.

Tre Altamira. 2019. InSAR Land Surveying and Mapping Services in Support of the DWR SGMA Program. Technical Report – Final Deliverable. Delivered to DWR. March 18.

U.S. Environmental Protection Agency. Estimated Nitrate Concentrations in Groundwater Used for Drinking. https://www.epa.gov/nutrient-policy-data/estimated-nitrate-concentrations-groundwater-used-drinking

United States Department of Agriculture (USDA). 1981. *Soil Survey of Kern County, California, Southeastern Part.*

USDA. 1988. *Soil Survey of Kern County, California, Northwestern Part.*

USDA. 2007. *Soil Survey of Kern County, Northeastern Part, and Southeastern Part of Tulare County, California.*

USDA. 2009. *Soil Survey of Kern County, California, Southwest Part.*

United States Fish and Wildlife Service. 2005. *Kern and Pixley National Wildlife Refuges. Final Comprehensive Conservation Plan.* February.

University of California Agriculture and Natural Resources. 2019. *California's Working Landscape – A Key Contributor to the State's Economic Vitality*. November 2019. https://ucanr.edu/files/315113.pdf

Vasconcellos, Jefferson. 2016. *Analysis of Competing Hypotheses for the Tectonic Evolution of the Bakersfield Arch.* Master's Thesis. California State University Bakersfield.

Viers, J.H., Liptzin, D., Rosenstock, T.S., Jensen, V.B., Hollander, A.D., McNally, A., King, A.M., Kourakos, G., Lopez, E.M., De La Mora, N., Fryjoff-Hung, A., Dzurella, K.N., Canada, H.E., Laybourne, S., McKenney, C., Darby, J., Quinn, J.F. & Harter, T. (2012) Nitrogen Sources and Loading to Groundwater. Technical Report 2 in: *Addressing Nitrate in California's Drinking Water with a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature.* Center for Watershed Sciences, University of California, Davis. http://groundwaternitrate.ucdavis.edu

Water for Education Foundation. 2019. *Aquapedia Background – Conjunctive Use*. https://www.watereducation.org/aquapedia/conjunctive-use

Wilson, W.E. 1968. *Casing Failures in irrigation wells in an area of land subsidence, California.* Geological Society of America Annual Meeting Program. 324 pp.

Wood & Dale, 1964. *Geology and Groundwater Features of the Edison-Maricopa Area, Kern County, CA* USGS Water Supply Paper 1656.

Attachment A

Joint Powers Agreement

KERN GROUNDWATER AUTHORITY
FOR THE TULARE LAKE BASIN PORTIONS OF KERN COUNTY
SECOND AMENDED AND RESTATED JOINT POWERS AGREEMENT

THIS SECOND AMENDED AND RESTATED AGREEMENT ("Agreement") is made and effective as of 7-22, 2019, pursuant to the Joint Exercise of Powers Act (Government Code Sections 6500, *et seq.)* by and between the public agencies listed on the attached Exhibit A.

This Agreement is made with reference to the following facts and understandings.

A. Each of the parties to this Agreement (the "Members") provides water service to landowners and/or residents and/or provides water to retail water entities within its respective service area..

B. Pursuant to Joint Powers Agreements dated May 27, 2014 (the "Original Agreement") and March 22, 2017 (the "Amended and Restated Agreement"), the Kern Groundwater Authority (the "Authority") was created to carry out the purposes of Part 2.75 of Division 6 (commencing at Section 10750 of the California Water Code) and develop, adopt and implement a groundwater management plan that would be available to those lands within the boundaries of the Authority's members and within the Tulare Lake Groundwater Basin.

C. On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in SB 1168, SB 1319 and AB 1739. Collectively, those bills, as subsequently amended, enacted the "Sustainable Groundwater Management Act" ("SGMA"). Governor Brown signed the legislation on September 16, 20 I 4 and it became effective on January I, 2015. In adopting SGMA, the Legislature intended "[t]o provide local groundwater agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater." (California Water Code Section 10720(d).)

D. SGMA anticipates that each affected groundwater basin or subbasin will be regulated separately by one or more Groundwater Sustainable Agencies (each, a "GSA"). A local agency or combination of local agencies may elect to be the GSA for a basin or sub-basin. SGMA generally provides that a combination of local agencies may form a GSA through a joint powers agreement, memorandum of understanding or other legal agreement. (California Water Code Section 10723.6)

E. Groundwater sustainability under SGMA is to be achieved through Groundwater Sustainability Plans ("GSPs"). Under SGMA, a GSP can be a single plan developed by one or more GSAs, or multiple coordinated plans within a basin or subbasin by multiple GSAs (California Water Code Section 10727).

F. The Members, individually and collectively, have the goal of cost-effective, sustainable groundwater management in the Kern County Subbasin that considers the interests and concerns of the Members and other stakeholders.

G. As used in this Agreement "Kern County Subbasin" means such basin as defined in Department of Water Resources Bulletin 118, as its boundaries may be modified from time to time through the procedures described in California Water Code Section 10722.2.

H. The intent of the Members under this Agreement is to provide each Member with the sole right and responsibility to implement SGMA within its respective boundaries and/or Management Areas, as defined herein, in a manner determined by the Member, whether through the Authority or as a GSA. To facilitate coordination within the Kern County Subbasin, the Members desire for the Authority to have the authority to serve as a GSA for some or all of the Members within the Kern County Subbasin in a manner that allows the Members (individually or collectively) to directly implement SGMA and a GSP within their respective Management Areas as defined herein, while the Authority serves primarily a coordinating and administrative role in order to provide for sustainable groundwater management through the subbasin. The Members expressly intend that the Authority will not have the authority to limit or interfere with the respective Members' rights and authorities over their own internal matters, including, but not limited to, a Member's surface water supplies, groundwater supplies, facilities, operations, water management, and Water Supply Matters, as defined herein. Nothing in this Agreement is intended to modify or limit Members' police powers.

I. The Members expressly intend that neither SGMA, nor this Agreement, nor any GSP adopted by the Authority shall be construed as authorizing the Authority, or any dispute resolution process contained herein, to:

(i) determine or alter surface water rights or groundwater rights (California Water Code Section 10720.5 (b));

(ii) make binding determinations of the water rights of any person or entity (California Water Code Section 10726.8 (b)); or

(iii) supersede the existing land use authority of cities or counties, including the city or county general plan, within the overlying basin (California Water Code Section 10726.8 (f)).

J. In light of the enactment of SGMA together with the goals and intent described above, the Members wish to amend and restate the Original Agreement in its entirety as provided herein.

THEREFORE, in consideration of the mutual promises, covenants and conditions herein set forth, it is agreed by and among the Members that the Amended and Restated Agreement effective as of March 22, 2017 is hereby amended and restated to read in its entirety as follows:

Article I: Definitions

As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

(a) "Associate Members" shall mean those Members of the Authority admitted in accordance with the terms and provisions of this Agreement that are not General Members. The Board of Directors may from time to time admit Associate Members on terms and conditions consistent with SGMA and as determined by the Board. Representatives of Associate Members may not serve on the Board and/or Board Committees. Likewise, while the Board of Directors welcomes their input, the representatives of Associate Members shall be non-voting, their presence shall not be counted in determining whether a quorum is present, and they shall not be permitted in closed sessions of the Board of Directors.

(b) "Authority" shall mean the Kern Groundwater Authority, being the separate entity created pursuant to the provisions of Government Code sections 6500 *et seq.* by this Agreement.

(c) "Board of Directors" or "Board" shall mean the governing body of the Authority as established by Section 3.01 of this Agreement.

(d) "Committee" shall mean any committee established pursuant to Section 3.03 of this Agreement.

(e) "Cooperative Members" shall mean those members of the Authority admitted in accordance with the terms and provisions of this Agreement, but are not General Members or Associate Members. The Board of Directors may from time to time admit Cooperative Members on terms and conditions consistent with SGMA and as determined by the Board and/or Board Committees. Cooperative Members shall not have any obligation to fund the Authority or otherwise pay money to the Authority under Article IV of this Agreement. Cooperative Members shall have no seat or voting rights on the Authority's Board of Directors, no responsibility to draft a GSP chapter, or any other responsibility under this Agreement unless otherwise agreed to in writing.

(f) "Fiscal Year" shall mean that period of 12 months established as the Fiscal Year of the Authority pursuant to Section 4.01 of this Agreement.

(g) "General Members" shall mean those Members of the Authority more particularly identified as General Members on Exhibit A, and any parties which shall hereafter become General Members in accordance with the terms and provisions of this Agreement. A local agency as defined by SGMA may participate as a General Member on its own behalf or join with one or more agencies as a single General Member. Multiple agencies which elect to coordinate their representation as one General Member shall, for purposes of this Agreement, be treated as one General Member.

(h) "GSA" shall mean Groundwater Sustainability Agency as defined in SGMA.

(i) "GSA Notice Date" shall mean March 1, 2017.

(j) "Kern County Subbasin" means the groundwater subbasin described in Recital G of this Agreement.

(k) "GSP" shall mean Groundwater Sustainability Plan as defined in SGMA.

(l) "Management Area" shall mean the area within the boundaries of a Member or group of Members to be managed by that Member or group of Members under any GSP adopted by the Authority.

(m) "Members" shall mean the General Members, Associate Members, and Cooperative Members.

(n) "SGMA" shall mean the Sustainable Groundwater Management Act.

(o) "Special Activities" shall mean activities that are consistent with the purpose of this Agreement, but which are undertaken by fewer than all the Members in the name of the Authority pursuant to Section 3.07.

(p) "Water Supply Matters" shall mean a Member's surface water supplies, groundwater supplies, facilities, operations, water management, water supply projects and financial affairs.

Article II: Creation of Authority

Section 2.01 Creation.

The Members hereby reaffirm that, pursuant to their joint exercise of powers under the provisions of Government Code sections 6500 *et seq.*, they have created a public entity to be known as the "Kern Groundwater Authority."

Section 2.02 Term.

This Agreement is an amendment of the Amended and Restated Agreement dated March 17, 2017, and shall therefore become effective, including without limitation on General Members not executing it, upon its execution by at least 75% of the General Members and will remain in effect until terminated by agreement of a majority of then participating General Members. Notwithstanding the above, once the Authority has adopted and approved a GSP for some or all of the Kern County Subbasin, this Agreement shall not be terminated except by agreement of 75% of the General Members (as described in Section 3.05 below). Unless it is terminated, this Agreement shall remain in effect and be binding upon the Members and upon all future Members for such a period as the Authority engages in any activities under this Agreement, except as to any party which withdraws or is terminated from its participation in the Authority in accordance with this Agreement. This Agreement shall supersede the Original Agreement and the Interim Funding Agreement effective 2013. Any monies collected pursuant to the Interim Funding Agreement which have not been expended as of the date of this Agreement shall be credited towards each Member's financial commitment as identified herein.

Section 2.03 Purpose.

(a) The purposes of this Agreement are to:

(i) provide for the joint exercise of powers common to each of the Members and powers granted pursuant to SGMA (subject to the restrictions contained in this Agreement), through the Authority, to cooperatively carry out the purposes of SGMA and develop, adopt and implement a legally sufficient GSP covering those portions of the Kern County Subbasin that are within the

jurisdictional boundaries of the Members, subject to the limitations set forth herein; and

(ii) provide a mechanism for the coordination of groundwater management activities by and among the Members, in accordance with SGMA.

(b) Each of the General Members (or group of General Members) shall have the sole and absolute right, in its sole discretion, to:

(i) become a GSA individually or collectively within the General Member's boundaries or the Management Area managed in whole or in part by such General Member;

(ii) approve the portion, section or chapter of the GSP adopted by the Authority as applicable within the General Member's boundaries or the Management Area managed in whole or in part by such General Member, as provided for in Section 7.01 of this Agreement; and

(iii) implement SGMA and the GSP adopted by the Authority within the General Member's boundaries or the Management Area managed in whole or in part by such General Member.

(c) Except to the extent requested by a General Member with respect to the lands within its boundaries, the Authority shall serve primarily a coordinating and administrative role in order to provide for sustainable groundwater management of the Kern County Subbasin in a manner that does not limit any Member's rights or authority over its own water supply matters, including, but not limited to, a Member's Water Supply Matters. Subject to the provisions, limitations and restrictions contained in this Agreement, activities unrelated to coordinating and administrative tasks necessary for groundwater management and sustainability shall not be undertaken by the Authority.

(d) Notwithstanding any other provision of this Agreement, the Authority shall not seek status as a GSA or approve a GSP prior to the GSA Notice Date.

(e) Not later than the GSA Notice Date, or such later date as determined by the Board of Directors, each Member shall provide the Authority with written notice that such Member will:

(i) continue as a Member and request the Authority to act as the GSA within such Member's boundaries or for the Management Area managed in whole or in part by such Member pursuant to a separate agreement between the Authority and the Member setting forth the terms and conditions of the Authority's role as the GSA within such Member's boundaries or for the Management Area managed in whole or in part by such Member;

(ii) continue as a Member and confirm that it will implement the GSP adopted by the Authority within such Member's boundaries or for the Management Area managed in whole or in part by such Member continue as a Member;

(iii) continue as a Member but seek GSA status within its boundaries or within the Management Area managed in whole or in part by such Member in order to implement SGMA and the GSP adopted by the Authority therein; or

(iv) seek GSA status within its boundaries or within the Management Area managed in whole or in part by such Member and adopt its own GSP, in which case such Member shall be deemed to have withdrawn from the Authority pursuant to Article VI but will endeavor in good faith to develop and execute a coordination agreement with the Authority in accordance with SGMA. Such Member may still be eligible to become an Associate Member pursuant to Section 6.02 (a).

Section 2.04 Powers.

(a) Subject to the limitations and restrictions contained within this Agreement, the Authority shall have the power to take any action, for the benefit of its Members, to carry out the purposes of this Agreement, including, but not limited to, applying for loans and grants, becoming a GSA for any or all of the Kern County Subbasin except the portions thereof for which Members become the GSA, and developing, adopting and implementing a GSP, subject to the paramount right of Members to become GSAs as specified in Section 2.03. The Authority shall have the power to sue and be sued. Notwithstanding the foregoing, the Authority shall not have the power to control, limit or empower a Member's rights and authorities over its own Water Supply Matters. Likewise, unless a Member requests it, the Authority shall have no power to interfere with (i) the Member's rights, use or management of the Member's water or water supply or (ii) the rights of individual landowners within the Member's boundaries to utilize, apply, store, or otherwise use surface or groundwater. Subject to the limitations and restrictions contained in this Agreement, the Authority is authorized, in its own name, to do all acts necessary for the exercise of said powers provided that said acts are duly adopted by the then seated Board of Directors and are consistent with this Agreement. Except as provided in Section 4.05, the Authority may not levy assessments on its Members. In accordance with California Government Code Section 6509, the foregoing powers shall be subject to the restrictions upon the manner of exercising such powers pertaining to the Cawelo Water District.

(b) Notwithstanding anything to the contrary in this Agreement, the Authority shall not (i) undertake any activities within any Member's boundaries, or within a Management Area managed in whole or in part by such Member, unless the Member formally and expressly requests, consents to and agrees, in writing, to the activity proposed in accordance with Section 7.4 or (ii) acquire or seek to acquire by eminent domain any property of a Member. Nothing in this Agreement shall modify or limit the police powers of Members, if any.

Article III: Internal Organization

Section 3.01 - Governing Body.

(a) The Authority shall be governed by a Board of Directors which is hereby established and which shall be initially composed of representatives of the General Members, as shown on Exhibit A. Membership on the Authority's Board of Directors shall not include Representatives from Associate and Cooperative Members. Without amending this Agreement, the Board of Directors composition shall be altered from time to time to reflect the termination and/or admission of any new General Members.

(b) Each General Member's governing board shall select a representative from its governing body or the governing body of one of the agencies within the General Member to serve as their Board member. A General Member may designate from its governing body or the governing

body of one of the agencies within the General Member to serve as its alternative Director. The role of each alternate Director shall be to assume the duties of the Director appointed by his/her Member entity in case of the absence or unavailability of such Director, including without limitation such Director's duties as a member of any Committee established pursuant to Section 3.03. The Directors and alternates so named shall continue to serve until their respective successors are appointed.

(c) Nothing in this Agreement shall preclude a future amendment of this Agreement to reconfigure the Board of Directors into a smaller body comprised of representatives of General Members or other individuals, all as defined in such amendment.

Section 3.02 Officers.

The Board shall select a Chair from among the Board of Directors who shall be the presiding officer of the Board meetings. The Board shall select a Vice Chair from among the Board of Directors who shall serve as the presiding officer in the absence of the Chair. The Board shall also select a Secretary, who need not be a member of the Board of Directors. The terms of such Officers shall be established by the Board of Directors from time to time and as necessary.

Section 3.03 Committees.

There shall be established such Committees as the Board of Directors shall determine from time to time. Each such Committee shall be comprised of representatives of General Members, shall exist for the term specified in the action establishing the Committee, shall meet as directed by the Board of Directors, and shall make recommendations to the Board of Directors on the various activities of the Authority. The Board of Directors may delegate authority to the Committee to administer and implement the various activities of the Authority, subject at all times to the limitations on the Authority set forth in this Agreement; provided, that no power to enforce any aspect of SGMA or the GSP adopted by the Authority shall be delegated to a Committee.

Members shall be given reasonable advance notice of all Committee meetings, including without limitation ad hoc Committee meetings, all of which meetings shall be open to Members and their representatives.

Section 3.04 Seal; Bylaws.

The Board may (but need not) adopt an official seal for the Authority and adopt such bylaws as it may deem necessary to regulate the affairs of the Authority in accordance with this Agreement. The bylaws may be amended from time to time by a majority vote of the Board of Directors as it may deem necessary.

Section 3.05 Voting; Quorum.

(a) Subject to Section 3.05(c), each member of the Board of Directors shall be entitled to a vote determined as follows:

(i) Each member of the Board shall have one (1) vote on matters with respect to which such member is entitled to vote.

(ii) Voting on actions related to Special Activities shall be weighted as determined by each Special Activity agreement.

(b) Directors holding two-thirds of the voting power on the entire Board of Directors on a matter shall constitute a quorum for the transaction of Authority business. Any Board member abstaining from a vote shall be counted for purposes of determining the existence of a quorum, but shall not be deemed to be voting.

(c) A Director (including a Director serving as a member of a Committee) shall be entitled to vote on any matter or action (i) that would affect the General Member represented by such Director, (ii) relating to the general business or administration of the Authority, or (iii) that would impact any land or landowners within the boundaries of the General Member represented by such Director or the Management Area managed in whole or in part by such General Member.

(d) Examples of matters and actions on which a Director shall be entitled to vote include without limitation matters or actions relating to the implementation of SGMA within the boundaries of the General Member represented by such Director, amounts to be paid by the General Member represented by such Director to the Authority, the imposition of fees or charges within the boundaries of the General Member represented by such Director, the adoption or amendment of the Authority's GSP.

(e) In the event of a disagreement as to whether a Director is entitled to vote on a matter or action coming before the Board or a Committee, such Director shall be entitled to vote on the matter or action unless 75% of the Directors present at the meeting determine that such Director is not so entitled.

(f) Except as otherwise provided in this Agreement, any action by the Board of Directors shall require a two-thirds vote of the Directors entitled to vote thereon that are present at the meeting. Any amendment of this Agreement shall be governed by Section 8.01.

(g) Two-thirds of the members of a Committee entitled to vote thereon shall constitute a quorum for a matter or action before the Committee. All questions and matters of any nature whatsoever coming before any Committee shall be determined, provided a quorum is present, by the concurrence of75% of the members of such Committee entitled to vote thereon present and voting on such matter. Any Committee member entitled to vote thereon abstaining from a vote shall be counted for purposes of determining the existence of a quorum, but shall not be deemed to be voting.

(h) This Section 3.05 shall not apply to matters affecting implementation of SGMA within a particular Management Area. Such matters shall be governed by the Member or Members implementing SGMA within that Management Area, except to the extent otherwise agreed upon by such Member(s) pursuant to 2.04(b) or in a Special Activity agreement.

Section 3.06 - Meetings.

Meetings of the Board of Directors and any Committee (to the extent applicable) shall be conducted in accordance with the Ralph M. Brown Act, California Government Code Sections 54950, *et seq.*

Section 3.07 - Special Activities.

With the prior approval of the entire Board of Directors, Members may undertake Special Activities in the name of the Authority. All Members shall be given the opportunity to participate in each Special Activity of the Authority unless the Special Activity is an action described in Section

7.04. Prior to undertaking a Special Activity, the Members electing to participate in the Special Activity shall enter into an activity agreement. Such activity agreement shall provide that (i) no Special Activity undertaken pursuant to such agreement shall conflict with the terms of this Agreement and (ii) the Members to the activity agreement shall indemnify, defend and hold the Authority, and the Authority's other Members, harmless from and against any liabilities, costs or expenses of any kind arising as a result of the Special Activity described in the activity agreement. All assets, rights, benefits, debts, liabilities and obligations attributable to a Special Activity shall be assets, rights, benefits debts, liabilities and obligations solely of the Members that have entered into the activity agreement for that Special Activity, in accordance with the terms of the activity agreement, and shall not be the assets, rights, benefits, debts, liabilities and obligations of those Members that have not executed the activity agreement.
Members not electing to participate in the Special Activity shall have no rights, benefits, debts, liabilities or obligations attributable to such Special Activity.

Article IV: Financial Provisions

Section 4.01 - Fiscal Year.

The Fiscal Year of the Authority shall be from January I through December 31 of each

Section 4.02 - Funds: Accounts.

(a) The North Kern Water Storage District shall serve as the Fiscal Agent and Treasurer or the Authority unless otherwise determined by the entire Board. The Fiscal Agent shall be responsible for all money of the Authority from whatever source. The Board may compensate the fiscal agent for services rendered.

(b) All funds of the Authority shall be strictly and separately accounted for and regular reports shall be rendered of all receipts and disbursements at least quarterly during the Fiscal Year. The books and records of the Authority shall be open to inspection by the Members.

(c) The Authority shall contract with a certified public accountant to make an audit or review of the accounts and records of the Authority which shall be conducted in compliance with Section 6505 of the California Government Code. The Fiscal Agent shall have the right to reject any proposed certified public accountant. All costs associated with this Audit will be the full responsibility of the Authority.

Section 4.03 - Property: Bonds.

The Board of Directors shall from time to time designate the officers and persons, in addition to those specified in Section 4.02 above, who shall have charge of, handle, or have access to any property of the Authority. Each such officer and person shall file a bond in an amount designated by the Board of Directors.

Section 4.04 - Budget.

By a date set by the Board of Directors each Fiscal Year, the Board of Directors shall adopt a budget for the Authority for the ensuing Fiscal Year; provided, that except as provided in Section 4.05,

the Authority shall not impose assessments or other charges on Members. Notwithstanding the foregoing, by its execution of this Agreement, each Member confirms that it has authorized its Director and Alternate Director to approve actions and expenditures by the Authority over and above the approved annual budget of the Authority for a Fiscal Year that do not create a fiscal obligation greater than $5,000 on such Member without further action of such Member.

Section 4.05 - Payments To The Authority.

(a) Except as otherwise provided, all fees, costs and expenses incurred by the Authority for general administrative services, such as legal, preparation of audits, and other general administrative functions shall be funded (i) from permissible contributions from third parties and (ii) assessments on the General Members, levied from time to time by the Board of Directors to carry out the activities of the Authority generally applicable to all General Members, which shall be equal per General Member, as shown on Exhibit A.

(b) No Member shall be bound, financially or otherwise, by any obligation, contract or activity undertaken by the Authority unless and except to the extent agreed upon by the Member, except that each Member shall be obligated to fund its then current annual share of the general basic budget of the Authority, provided such budgets are otherwise approved as provided herein. Funding of other matters shall be through Special Activity agreements or as otherwise agreed to by the Members in writing.

(c) Cooperative Members shall not be assessed by the Authority and are under no obligation to fund or otherwise pay money to the Authority.

Section 4.06 - GSP Fees.

The Authority may impose reasonable fees, charges, assessments and other levies to implement its GSP and/or SGMA; provided, that the Authority shall have no authority to impose any such fees, charges, assessments or other levies on any of its Members or within a Management Area without the express consent and approval of the affected Member(s), or the Member or Member implementing the Authority's GSP and SGMA within such Management Area.

Article V: Management

Section 5.01 - Management.

In addition to, or in lieu of, hiring employees, the Authority may engage one or more General Member(s) or third party(ies) to manage any or all of the business of the Authority on terms and conditions acceptable to the Board of Directors. Any General Member or third party so engaged shall have such responsibilities as are set forth in the contract for such General Member's or third party's services.

Article VI: Relationship of Authority And Its Members

Section 6.01 - Separate Entity; Property.

In accordance with California Government Code Sections 6506 and 6507, the Authority shall be a public entity separate and apart from the parties to this Agreement. Unless, and to the extent

otherwise agreed herein, the debts, liabilities and obligations of the Authority shall not be debts, liabilities or obligations of the Member entities. The Authority shall own and hold title to all funds, property and works acquired by it during the term of this Agreement.

Section 6.02 - Admission, Withdrawal and Termination of Members.

(a) Additional qualified parties may join in this Agreement and become General Members upon the approval of the entire Board of Directors, subject to terms and conditions as may be established by the Board of Directors. Associate Members may be admitted on terms and conditions established by the entire Board of Directors. Prior to being admitted as a new Member, an entity shall execute an agreement to be bound by the terms of this Agreement and any other terms and conditions established by the Board of Directors.

(b) Notwithstanding anything herein to the contrary, any Member may withdraw from this Agreement by giving 30 days written notice of its election to do so, which notice shall be given to the Board of Directors and to each of the other parties.

(c) Upon withdrawal, the Member shall not be relieved of all obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the withdrawing Member's notice of withdrawal, but shall remain responsible for all obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the withdrawing Member's notice of withdrawal.

(d) Subject to any contrary provisions of SGMA, a Member may be terminated by a three-fourths vote of the Directors representing Members not subject to the termination vote if such Member is then in breach of this Agreement and the breach is identified in the vote of the Board of Directors. Upon termination, the breaching Member shall no longer be a Member of the Authority; provided, that such termination shall become effective no earlier than 90 days after such vote of the Board of Directors and shall only be effective if the breach identified in the vote of the Board of Directors has not be cured by the effective date for the termination.

(e) Upon termination, the Member shall be entitled to a reimbursement for all assessments collected within 12 months prior to the termination vote and they shall be relieved of all ongoing obligations for assessments to pay costs or liabilities of the Authority which were incurred prior to the date of the termination.

(f) Upon withdrawal or termination as a Member, the provisions of Section 2.04(b) shall remain applicable to any such withdrawing or terminated Member. The withdrawing or terminated Member will also be entitled to copies of all documents, information, and material developed by the Authority and paid for in whole or in part by the Member prior to the Member's withdrawal or termination.

(g) Upon withdrawal or termination as a Member, whether occurring before or after the GSA Notice Date and/or the date the Authority becomes a GSA as provided for in SGMA, or whether occurring before or after June 30, 2017, it is contemplated the withdrawing or terminated Member would concurrently become (or designate) a GSA for the lands within its boundaries (or a Management Area managed in whole or in part by such Member), so that such lands of the withdrawing or terminated Member would continue to be subject to a GSA and if applicable a GSP and the powers of such withdrawing Member within its boundaries would not

be limited by this Agreement. In such event the Authority and its remaining Members shall (i) not object to or interfere with the lands in the withdrawing or terminated Member's boundaries (or a Management Area managed in whole or in part by such Member) being in a GSA, as designated by such withdrawing or terminated Member, (ii) facilitate such transition to the extent reasonably necessary, and (iii) in cooperation with the withdrawing or terminated Member, withdraw from managing the Kern County Subbasin as a GSA (if it has already elected to be a GSA) for that portion of the Basin within the boundaries of the withdrawing or terminated Member and so notify the Department of Water Resources.

Section 6.03 - Disposition Of Property Upon Termination Or Determination By Board Of Directors Of Surplus.

(a) Upon termination of this Agreement or upon determination by the Board of Directors that any surplus money is on hand, such surplus money shall be returned to the Members of the Authority. The distribution of said surplus shall be proportionate to the current year percentages as shown in Exhibit A, or as modified after the inclusion of new Members.

(b) The Board of Directors shall first offer any surplus properties, works, rights and interests of the Authority for sale to the Members and the sale shall be at the Authority's actual cost unless otherwise required by law. If no such sale is consummated, then the Board of Directors shall offer the surplus properties, works, rights and interests of the Authority for sale in accordance with applicable law to any governmental agency, private entity or persons for good and adequate consideration.

Section 6.04 - Liability For Debts.

The Members do not intend hereby to be obligated either jointly or severally for the debts, liabilities or obligations of the Authority, except as may be specifically provided for in California Government Code Section 895.2 as amended or supplemented. Provided, however, if any General Member(s) of the Authority are, under such applicable law, held liable for the acts or omissions of the Authority caused by negligent or wrongful act or omission occurring in the performance of this Agreement, such parties shall be entitled to contribution from the other Members so that after said contributions each General Member shall bear an equal share of such liability, as shown on the then-current Exhibit A. This Section 6.04 does not apply to acts or omissions of a Member in implementing the GSP adopted by the Authority within such Member's boundaries or a Management Area managed in whole or in part by such Member.

Section 6.05 - SGMA-Related Expenses Incurred by Members.

Expenses incurred by a Member, or group of Members, for the implementation of the SGMA within a Management Area shall be borne solely by that Member or group of Members. Neither the Authority nor its other Members shall be liable for such expenses.

Article VII - Implementation of SGMA Section

7.01 - Development of GSP.

Any Member or group of Members may create its or their own chapter or provisions

governing SGMA implementation within their respective boundaries or a Management Area managed in whole or in part by such Member(s) for inclusion by the Authority into the Authority's GSP. Cooperative Members shall be under no obligation to prepare or otherwise contribute to the preparation of any GSP chapter(s). The Authority shall promptly review the proposed chapter or provisions for consistency with the Authority's GSP and to determine that it meets the requirements of SGMA. If the Authority determines by a vote of 75% of the Directors that a Member's proposed chapter or provisions is/are consistent with SGMA and the Authority's GSP, it shall incorporate such chapter or provisions into the Authority's GSP. Such chapter or provisions may include operating conditions and criteria 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, and in reviewing a Member's chapter the Authority shall not reject or fail to approve a Member's chapter based solely upon such operating conditions and criteria. The Authority shall not adopt a GSP that will be implemented within any Member's boundaries or Management Area without the prior approval of the Member.

Section 7.02 - Authorization to Carry Out the Terms of the GSP.

The Authority is authorized to carry out any of the following powers for the benefit of its Members that are included in the GSP adopted by the Authority without any further approval of the Board of Directors, subject at all times to the limitations and restrictions contained within this Agreement:

(a) Collection and maintenance of water extraction information and other technical data.

(b) Coordination of actions within, and reporting by, a Management Area.

(c) Carrying out studies and other technical investigations.

(d) Establishment and administration of conjunctive use and land fallowing programs.

(e) Requiring permitting of water extraction facilities.

(f) Requiring installation of meters.

(g) Buy, sell, exchange, recharge, and/or store water if the benefits thereof are made available to all General Members.

(h) Fix and collect rates for replenishment and other activities as a regulatory or service fee provided for at Water Code Sections 10730 through 10731.

Section 7.03 - Actions Requiring Additional Approval.

Subject to the limitations of this Agreement, the Authority shall not do any of the following without the approval of 75% of the voting power of the Board of Directors:

(a) Restrict or otherwise limit extraction of native groundwater other than through economic incentives and disincentives.

(b) Fund capital construction projects.

Notwithstanding any other provision of this Agreement, the Authority shall not restrict or otherwise limit the extraction of water stored (whether through direct recharge or in lieu deliveries) in the Kern County Subbasin as a part of any banking or recharge project or program, or otherwise seek to regulate the operation any such project or program.

Section 7.04 - Management Areas.

Any General Member (or group of General Members) may request that the Authority directly assume the responsibility of implementing SGMA and the Authority's GSP within its Management Area by giving written notice to the Authority, which notice may be given at any time. Where the service areas of multiple General Members overlap a Management Area, the General Members within the Management Area shall unanimously join the request. The Board of Directors shall take action to accept or reject such request. If the Authority accepts such request, the Authority and the requesting General Member(s) shall develop a mutually acceptable agreement describing the respective roles and responsibilities of the Authority and the requesting General Member(s) with respect to such implementation.

Except as otherwise expressly provided, the Authority's role within a Management Area, unless otherwise unanimously requested by the General Member(s) managing such Management Area, shall be primarily coordinating and administrative. In particular, the roles and responsibilities for implementing SGMA and the GSP within a Management Area shall be the subject of a Special Activity agreement between the General Member(s) and the Authority.

Article VIII: Miscellaneous Provisions

Section 8.01 - Amendment.

This Agreement may be amended from time to time by the concurrence of 75% of the General Members. To provide non-concurring parties an opportunity to withdraw from the Authority as provided herein, an amendment shall be binding on all parties 60 days after the required concurrence has been obtained.

Section 8.02 Severability And Validity Of Agreement.

Should the participation of any party to this Agreement, or any part, term or provision of this Agreement be decided by a courts or the Legislature to be illegal, in excess of that party's authority, in conflict with any law of the State of California, or otherwise rendered unenforceable or ineffectual, the validity of the remaining portions, terms or provisions of this Agreement shall

not be affected thereby and each party hereby agrees it would have entered into this Agreement upon the remaining terms and provisions.

Section 8.03 - Assignment.

Except as otherwise provided in this Agreement, the rights and duties of the parties to this

Agreement may not be assigned or delegated without the advance written consent of the Authority (as evidenced by a majority vote of the Board of Directors), and any attempt to assign or delegate such rights or duties in contravention of this section shall be null and void. Any assignment or delegation permitted under the terms of this Agreement shall be consistent with the terms of any contracts, resolutions or indentures of the Authority then in effect, including without any Special Activity agreement to which the assigning or delegating Member is a party. This Agreement shall inure to the benefit of and be binding upon the successors and assigns of the parties hereto. This section does not prohibit a party from entering into an independent agreement with another agency regarding the financing of that party's contributions to the Authority or the disposition of proceeds which that party receives under this Agreement so long as such independent agreement does not affect, or purport to affect, the rights and duties of the Authority or the parties under this Agreement.

Section 8.04 - Execution In Parts Or Counterparts.

This Agreement may be executed in parts or counterparts, each part or counterpart being an exact duplicate of all other parts or counterparts, and all parts or counterparts shall be considered as constituting one complete original and may be attached together when executed by the parties hereto. Facsimile or electronic signatures shall be binding.

Section 8.05 - Notices.

Notices authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when mailed, postage prepaid, or delivered during working hours to the addresses set forth for each of the parties hereto on Exhibit "A" of this Agreement, or to such other changed addresses communicated to the Authority and the Member entities in writing, and to such other entities that become Members.

Section 8.06 - Dispute Resolution.

(a) A dispute resolution group shall be established by the Board of Directors to resolve disputes and/or controversies through mediation relating to the interpretation, construction, performance, termination, breach of, or withdrawal from this Agreement (the "Dispute Resolution Group"). The Dispute Resolution Group shall meet with the parties involved no later than 30 days following notification of the dispute or controversy. Thereafter, the Dispute Resolution Group will have 90 days to endeavor to resolve the dispute.

(b) Following conclusion of the dispute resolution process as herein provided, any Member may pursue any judicial or administrative remedies otherwise available. Notwithstanding this Section 8.06, a Member may seek a preliminary injunction or other interlocutory judicial relief if necessary to avoid irreparable damages or to preserve the status quo.

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

CAMRO W.D.

Name of Member

By: _____

Print Name: DAVID ANSCHUTZ

Title: GENERAL MANAGER

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

City of Shafter

Name of Member

By: _____

Print Name: Chad Givens

Title: Councilmember

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Kern County Water Agency

Name of Member

By: _____

Print Name: Curtis Creel

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Kern-Tulare Water District

Name of Member

By: _____

Print Name: for Steve Datke

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Northern WMD

Name of Member

By: _____

Print Name: Richard A. Diamond

Title: GM

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Rosedale-Rio Bravo W.S.D

Name of Member

By: _____

Print Name: Eric L. Averett

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Semitropic Water Storage District

Name of Member

By: _____

Print Name: Jason Gianquinto

Title: General Manager

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Shafter-Wasco Irrigation District

Name of Member

By: Craig D. Fulwyler

Print Name: Craig D. Fulwyler

Title: Board of Directors, President

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

Southern San Joaquin MUD

Name of Member

By: Roland Gross

Print Name: Roland Gross

Title: GM/Secretary

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

WEST KERN WATER DIST

Name of Member

By: Gary F Morris

Print Name: GARY MORRIS

Title: BOARD PRESIDENT

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective Board of Directors or governing board, have caused their names to be affixed by their proper and respective officers as of the day and year first above-written.

WDWA

Name of Member

By: 3.7.21

Print Name: ROB GOFF

Title: BOARD MEMBER

EXHIBIT A

GENERAL MEMBERS

Cawelo Water District

City of Shafter

Kern County Water Agency, on behalf of the Pioneer GSA

Kern-Tulare Water District

North Kern Water Storage District

Rosedale-Rio Bravo Water Storage District

Semitropic Water Storage District

Shafter-Wasco Irrigation District

Southern San Joaquin Municipal Utility District

West Kern Water District

Westside District Water Authority

EXHIBIT B

Associate Members

Eastside Water Management Area

EXHIBIT C

Cooperative Members

Kern County Water Agency

Attachment B

Amended Coordination Agreement

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

First Amended Kern County Subbasin Coordination Agreement

THIS FIRST AMENDED KERN COUNTY SUBBASIN COORDINATION AGREEMENT (the "Agreement") is made effective as of 7/22/2022 by and among the Groundwater Sustainability Agencies ("GSA") within the Kern County Subbasin that are developing a Groundwater Sustainability Plan ("GSP") (each a "Party" and collectively the "Parties"), each of which is identified in Appendix 1 and is made with reference to the following facts:

WHEREAS, on September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act ("SGMA"); and

WHEREAS, SGMA requires all groundwater basins designated as high or medium priority by the Department of Water Resources ("DWR") to manage groundwater in a sustainable manner; and

WHEREAS, the Kern County Subbasin (Basin Number 5-22. 14, DWR Bulletin 118) ("Basin") within the San Joaquin Valley Groundwater Basin, has been designated as a high-priority basin by DWR; and

WHEREAS, the Basin includes fourteen (14) GSAs that are managing the Basin through six (6) different GSPs; and

WHEREAS, SGMA allows local agencies to engage in the sustainable management of groundwater, but requires GSAs intending to develop and implement multiple GSPs within a basin to enter into a coordination agreement;

WHEREAS, the Agreement does not prevent any Party from providing comments on a GSP, or otherwise coordinating among parties with regard to specific items in a GSP outside this Agreement, on issues including but not limited to specific border conditions between GSP's and/or the timing and/or effect of projects and management actions contained within another GSP; and

WHEREAS, nothing in this Agreement represents or should be construed as the determination of any claim or assertion of a groundwater right; specifically, the coordinated water budget information or data does not amount to an allocation, or otherwise represent a determination, validation, or denial of any claimed or asserted groundwater right;

WHEREAS, this Agreement shall supersede and replace all prior agreements, promises, and understandings, oral or written, related to the coordination of GSPs in the Basin, including the Coordination Agreement effective January 20, 2020.

THEREFORE, in consideration of the facts recited above and of the covenants, terms and conditions set forth herein, the Parties agree as follows:

SECTION 1 – PURPOSE

The purpose of this Agreement is to comply with SGMA coordination agreement requirements and ensure that the multiple GSPs within the Basin are developed and implemented utilizing the same

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

methodologies and assumptions as required under SGMA and Title 23 of the California Code of Regulations, and that the elements of the GSPs are appropriately coordinated to support sustainable management.

The Parties intend that this Agreement be a description of how the multiple GSPs, developed by the individual GSAs, are implemented together to satisfy the requirements of SGMA. The Parties intend this Agreement to be incorporated as part of each individual GSP developed by the Parties.

SECTION 2 – GENERAL GUIDELINES

2.1 Responsibilities of the Parties

The Parties shall work collaboratively to comply with SGMA and this Agreement. Each Party to this Agreement is a GSA and acknowledges it is bound by the terms of the Agreement. This Agreement does not otherwise affect each Party's responsibility to implement the terms of their respective GSP. Rather, this Agreement is the mechanism through which the Parties will coordinate portions of the multiple GSPs to ensure such GSP coordination complies with SGMA.

2.2 No Adjudication or Alternative Plans in the Basin

As of the date of this Agreement, there are no portions of the Basin that have been adjudicated or have submitted for DWR approval an alternative to a GSP pursuant to Water Code Section 10733.6.

SECTION 3 – GOVERNANCE

3.1 Basin Coordination Committee

The Basin Coordination Committee (BCC) will oversee the activities described in section 3.1.5 of this Agreement. The Basin Coordination Committee will consist of one representative appointed from each GSP.

3.1.1 Each Basin Coordination Committee member's compensation for service on the Basin Coordination Committee, if any, is the responsibility of the appointing Party.

3.1.2 Each Basin Coordination Committee member shall serve at the pleasure of the appointing GSP and may be removed or substituted from the Basin Coordination Committee by the appointing GSP at any time.

3.1.3 The Basin Coordination Committee will meet periodically as it deems necessary to carry out the activities described in this Agreement

3.1.4 The Basin Coordination Committee may suggest subcommittees, workgroups, or otherwise request staff of the Parties to develop technical data, supporting information and/or recommendations.

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

3.1.5 The purposes of the Basin Coordination Committee are to (1) recommend to their respective GSAs the appointment of a Plan Manager who will act in accordance with this Agreement, and (2) provide a forum wherein the Parties may discuss basin coordination activities, which may include the development, planning, financing, environmental review, permitting, implementation, and long-term monitoring of the multiple GSPs in the Basin, pursuant to SMGA requirements ("Coordination Activities").

3.2 Plan Manager

The Plan Manager shall be appointed by unanimous agreement by the Parties for a term of one calendar year, and annually thereafter, and may be removed by unanimous agreement of the Parties with or without cause. The Plan Manager shall serve as the point of contact for DWR as specified in 23 CCR § 357.4, subd. (b)(1). The Plan Manager shall submit or assist with the submittal of all GSPs, plan amendments, supporting information, monitoring data and other pertinent information, Annual Reports, and periodic evaluations to DWR when required. The Plan Manager has no authority to take any action or represent the Basin Coordination Committee or a particular GSA without the specific direction and authority of the Basin Coordination Committee or the particular GSA, respectively. The Plan Manager is obligated to immediately disclose all communications he/she receives in his/her capacity as Plan Manager to the Basin Coordination Committee and the affected GSA, as appropriate under the circumstances.

SECTION 4 – EXCHANGE OF DATA AND INFORMATION

4.1 Procedure for Exchange of Information

4.1.1 The Parties may exchange information through collaboration and/or informal requests made at the Basin Coordination Committee level or through subcommittees suggested by the Basin Coordination Committee. However, to the extent it is necessary to make a written request for information to another Party, each Party shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Basin Coordination Committee. Requests may be communicated in writing and transmitted in person or by mail, facsimile machine or other electronic means to the appropriate representative as named in this agreement.

4.1.2 Nothing in this Agreement shall be construed to prohibit any Party from voluntarily exchanging information with any other Party by any other mechanism separate from the Basin Coordination Committee.

4.2 Non-Disclosure of Confidential Information

Pursuant to Section 4.1 of this Agreement, a Party may provide one or more of the other Parties with confidential information. To ensure the protection of such confidential information and in consideration of the agreement to exchange said information, appropriate arrangements may be made to restrict or prevent further disclosure.

SECTION 5 – METHODOLOGIES & ASSUMPTIONS

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

Pursuant to California Water Code section 10727.6 and 23 CCR, § 357.4, the Parties will meet and agree upon the methodologies used in their respective GSPs with respect to utilizing the same data and methodologies for the following assumptions: 1) groundwater elevation data; 2) groundwater extraction data; 3) surface water supply; 4) total water use; 5) change in groundwater storage; 6) water budget; and 7) sustainable yield, and that such methodologies and assumptions will continue to be used in the future development and implementation of such GSPs, except to the extent modified by the Parties in the future. Information regarding the agreed upon Basin methodologies and assumptions shall be attached as Appendix 2 to this Agreement when approved by all Parties.

SECTION 6 – MONITORING NETWORK

6.1 The Parties shall develop a monitoring network and monitoring network objectives for the Basin in accordance 23 CCR, §§ 354.32 – 354.40. Each network shall facilitate the collection of data in order to characterize groundwater and related surface water conditions in the Basin and evaluate changing conditions that occur from implementation of the individual GSPs. The individual GSPs shall include monitoring objectives, protocols, and data reporting requirements as necessary under SGMA and SGMA Regulations.

6.2 The monitoring network(s) will demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions. Each Party's GSP will describe the monitoring network's objectives for the Basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface water conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of GSP implementation. The Parties shall implement the monitoring network objectives to accomplish the following: a) demonstrate progress toward achieving measurable objectives described in the GSPs; b) monitor impacts to the beneficial uses or users of groundwater; c) monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds; and d) quantify annual changes in water budget components. Information regarding the agreed upon Basin monitoring network shall be attached as Appendix 3 to this Agreement when approved by all Parties.

6.3 The Parties shall design a monitoring network that will achieve the following for the enumerated sustainability indicators:

6.3.1 Chronic Lowering of Groundwater Levels:

The network shall collect information sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods: a) density of monitoring wells to collect measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer; and b) take static groundwater elevation measurements, at least two times a year, representing seasonal low and high conditions.

6.3.2 Change in Groundwater Storage:

The network will provide sufficient data for the GSAs to estimate the change in annual groundwater in storage.

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

6.3.3 Degraded Water Quality:

The network will collect sufficient spatial and temporal data from each GSA to determine groundwater quality trends for water quality indicators, as determined by the GSA, to address known water quality issues.

6.3.4 Land Subsidence:

The network will identify the location, rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or any other appropriate method.

6.3.5 Seawater Intrusion/Depletion of Interconnected Surface Water:

The network will not be designed to monitor Seawater Intrusion and/or Depletion of Interconnected Surface Water because these issues are not applicable to the Basin.

6.4 The Parties shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors: a) the amount of current and projected groundwater use; b) aquifer characteristics, including confined or unconfined aquifer conditions or other physical characteristics that affect groundwater flow; c) impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal; d) whether individual GSAs have adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.

6.5 Parties may designate a subset of monitoring sites as representative of conditions in the Basin or a portion of the Basin.

6.6 The Parties shall identify data gaps where the Basin does not contain sufficient monitoring sites, where the frequency of monitoring is insufficient, or sites are unreliable. If such gaps are identified, the Parties shall describe the reason for the gap and describe actions that may be taken to remedy such gaps.

6.7 The Parties shall share information necessary to create a Basin map displaying the location and type of each monitoring site within the Basin, and a report in tabular format, including information regarding the monitoring site type, frequency of measurement, and purpose for which the monitoring site is being used.

SECTION 7 – COORDINATED WATER BUDGET

7.1 In accordance with 23 CCR, § 357.4 subd. (b) the Parties shall prepare a coordinated water budget for the Basin as described in this sub-section, as required by 23 CCR, § 354.18. The water budget will provide an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the Basin, including historical, current, and projected water budget conditions, and the change in the volume of water stored. Information regarding the agreed upon coordinated water budget shall be attached as Appendix 4 to this Agreement when approved by all Parties.

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

7.2 Each Party for its respective GSP shall endeavor to provide the information required by 23 CCR, § 356.2 to the Basin Coordination Committee by March 1 for the preceding calendar year.

7.3 The Parties shall use the projected water budgets to estimate future baseline conditions of supply, demand, and aquifer response to their GSP implementation, and to identify the uncertainties of these projected water budget components. The Parties shall use the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon for the projected water budget.

7.3.1 To the extent available, use 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.

7.3.2 Projected water demand shall utilize the most recent reliable land use, population growth, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.

7.3.3 Projected surface water supply shall utilize the most recent reliable water supply information as the baseline condition for estimating future surface water supply. The projected surface supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply as identified in the historical water budget and the projected changes in local land use planning, population growth, and climate.

SECTION 8 – COORDINATED DATA MANAGEMENT SYSTEM

The Parties will develop and will maintain a data management system that is capable of storing and reporting information relevant to the development and/or implementation of the GSPs and monitoring network of the Basin as required by SGMA and the SGMA Regulations. Information regarding the agreed upon coordinated data management system shall be attached as Appendix 5 to this Agreement when approved by all Parties.

SECTION 9 – ADOPTION AND USE OF THE COORDINATION AGREEMENT

9.1 Cooperative Implementation of GSPs

The Parties intend that their individual GSPs will be implemented together in order to satisfy the requirements of SGMA. The collective GSPs in a coordinated manner will utilize the groundwater models, a description of the physical setting and characteristics of the separate aquifer systems within the Basin, the methodologies and assumptions as specified in Water Code section 10727.6, a description

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

of the undesirable results, the minimum thresholds, the measurable objectives, and monitoring protocols that together provide a description of the sustainable yield of the Basin(s) as a whole, and how it will be sustainably managed.

9.2 GSP and Coordination Agreement Submission

The Parties shall submit their respective GSPs to DWR through the Plan Manager in accordance with SGMA and SGMA Regulations. The Parties intend that this Agreement suffice to fulfill the requirements of providing an explanation of how the GSPs implemented together satisfy Water Code sections 10727.2, 10727.4 and 10727.6 for the entire Basin.

9.3 In Event Entire Basin Not Covered by GSP

In the event it appears that the entire Basin may not be covered by one or more GSPs as of January 31, 2020, each Party may take such action as deemed necessary or appropriate by such Party with respect to filing its GSP and/or other documents with DWR.

9.4 Duration of Coordination Agreement

This Coordination Agreement shall be reopened for amendment at the at the submission of the next round of GSP's covering the Kern Subbasin (no later than 5 years from January 31, 2020). Unless amended at that time, the Coordination Agreement shall be automatically renewed every 5 years. The parties may agree to unanimously amend this Coordination Agreement at any time.

SECTION 10 – Modification and Termination of the Agreement

10.1 Modification

This Agreement shall be reviewed as part of each five year assessment and may be supplemented, amended, or modified only by the written agreement of all the Parties. No supplement, amendment, or modification of this Agreement shall be binding unless it is in writing and signed by all Parties.

10.2 Withdrawal, Termination, Adding Parties

10.2.1 A Party may unilaterally withdraw from this Agreement without causing or requiring termination of this Agreement, effective upon 30 days' notice to the other Parties.

10.2.2 A new GSA or group of GSA's may be added as a Party to this Agreement if such entity or entities is submitting a GSP within the Basin.

10.2.3 This Agreement may be rescinded by unanimous written consent of all the Parties. Nothing in this Agreement shall prevent the Parties from entering into another coordination agreement.

SECTION 11 – Dispute Resolution

11.1 Procedures for Resolving Conflicts

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

In the event that any dispute arises among the Parties relating to the rights and obligations arising from this Agreement, the aggrieved Party or Parties shall provide written notice to the other Parties of the dispute. Within thirty (30) days after such written notice, the Parties shall attempt in good faith to resolve the dispute through informal means. If the Parties cannot agree upon a resolution of the dispute within thirty (30) days from the providing of written notice specified above, the dispute will be elevated to the BCC for consideration, along with the notice of dispute and any other relevant supporting documentation produced and shared by the disputing parties pursuant to their informal meet and confer process. The BCC may issue a recommendation concerning resolution of the dispute. If the Parties cannot agree upon a resolution of the dispute following the input of the BCC, the disputing Parties will meet and confer to determine if other alternative dispute resolution methods are agreeable, including voluntary non-binding mediation, which may include the Department of Water Resources dispute resolution process, arbitration, or appointment of a panel of technical experts prior to commencement of any legal action. The cost of alternative dispute resolution shall be paid in equal proportion among the Parties to the dispute, otherwise the Parties shall bear their own costs. Upon completion of alternative dispute resolution, if any, and if the controversy has not been resolved, any Party may exercise any and all rights to bring a legal action relating to the dispute.

11.2 Litigation

In the event a dispute or claim is not resolved by a mutually agreeable settlement through informal negotiation or voluntary mediation, the aggrieved Party may file suit in a County Superior Court with jurisdiction to provide a binding decision on the matter.

DocuSigned by:
Jeof Wyrick
E7E722SR0FF4B0...

7/15/2022

Henry Miller Water District — Date
Jeof Wyrick, President

DocuSigned by:
[signature]
B0DC4B7...

7/15/2022

Kern Groundwater Authority — Date
Dan Waterhouse, Chair

DocuSigned by:
Terry Chicca
C2B5D11...

7/14/2022

Buena Vista Water Storage District — Date
Terry Chicca, President

DocuSigned by:
[signature]
ECC3E...

7/14/2022

Kern River Groundwater Sustainability Agency — Date
Rodney Palla, Chairman

DocuSigned by:
[signature]
D9DC12...

7/18/2022

Olcese Water District Groundwater Sustainability Agency — Date
James L. Nickel, President

DocuSigned by:
[signature]
E1C0...

7/21/2022

South of Kern River Groundwater Sustainability Agencies — Date
Derek Yurosek, Chairman

DocuSign Envelope ID: D41CC53E-197B-4AF9-8776-3D4BCDAEFC43

APPENDIX 1

Buena Vista Water Storage District

Henry Miller Water District

Kern Groundwater Authority Groundwater Sustainability Agency

Kern River Groundwater Sustainability Agency

Olcese Water District Groundwater Sustainability Agency

South of Kern River Groundwater Sustainability Agencies

Attachment C

Communication and Engagement Plan

Kern Groundwater Authority

Communication & Engagement Plan

Kern County, California
Adopted May 2018
Updated August 2019
Updated December 2019

Prepared for:

KERN GROUNDWATER AUTHORITY

Kern Groundwater Authority
1800 30th Street, Suite 280, Bakersfield, California 93301

Prepared by:

Provost & Pritchard Consulting Group
1800 30th Street, Suite 280, Bakersfield, California 93301

COPYRIGHT 2019 by PROVOST & PRITCHARD CONSULTING GROUP
ALL RIGHTS RESERVED

Provost & Pritchard Consulting Group expressly reserves its common law copyright and other applicable property rights to this document. This document is not to be reproduced, changed, or copied in any form or manner whatsoever, nor are they to be assigned to a third party without first obtaining the written permission and consent of Provost & Pritchard Consulting Group In the event of unauthorized reuse of the information contained herein by a third party, the third party shall hold the firm of Provost & Pritchard Consulting Group harmless, and shall bear the cost of Provost & Pritchard Consulting Group's legal fees associated with defending and enforcing these rights.

Report Prepared for:

Kern Groundwater Authority

1800 30th Street, Suite 280

Bakersfield, CA 93301

Contact:

Patty Poire, Planning Manager

Telephone: (661) 479-7171

Email: ppoire@kerngwa.com

Website: www.kerngwa.com

Report Prepared by:

Provost & Pritchard Consulting Group

Trilby Barton, Public Outreach Coordinator

Contact:

Telephone: (661) 616-5900

Email: tbarton@ppeng.com

Note: This Communication & Engagement Plan is a living document and will be updated as necessary throughout the GSP development, public review, and implementation phases.

Table of Contents

Abbreviations iv
Introduction Intro-1
SGMA Overview Intro-1
Communication & Engagement Plan Intro-1
I. Goals and Desired Outcomes I-1
A. Description and Background of the Kern Groundwater Authority I-1
I.A.1 GSA Description & Boundary I-1
I.A.2 Industries, DACs, Municipalities I-2
I.A.3 KGA's Decision-Making Process I-5
B. Goals/Desired Outcomes of GSP Development I-5
C. Communication Objectives to Support the GSP I-5
I.C.1 Phase 1: GSA Formation and Coordination I-5
I.C.2 Phase 2: GSP Preparation and Submission I-5
I.C.3 Phase 3: GSP Review and Evaluation I-6
I.C.4 Phase 4: Implementation and Reporting I-6
D. Overriding Concerns, Major Concerns or Challenges I-6
II. Audience Identification II-1
A. Primary Stakeholder Groups II-1
II.A.1 Role of Board of Directors II-1
II.A.2 Role of KGA/GSA Managers Committee II-1
II.A.3 Role of Stakeholder Committee II-1
B. Secondary Stakeholder Groups II-2
II.B.1 Native American Tribes II-2
C. Community Organizations, Public Agencies and Other Entities II-3
II.C.1 School Districts II-3
D. Interested Persons List II-12
III. Audience Survey and Mapping III-1
A. Stakeholder Survey III-1
III.A.1 Identification of Stakeholder Issues, Interests and Challenges III-1
III.A.2 Survey Questions III-1
III.A.3 Stakeholder Survey Distribution III-3
B. "Lay of the Land" Overview III-3

III.B.1 Types of Stakeholders III-4
III.B.2 Stakeholder Key Interests Related to Groundwater III-4
III.B.3 Key Documented Issues III-4
IV. Messages and Talking Points IV-1
IV.A.1 Key Messages & Talking Points IV-1
IV.A.2 Likely Questions or Issues and Responses IV-2
V. Venues for Engaging V-1
A. Direct Stakeholder Outreach V-1
V.A.1 Collaboration Meetings – Primary Stakeholders V-1
V.A.2 Educational/Outreach Public Meetings V-1
V.A.3 Printed Communication V-2
V.A.4 Digital Communication V-4
V.A.5 Media Coverage V-5
VI. Implementation Timeline VI-1
VII. Evaluation and Assessment VII-1
A. Evaluation and Assessment Process VII-1
VII.A.1 Monthly Outreach Reports to Planning Manager VII-1
VII.A.2 Quarterly Milestone Review VII-1
Appendix A: Kern Groundwater Authority Branding Summary A-1
Appendix B: Stakeholder Surveys B-1
Appendix C: List of Kern Groundwater Authority Public Outreach Efforts C-1

List of Figures

Figure Intro-1. Stakeholder Engagement Requirements by Phase Intro-2
Figure I-1. Kern Groundwater Authority GSA Boundary I-7
Figure I-2. Disadvantaged Communities within the Kern Groundwater Authority I-8
Figure I-3. Kern Groundwater Authority Public Agencies and Water/Irrigation Districts I-9
Figure I-4. Elementary School Districts within Kern Groundwater Authority I-10
Figure I-5. High School Districts within Kern Groundwater Authority I-11
Figure VI-1. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 1: GSA Formation and Coordination VI-2
Figure VI-2. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 2: GSP Preparation and Submission, and Phase 3: GSP Review and Evaluation VI-3
Figure VI-3. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 3: GSP Review and Evaluation VI-4

List of Tables

Table I-1. GSAs in Kern Sub-basin I-1
Table I-2. Kern Groundwater Authority Member Entities I-2
Table I-3. Disadvantaged Communities within the Kern Groundwater Authority I-4
Table I-4. Municipalities within the Kern Groundwater Authority I-4
Table II-1. Consideration of All Interests of All Beneficial Uses and Users of Groundwater II-2
Table II-2. Secondary Stakeholder Groups with Interests in the Kern Groundwater Authority II-2
Table II-3. Native American Tribes in the Kern Groundwater Authority II-3
Table II-4. Community Organizations and Public Agencies II-4
Table III-1. Stakeholder Issues, Interests & Challenges III-1
Table IV-1. Likely Questions or Issues IV-2
Table V-1. Potential Public Meeting Venues & Locations V-2
Table V-2. Public Agencies & Community Organizations Social Media Outlets V-5
Table V-3. Kern County Media Outlets V-6
Table C-1. List of KGA Public Outreach Efforts C-1

Abbreviations

AB.....Assembly Bill
C&E.....Communication & Engagement
DAC.....Disadvantaged Community
DDW.....Division of Drinking Water
DWR.....Department of Water Resources
FKC.....Friant-Kern Canal
GSA.....Groundwater Sustainability Agency
GSP.....Groundwater Sustainability Plan
ILRP.....Irrigated Lands Regulatory Program
JPA.....Joint Powers Authority
KGA.....Kern Groundwater Authority
MCL.....Maximum contaminant levels
PSA.....Public service announcement
SB.....Senate Bill
SDAC.....Severely Disadvantaged Community
SRT.....Sequoia Riverlands Trust
SGMA.....Sustainable Groundwater Management Act
SWRCB.....State Water Resources Control Board

Introduction

SGMA Overview

The Sustainable Groundwater Management Act (**SGMA**) is a combination of three bills signed by California Governor Jerry Brown in 2014: Assembly Bill (**AB**) 1739, Senate Bill (**SB**) 1168, and SB 1319. SGMA provides local agencies with the framework to manage groundwater basins in a sustainable manner. The legislation recognizes that groundwater is most effectively managed at the local level, and local agencies will need to achieve groundwater sustainability by 2040.

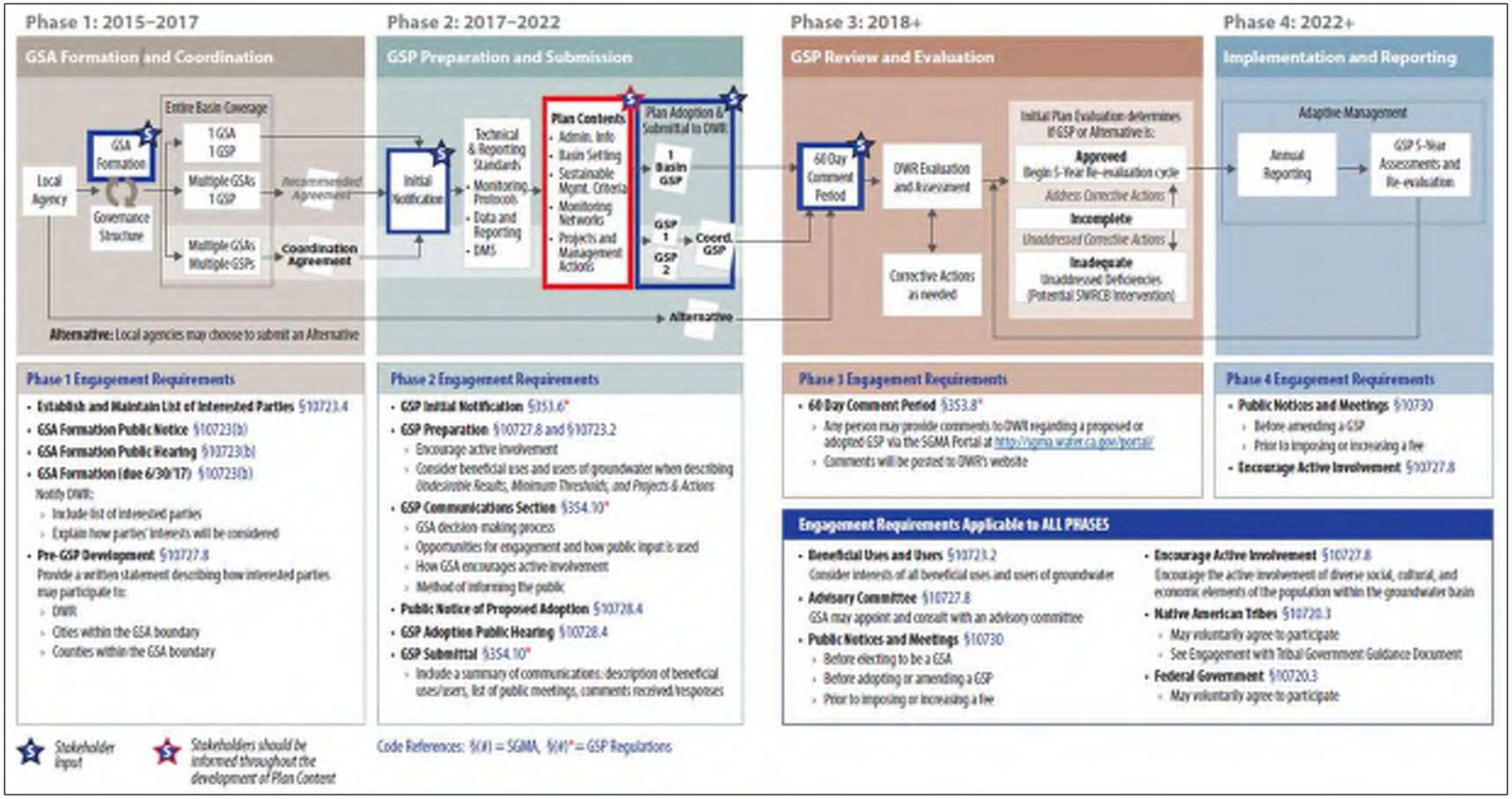
In SGMA, sustainable groundwater management is defined as management of groundwater supplies in a manner that can be maintained in planning and implementation phases without causing undesirable results. Undesirable results include significant and unreasonable chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and interconnected surface waters.

Implementation of SGMA and outreach requirements are broken down into four phases (**Figure ES-1**):

- **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 ranged from 2017 to 2019. During this phase, GSAs developed 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 was held in late 2019, and consisted of a public review period. The public review period was 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.

Communication & Engagement Plan

As required by SGMA, GSAs must consider the interests of all beneficial uses and users of groundwater and include them in the GSP development process. The Kern Groundwater Authority's Communication & Engagement (**C&E**) Plan addresses how stakeholders within the boundary will be engaged through stakeholder education and opportunities for input and public review during the development and implementation of the GSP. This plan provides an overview of the KGA, its stakeholders, and decision-making process; identifies opportunities for public engagement and discussion of how public input and responses will be used; describes how the KGA encourages the active involvement of diverse, social, cultural, and economic elements of the population within the KGA boundary; and the methods to be used to inform the public stakeholders about the progress of GSP development, public review and implementation.



Source: GSP Stakeholder Communication and Engagement Guidance Document, California Department of Water Resources, June 2017

Figure Intro-1. Stakeholder Engagement Requirements by Phase

I. Goals and Desired Outcomes

This section of the Communication & Engagement Plan provides a description of the Kern Groundwater Authority, defines the goals of how to address the challenges, regulatory requirements and opportunities, and how to reach the desired outcomes of communication efforts.

A. Description and Background of the Kern Groundwater Authority

I.A.1 GSA Description & Boundary

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 Sub-basin is a high-priority basin that is in critical groundwater overdraft. The Kern County Groundwater Sub-basin currently has 10 GSAs (listed in **Table I-1**).

Table I-1. GSAs in Kern Sub-basin

GSAs within the Kern Sub-basin		
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	

On April 26, 2017, the Kern Groundwater Authority, a joint-powers authority (**JPA**), elected to become an official GSA for the portion of the Kern County sub-basin designated in **Figure I-1**. The KGA provides local policy makers, stakeholders and the public with a forum to monitor, report and/or discuss groundwater activities, and identify and address any local groundwater issues. The KGA was formed for the purpose of SGMA, which includes but is not limited to the following activities: coordinating groundwater management programs and activities, identifying and addressing issues pertaining to sustainable groundwater management, and establishing a framework for local groundwater management.

Kern Groundwater Authority's member entities are listed in **Table I-2**. These members overlie the larger portion of the Kern County Subbasin (Basin Number 5-022.14, DWR Bulletin 118) of the San Joaquin Valley Basin, which create the GSA's boundary. The boundary stretches along the northwest, northeast and southern parts of Kern County, California (**Figure I-1**), and includes agricultural lands, urban and industrial areas, and oil fields.

Table I-2. Kern Groundwater Authority Member Entities

Kern Groundwater Authority Member Agencies		
Arvin Community Services District	Arvin-Edison Water Storage District	Cawelo Water District
City of Shafter	Eastside Water Management Area*	Kern County Water Agency
Kern-Tulare Water District	Kern Water Bank Authority	North Kern Water Storage 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	

*Associate member

Under SGMA, the KGA is responsible for submitting a GSP to the DWR by January 31, 2020 and works cooperatively with the other Kern County Sub-basin GSAs to meet the sustainability requirements for the sub-basin as a whole. The KGA is also working with the other Kern County Sub-basin GSAs, and will continue to do so, on the communication and engagement of all beneficial users.

Throughout the SGMA phases, the KGA's Board of Directors, KGA Planning Manager and general managers of each member agency will be responsible for collecting and organizing data, engaging and retaining experts and consultants, and soliciting feedback from beneficial users of groundwater and interested parties within the GSA boundary. The specific roles of the Board of Directors and committees are described in **Section II.A**.

I.A.2 Industries, DACs, Municipalities

I.A.2.1 Industries

Collaboration meetings will be held with the companies and organizations within the following industries to make sure their organizational visions and groundwater needs for facility operations and conservation efforts are taken into consideration during GSP development and implementation phases.

I.A.2.1.1 Agriculture

The primary industry within the KGA is agriculture, as Kern County is currently the number one agricultural-producing county in the United States. The top five commodities produced in Kern County are grapes, almonds, citrus, pistachios and milk, according to the Kern County Agricultural Crop Report published by the Kern County Ag Commissioner's office. These top five crops comprise over $4.3 billion of the over $7 billion in gross value of crops produced within Kern County. Other top commodities produced in Kern County include: carrots, cattle and calves, potatoes, cherries, pomegranates, alfalfa, and silage and forage. As the primary industry, agriculture is the largest private employer in the county, with on-farm employment accounting for 15 percent of all jobs within Kern County, according to California's State Employment Development Department

With a substantial amount of KGA's acreage in agriculture production, it is important agriculture industry stakeholders are involved and informed during the development and public review phases of the GSP, as implementation will have a significant direct impact on the industry, and ultimately the local, state and national economies. KGA will continue to reach out to the Kern County farmers and will work with them collaboratively.

I.A.2.1.2 Food Processing

Kern County is one of the nation's top agricultural producing counties, and a prime location for the food processors to establish their part of the farm-to-table process. Four of the top 10 food processing companies in Central California are established in Kern County, accounting for nearly 15,000 jobs for the local workforce. Because of their significant impact on the economy within the Kern Sub-basin, direct tie to the agricultural industry and substantial reliance on groundwater supplies to operate their facilities, food processors are a crucial piece of groundwater sustainability management within the KGA boundary.

I.A.2.1.3 Oil Production

Kern County is not only one of the nation's top agricultural producing counties, but also one of the nation's top oil producing counties. Oil and agricultural production have shared the surface of Kern County lands for over 100 years and under current conditions will continue sharing. To be exact, the largest landowners within the county are oil companies who produce oil from those land holdings, and also lease those lands for activities such as grazing and the production of agricultural crops, depending on the location within the Kern subbasin. With the passing of SGMA, the oil industry has participated in many workshops and are considered as one of the beneficial users of groundwater within the county. KGA and its members will continue to seek out the oil industry for participation in the process of the GSP development and implementation and consider their industry not only as a beneficial user of groundwater, but also as the provider of additional water from activities of drilling oil.

I.A.2.1.4 Environmental

There are several environmental organizations within the KGA who focus on land conservation efforts (listed in **Table II-4**). The Kern Wildlife Refuge and Kern River Parkway Foundation are two specific organizations that need to be engaged. The KGA will reach out to these organizations to discuss their land conservation needs so that a healthy regional watershed with ecologically functional waterways can be taken into consideration for GSP development and implementation. Collaboration efforts may be put into place for certain groundwater sustainability projects such as the development of recharge basins.

I.A.2.2 DACs

Communication and educational outreach efforts with disadvantaged communities (**DAC**) and severely disadvantaged communities (**SDAC**) is essential for the development and implementation of the KGA's GSP, and residents are generally dedicated to bettering their communities, particularly when it comes to their water supplies. Important information that will be essential to communicate to and engage DACs will include an explanation of SGMA, water conservation education and soliciting feedback. A composite listing of the 22 DACs and SDACs, along with their populations and number of households, within the GSA boundary are listed in **Table I-3** and laid out in **Figure I-2**.

By including DACs and SDACs in communication efforts during the development, public review and implementation phases of the GSP, residents will be more likely to participate and provide feedback that could be crucial to long-term solutions for groundwater sustainability within their communities. Any feedback received from DAC/SDAC residents will be reviewed by the KGA Board of Directors and Stakeholder Committee and taken into consideration during the GSP development phase. During Phase I: GSA Formation & Coordination, the local DACs were engaged in the process and invited to participate in the formation process and with member-representation on the KGA's Board of Directors. The City of Shafter and Arvin Community Services District currently hold Board of Directors seats.

Table I-3. Disadvantaged Communities within the Kern Groundwater Authority

Community	Population	Households	DAC/SDAC
Buttonwillow	1,371	378	SDAC
City of Arvin	20,028	4,595	SDAC
City of Delano	52,883	10,549	SDAC
City of McFarland	12,784	2,817	SDAC
City of Shafter	17,261	4,434	DAC
City of Wasco	25,865	5,264	DAC
Cherokee Strip	295	68	SDAC
Derby Acres	324	145	SDAC
Dustin Acres	295	128	DAC
Edmundson Acres	274	54	SDAC
Fellows	106	37	DAC
Ford City	4,154	1,323	SDAC
Lost Hills	2,194	452	SDAC
Maricopa	1,158	395	SDAC
McKittrick	112	38	DAC
Mettler	88	31	DAC
Mexican Colony	216	63	SDAC
Smith Corner	661	137	SDAC
South Taft	1,680	471	DAC
Tupman	176	45	DAC
Valley Acres	717	227	DAC
Weedpatch	2,170	583	SDAC

I.A.2.3 Municipalities

The municipalities within the KGA are listed in **Table I-4**. These municipalities will be engaged in outreach efforts throughout the GSP development, public review and implementation phases, as described in **Section II.C**. School districts will be an integral part of outreach efforts, particularly within DACs, and are outlined in **Figure I-4** and **Figure I-5**. Further detail on how school districts will be engaged is described in **Section II.C**.

Table I-4. Municipalities within the Kern Groundwater Authority

Municipalities within the Kern Groundwater Authority			
Arvin Community Services District	City of Delano	City of McFarland	City of Maricopa
City of Shafter	City of Taft	City of Wasco	

I.A.3 KGA's Decision-Making Process

The KGA's decision-making process is broken down by the roles of the Board of Directors and Stakeholder Committee. The roles of these KGA entities and their responsibilities are outlined below and described in more detail in **Section II.A**.

- **Board of Directors –** Adopt general policies regarding development and implementation of the GSP
- **Executive Policy Committee** – Need-only committee to provide direction on finances and other issues
- **KGA/GSA Managers Committee –** Meets weekly to coordinate all of the GSPs within the subbasin, which is then presented at the monthly Stakeholder Committee meeting to seek input.

B. Goals/Desired Outcomes of GSP Development

The overall, main goal of the KGA is to establish and execute a plan that will sustain and manage groundwater within the Kern Sub-basin in a way that is cost-effective with minimal negative impacts to the beneficial uses and users.

C. Communication Objectives to Support the GSP

The ultimate goal of communication objectives during the formation/coordination, GSP development, public review and implementation phases of the SGMA compliance, is to encourage active involvement of diverse, social, cultural, and economic elements of the population within the GSA boundary. The KGA will give beneficial users and users of groundwater opportunities to engage in the GSP process, provide educational outreach opportunities for stakeholders while reaching out through specific communication avenues (**Section V**). As primary stakeholders, members of the Board of Directors and Stakeholder Committee are direct representatives of their districts, communities and industries, and it is important for them to continually gather feedback/input, and concerns/needs of their constituents and report back to their respective meetings. Any primary or secondary stakeholder input received will be reviewed and taken into consideration during GSP development.

I.C.1 Phase 1: GSA Formation and Coordination

Phase 1: GSA Formation and Coordination has been completed. This phase stretched from 2015 through 2018, and consisted of forming the KGA, establishing the List of Interested Parties (**Section II.D**), establishing the Stakeholder Committee, and creating the Communication & Engagement Plan to outline communication efforts for the GSP development, public review and implementation phases. Stakeholder input was utilized during the GSA formation phase, as beneficial users and stakeholders with interests in groundwater usage within the KGA's boundary were notified via public meeting notices as soon as the process began.

I.C.2 Phase 2: GSP Preparation and Submission

Phase 2: GSP Preparation and Submission spanned from 2017 through 2019. With the goal to have the draft GSP in the fourth quarter of 2019, 2018 was primarily the technical development of the plan, while working with the Board of Directors and Stakeholder Committee, as well as primary stakeholders (**Section II.A**), for feedback and input. During 2018 and 2019, public outreach meetings and interaction with secondary

stakeholder groups (**Section II.B**) and other community organizations and entities (**Section II.C**) were held with the purpose of educating and informing stakeholders about SGMA and the GSP process, while also soliciting feedback and input from these groups via Stakeholder Surveys (**Section III.A**) to consider and possibly include feedback and input into the GSP.

I.C.3 Phase 3: GSP Review and Evaluation

During 2019, Phase 3: GSP Review and Evaluation, the communication and engagement efforts continued. Once the draft of the GSP was completed late in the third quarter of 2019, the public review process began in the fourth quarter. A 90-day comment period was held, with the GSP draft posted on the KGA's website for primary and secondary stakeholders to conveniently download and review. Outreach meetings were held and presentations given to stakeholders during this phase at the same locations. These meetings focused on an overview of the GSP content, while giving stakeholders a public forum to provide their feedback and comments.

Once the public review period was complete, public comments were taken into consideration and incorporated into the final version of the KGA's GSP before submission to the DWR by January 31, 2020. Following submittal, stakeholders will be given a second 60-day comment period through the DWR's SGMA portal at http://sgma.water.ca.gov/portal/. Comments will be posted to the DWR's website prior to the state agency's evaluation, assessment and approval.

I.C.4 Phase 4: Implementation and Reporting

Phase 4: Implementation and Reporting will begin once the plan is submitted by January 31, 2020. Even while the DWR is reviewing the GSP, SGMA-implementation at the GSA-level must begin. During the implementation phase, communication and engagement efforts will be shifted to educational and informational awareness of the requirements and processes for reaching groundwater sustainability. Active involvement of all stakeholders is encouraged during this phase, and public notices are required for any public meetings and prior to imposing, and later increasing, any fees.

D. Overriding Concerns, Major Concerns or Challenges

Through preliminary discussions with primary stakeholders during the KGA's Stakeholder Committee meetings, overriding concerns, major concerns or challenges are centralized around economic impacts to the agricultural industry, which will also have a direct impact on DACs. Economic impacts could include loss of jobs and loss of tax revenue due to the decreased land values of fallowed ground. Many of DAC residents are employed by the agricultural industry, and many infrastructure improvement projects within these communities are facilitated by the County of Kern and funded through state and federal funding secured with the assistance of technical providers. The agricultural industry and DACs will be the main target audiences for direct outreach meetings because of the significant impact SGMA implementation will have on these two users of groundwater.

A summary of additional top concerning issues affecting groundwater, and the effect of SGMA on agriculture and rural communities/DACs is listed in **Table III-1**.

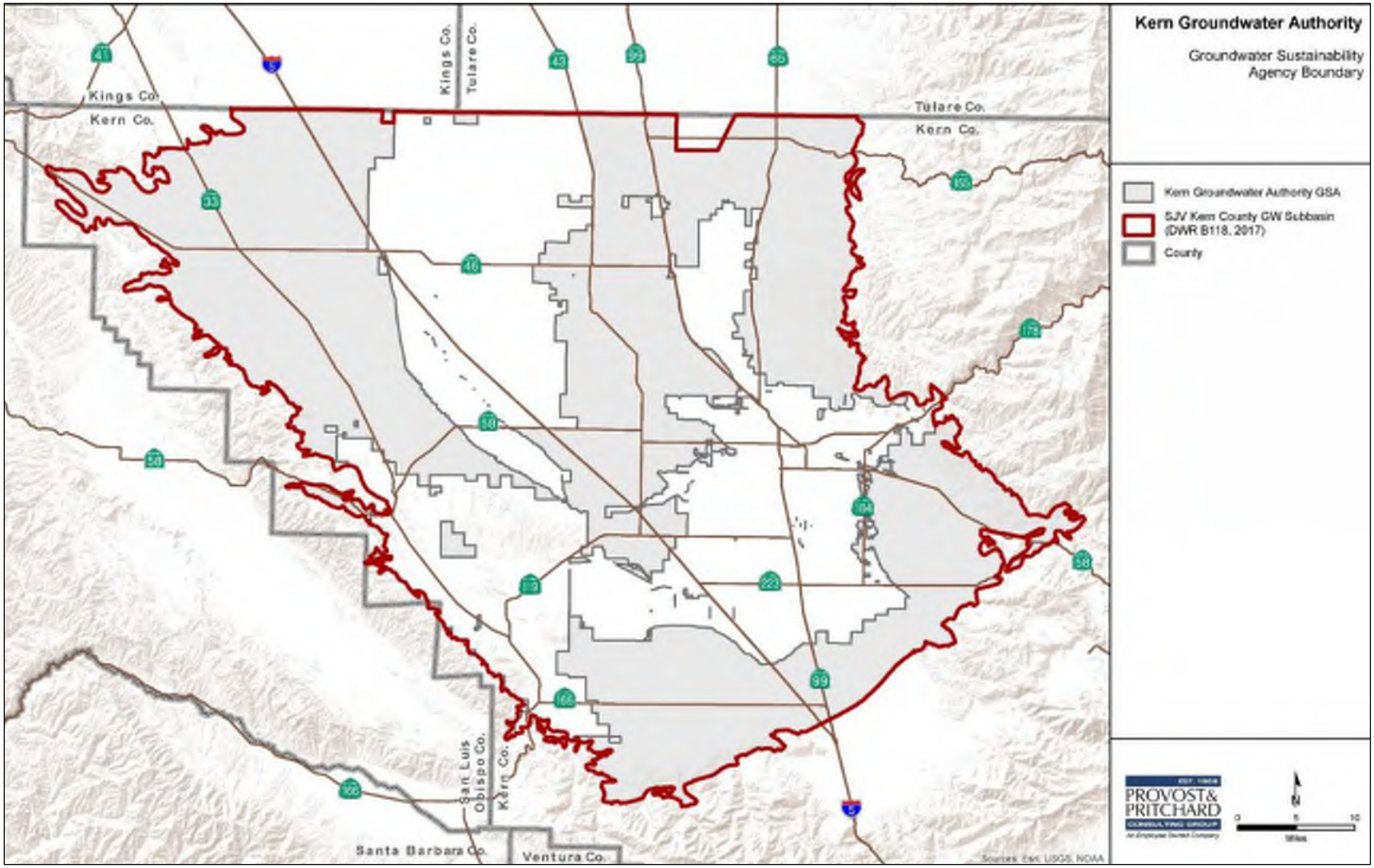


Figure I-1. Kern Groundwater Authority GSA Boundary

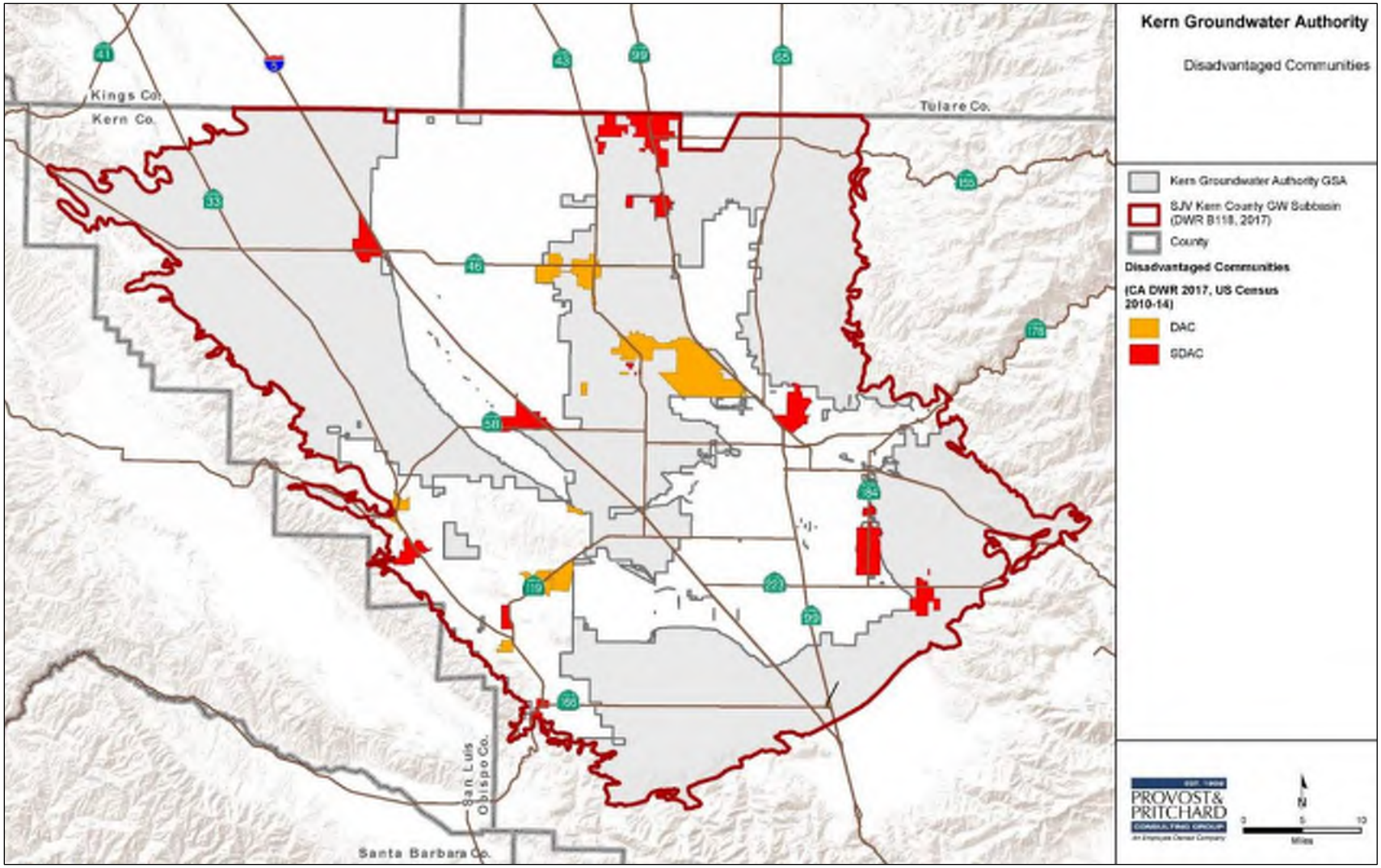


Figure I-2. Disadvantaged Communities within the Kern Groundwater Authority

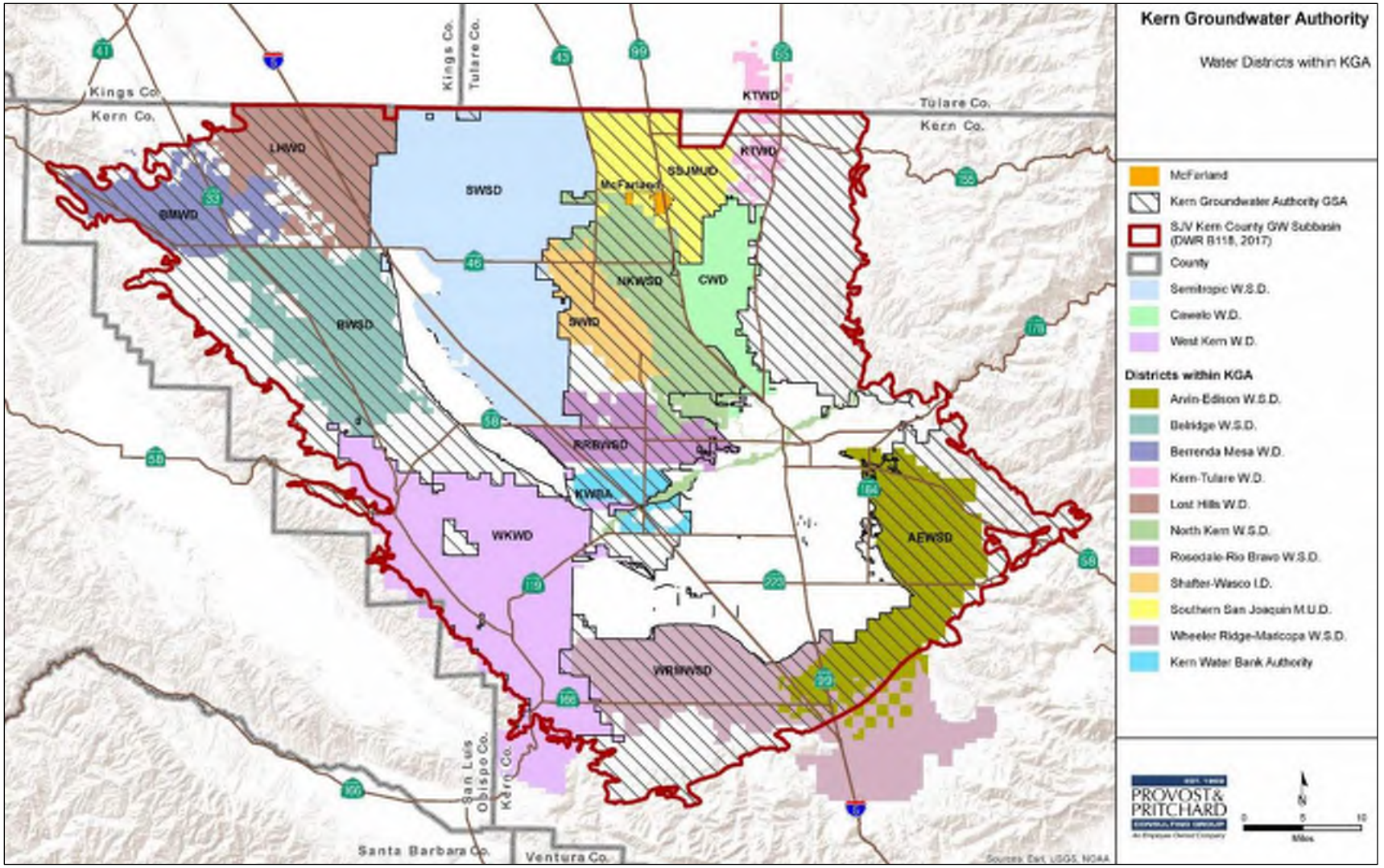


Figure I-3. Kern Groundwater Authority Public Agencies and Water/Irrigation Districts

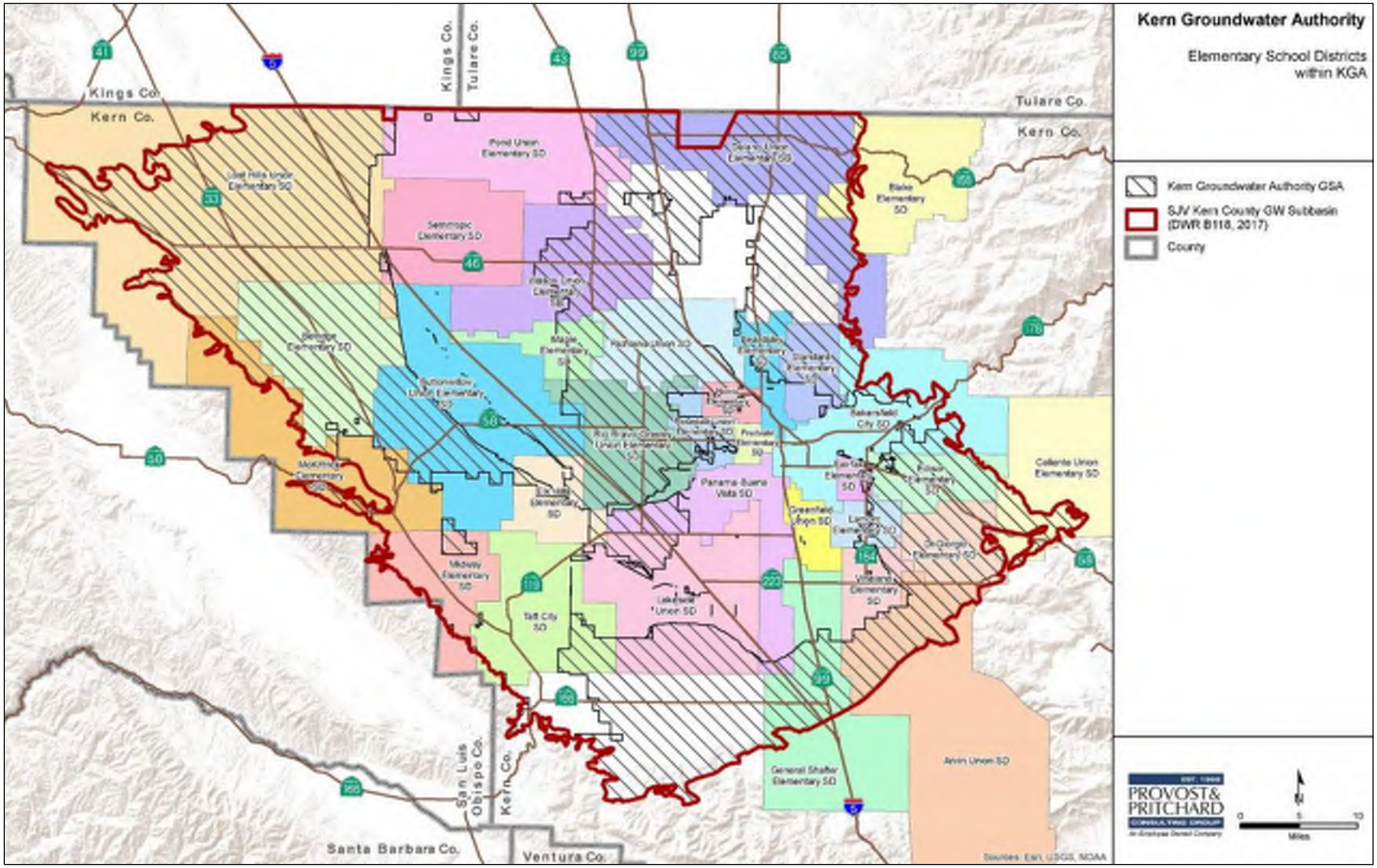


Figure I-4. Elementary School Districts within Kern Groundwater Authority

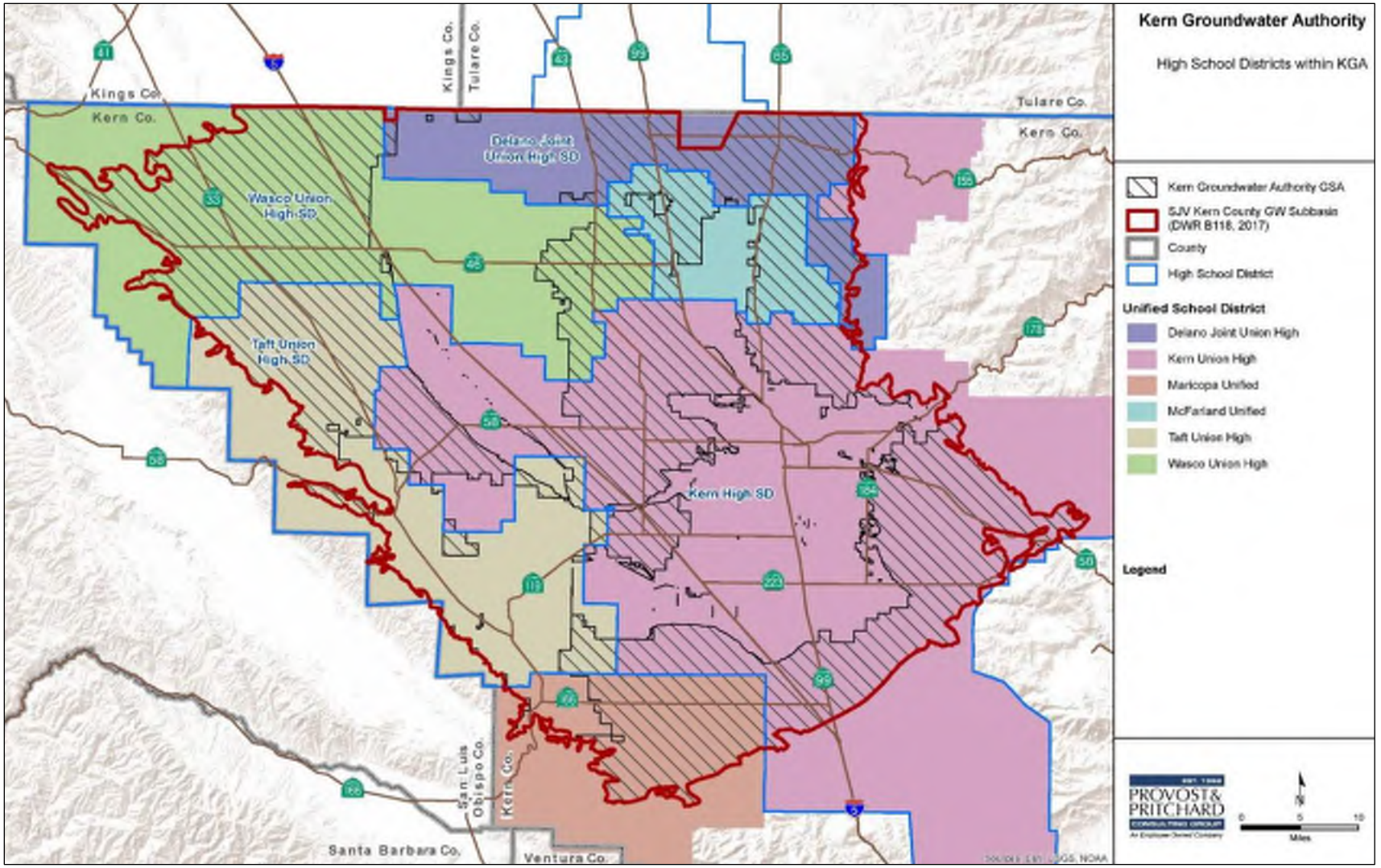


Figure I-5. High School Districts within Kern Groundwater Authority

II. Audience Identification

A. Primary Stakeholder Groups

The primary stakeholder groups of the Kern Groundwater Authority are members of the Board of Directors and Stakeholder Committee. Their specific roles in the communication and engagement process are discussed in this section.

II.A.1 Role of Board of Directors

The Kern Groundwater Authority's Board of Directors is the governing body of the GSA and was formed to adopt general policies regarding development and implementation of the GSP. The Board is comprised of one representative and an alternate from each of the general member agencies (**Table I-1**).

The Board of Directors meetings are held on the fourth Wednesday of every month at the Kern County Administration Building, located at 1115 Truxtun Avenue in Bakersfield, unless otherwise posted on the KGA's website, www.kerngwa.com/board-of-directors.html.

II.A.2 Role of KGA/GSA Managers Committee

The KGA/GSA Managers Committee meets weekly to coordinate the developments of all five groundwater sustainability plans in the Kern Subbasin. The committee is comprised of KGA management and managers from each GSA. The meetings are held every Friday at 8 a.m. at the Rosedale-Rio Bravo Water Storage District office, located at 849 Allen Road in Bakersfield.

II.A.3 Role of Stakeholder Committee

In Section 10727.8 "Public Notification and Participation; Advisory Committee" of the Sustainable Groundwater Management Act, GSAs may appoint and consult with an advisory committee for the purpose of developing and implementing a GSP. Through this advisory committee, the GSA is able to encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater basin prior to and during the development and implementation of the GSP.

In the general interest of encompassing representatives of all interests of the sub-basin, Kern Groundwater Authority established a Stakeholder Committee. These representatives encompass residential, agricultural, environmental, rural, domestic well, and municipal interests. The specific role of the KGA's Stakeholder Committee is to serve as a sounding board for the ideas/concepts developed by the KGA/GSA Managers Committee. Their comments and input have been and will continue to be encouraged and considered in the development of SGMA concepts and implementation.

The Stakeholder Committee meets on the first Monday of every month at 3 p.m. at the Rosedale-Rio Bravo Water Storage District, located at 849 Allen Road in Bakersfield, California, unless otherwise posted on the KGA's website: www.kerngwa.com/stakeholders.html.

B. Secondary Stakeholder Groups

Secondary stakeholder groups have been identified by the Kern Groundwater Authority, based on discussions of interests identified in SGMA, Section 10723.2 "Consideration of All Interests of All Beneficial Uses and Users of Groundwater" (**Table II-1**).

Table II-1. Consideration of All Interests of All Beneficial Uses and Users of Groundwater

SGMA, Section 10723.2. Consideration of All Interests of All Beneficial Uses and Users of Groundwater		
Agricultural Users	Domestic Well Owners	Municipal Well Operators
Public Water Systems	Local Land Use Planning Agencies	Environmental Users of Groundwater
Surface Water Users	Federal Government	California Native American Tribes
Disadvantaged Communities	Entities monitoring and reporting groundwater elevations in all or part of a groundwater basin	

Based on these discussions, secondary stakeholders to be targeted for communication and engagement during the GSP development, public review and implementation phases have been narrowed to those with financial, political, business or personal stakes in the management and sustainability of groundwater within the jurisdiction of the Kern Groundwater Authority. These secondary stakeholders are listed in **Table II-2**.

Table II-2. Secondary Stakeholder Groups with Interests in the Kern Groundwater Authority

Secondary Stakeholder Groups with Interests in the Kern Groundwater Authority		
Agricultural Users	Domestic Well Owners	Municipal Well Operators
Public Water Systems	Local Land Use Planning Agency	Environmental User
Surface Water Users	Native American Tribes	Disadvantaged Communities
City Resident*	Food Processor*	Industrial User/Oil Producer*
Entity monitoring and reporting groundwater elevations in all or part of a groundwater basin		

*Additional secondary stakeholder groups identified by the KGA

Secondary stakeholder groups will be engaged through public outreach meetings and email blasts. These meetings will be held during Phase 2: GSP Preparation and Submission, Phase 3: GSP Review and Evaluation, and Phase 4: Implementation and Reporting.

II.B.1 Native American Tribes

Native American Tribes within the KGA boundary will be invited to participate in GSP development. The KGA will reach out to them by sending them a letter about SGMA and the KGA along with a stakeholder survey. These tribes are listed in **Table II-3**.

Table II-3. Native American Tribes in the Kern Groundwater Authority

Native American Tribe	Contact	Contact Information
Kitanemuk & Yowlumne Tejon Indians (Yowlumne Kitanemuk)	Delia Dominguez, Chairperson	115 Radio Street Bakersfield, CA 93305 Telephone: (626) 339-6785 Email: deedominguez@juno.com

Source: Native American Heritage Commission, Native American Contacts (January 18, 2018)

C. Community Organizations, Public Agencies and Other Entities

There are many community organizations, public agencies and other entities throughout the KGA's boundary that will be utilized to reach out to secondary stakeholders. These resources identified as avenues for outreach opportunities are listed in **Table II-4**. Additional community organizations, public agencies and entities may be added to the list as GSP development and implementation phases move forward, and additional connections are made between the KGA and the communities within its boundary.

The Kern Groundwater Authority will communicate with these resources and request opportunities to give presentations at their respective meetings. If a Board of Director or Stakeholder Committee member is currently involved with or has contacts within a community organization, public agency or other entity, they may present on behalf of the KGA to further outreach efforts. Presentations may include an overview on SGMA and why it is important to the audience, explanation and updates of the GSP development process including an awareness of the public review period, and education of GSP requirements during the implementation phase. In addition, the KGA and the member districts will work with these organizations and agencies to distribute stakeholder surveys, public outreach meeting notices, and educational information via email distribution, social media posts, and printed materials (handouts).

II.C.1 School Districts

School districts within the KGA boundary are also listed in **Table II-4**. While many of the schools receive their water from the cities they are located in, they are an avenue for communicating with stakeholders whose students attend the schools, particularly families within DACs/SDACs.

Table II-4. Community Organizations and Public Agencies

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Agriculture Organizations			
California Citrus Mutual	Agricultural Users, Domestic Well Owners, Surface Water Users	https://www.cacitrusmutual.com/	Kern Groundwater Authority
California Women for Agriculture – Kern Chapter	Agricultural Users, Domestic Well Owners, Surface Water Users	Email: kerncountycwa@gmail.com	Kern Groundwater Authority
Kern River Watershed Coalition Authority (KRWCA) – Irrigated Lands Regulatory Program	Agricultural Users, Domestic Well Owners, Surface Water Users	http://www.krwca.org	Kern Groundwater Authority
Kern County Cattlewomen	Agricultural Users, Domestic Well Owners, Surface Water Users, Environmental	http://www.kerncattlewomen.org/	Kern Groundwater Authority
Kern County Cattlemen's Association	Agricultural Users, Domestic Well Owners, Surface Water Users, Environmental		Kern Groundwater Authority
Kern County Farm Bureau, Kern County Young Farmers & Ranchers	Agricultural Users, Domestic Well Owners, Surface Water Users	https://kerncfb.com/	Kern Groundwater Authority
University of California Cooperative Extension – Kern County	Agricultural Users, Domestic Well Owners, Surface Water Users	http://cekern.ucanr.edu/	Kern Groundwater Authority
DACs/Environmental Justice Organizations			
Center for Race, Poverty & the Environment (Delano office)	DACs and SDACs, Environmental Users	https://crpe-ej.org/en/	Kern Groundwater Authority
Community Water Center	DACs and SDACs	http://www.communitywatercenter.org/	Kern Groundwater Authority
Leadership Counsel for Justice & Accountability	DACs and SDACs	http://www.leadershipcounsel.org/	Kern Groundwater Authority
Rural Communities Association Corporation	Agricultural Users, Domestic Well Owners, Environmental, DACs	http://www.rcac.org/	Kern Groundwater Authority
Self-Help Enterprises	DACs and SDACs	https://www.selfhelpenterprises.org/	Kern Groundwater Authority

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Environmental Organizations			
Audubon California	Environmental Users	http://ca.audubon.org/	Kern Groundwater Authority
California Waterfowl	Environmental Users	https://www.calwaterfowl.org/	Kern Groundwater Authority
Ducks Unlimited	Environmental Users	http://www.ducks.org/california/california-state-district-chairmen	Kern Groundwater Authority
Sequoia Riverlands Trust	Environmental, Agricultural Users	http://sequoiariverlands.org/	Kern Groundwater Authority
Sierra Club – Kern-Kaweah Chapter, Buena Vista Group	Environmental Users	https://www.sierraclub.org/kern-kaweah/buena-vista-group	Kern Groundwater Authority
Tejon Ranch Conservancy	Environmental, Agricultural Users	http://www.tejonconservancy.org/	Kern Groundwater Authority
The Nature Conservancy	Environmental	http://www.nature.org	Kern Groundwater Authority
Irrigation Districts/Water Districts/Water Agencies			
Arvin Community Services District	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	https://www.arvincsd.com/	Arvin Community Services District
Arvin-Edison Water Storage District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.aewsd.org/	Arvin-Edison Water Storage District
Kern County Integrated Regional Water Management Group	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators, Environmental Users	http://www.kernirwmp.com/	Kern Groundwater Authority
Cawelo Water District	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	http://www.cawelowd.org/	Cawelo Water District
Eastside Water Management Area (white area within Kern County)	Agricultural Users, Domestic Well Owners	Jim Beck (661) 333-7091; jbeck@hgcpm.com	Eastside Water Management Area, Kern Groundwater Authority

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Kern County Water Agency	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	http://www.kcwa.com/	Kern Groundwater Authority
Kern-Tulare Water District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems		Kern-Tulare Water District
Kern Water Bank Authority	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.kwb.org/	Kern Water Bank Authority
North Kern Water Storage District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://northkernwsd.com/	North Kern Water Storage District
Rosedale-Rio Bravo Water Storage District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.rrbwsd.com/	Rosedale-Rio Bravo Water Storage District
Semitropic Water Storage District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.semitropic.com/	Semitropic Water Storage District
Shafter-Wasco Irrigation District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.swid.org/	Shafter-Wasco Irrigation District
Southern San Joaquin Municipal Utility District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.ssjmud.org/	Southern San Joaquin Municipal Utility District
Tejon-Castaic Water District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems		Tejon-Castaic Water District
Water Association of Kern County	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.wakc.com/	Kern Groundwater Authority

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
West Kern Water District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	http://www.wkwd.org/	West Kern Water District
Westside District Water Authority	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems		Westside District Water Authority
Wheeler Ridge-Maricopa Water Storage District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs, Public Water Systems	https://wrmwsd.com/	Wheeler Ridge-Maricopa Water Storage District
Municipal Agencies/Chambers of Commerce			
Arvin Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	http://www.arvinchamberofcommerce.com/	Arvin Community Service District
Greater Bakersfield Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	https://www.bakersfieldchamber.org/	Kern River Groundwater Authority
City of McFarland	Public Water Systems, Municipal Well Operators, DACs	https://www.mcfarlandcity.org/	Southern San Joaquin Municipal Utility District
City of Shafter	Public Water Systems, Municipal Well Operators, DACs	https://www.shafter.com/	Shafter-Wasco Irrigation District
City of Taft	Public Water Systems, Municipal Well Operators, DACs	http://www.cityoftaft.org/	West Kern Water District
City of Wasco	Public Water Systems, Municipal Well Operators, DACs	http://www.ci.wasco.ca.us/	Shafter-Wasco Irrigation District
County of Kern – Board of Supervisors and County Management	Domestic Well Owners, Surface Water Users, DACs, Municipal Well Operators, Public Water Systems	https://www.kerncounty.com/	Kern Groundwater Authority
Greater Lamont Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	https://lamontchamber.wildapricot.org/	Arvin-Edison Water Storage District

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Shafter Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	http://www.shafterchamber.org/	Shafter-Wasco Irrigation District
Taft District Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	https://www.taftchamber.com/	West Kern Water District
Wasco Chamber of Commerce	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems, DACs, Municipal Well Operators	Post Office Box 783, Wasco, California 93280 Telephone: (661) 758-2746	Shafter-Wasco Irrigation District
School Districts & Parent-Teacher Associations			
Arvin Union School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://www.arvinschools.com/	Arvin Community Services District, Arvin-Edison Water Storage District
Bakersfield City School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.bcsd.com/	Arvin-Edison Water Storage District
Beardsley Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://beardsleyschool.org/	Kern Groundwater Authority, County of Kern
Belridge Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://belridgeschool.org/	Belridge Water Storage District
Blake Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs		Kern Groundwater Authority, County of Kern
Buttonwillow Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.buttonwillow.k12.ca.us/	Belridge Water Storage District, Rosedale-Rio Bravo Water Storage District
Caliente Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs		Arvin-Edison Water Storage District
Delano Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.duesd.org/	Southern San Joaquin Municipal Utility District, Kern-Tulare Water District, Lost Hills Water District
Delano Joint Union High School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.djuhsd.org/	Southern San Joaquin Municipal Utility District

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Di Giorgio Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://digiorgio.k12.ca.us/	Arvin-Edison Water Storage District
Edison Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.edison.k12.ca.us/	Arvin-Edison Water Storage District
Elk Hills Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://elkhills.k12.ca.us/	Kern Water Bank Authority
Fairfax Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.fairfax.k12.ca.us/	Arvin-Edison Water Storage District
General Shafter Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://generalshafter.org/	Arvin-Edison Water Storage District, Wheeler Ridge-Maricopa Water Storage District
Kern High School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.kernhigh.org/	Arvin-Edison Water Storage District, Wheeler-Ridge Maricopa Water Storage District, Kern Water Bank Authority, Rosedale-Rio Bravo Water Storage District, North Kern Water Storage District
Lakeside Union School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.lakesideusd.org/	Wheeler Ridge-Maricopa Water Storage District
Lamont Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.lamontschooldistrict.org/	Arvin-Edison Water Storage District
Lost Hills Union School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.losthills.k12.ca.us/	Lost Hills Water District, Berrenda Mesa Water District
Maple Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	Telephone: (661) 746-4439	Shafter-Wasco Irrigation District
Maricopa Unified School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://www.musd20.org/	Wheeler Ridge-Maricopa Water Storage District
McKittrick Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	Telephone: (661) 762-7303	Belridge Water Storage District

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Midway Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://midwayschooldistrict.org/	Kern Groundwater Authority
Norris School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.norris.k12.ca.us/	North Kern Water Storage District
Panama-Buena Vista School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.pbvusd.k12.ca.us/	Kern Water Bank Authority, Rosedale Rio Bravo Water Storage District
Pond Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://www.pond.k12.ca.us/	Southern San Joaquin Municipal Utility District, North Kern Water Storage District
Richland Union School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.richland.k12.ca.us/	Shafter Wasco Irrigation District, North Kern Water Storage District
Rio Bravo-Greeley Union School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://www.rbgusd.k12.ca.us/	Rosedale-Rio Bravo Water Storage District, Kern Water Bank Authority
Rosedale Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.ruesd.net/	North Kern Water Storage District, Rosedale-Rio Bravo Water Storage District
Standard Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://std-elem.standard.k12.ca.us/	Kern Groundwater Authority
Taft City School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://taftcityschools.com/	West Kern Water District
Taft Union High School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.taft.k12.ca.us/	West Kern Water District
Vineland Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	http://vineland.k12.ca.us/	Arvin-Edison Water Storage District
Wasco Union Elementary School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.wuesd.org/	North Kern Water Storage District, Shafter-Wasco Irrigation District
Wasco Union High School District	Agricultural Users, Domestic Well Owners, Surface Water Users, DACs	https://www.wascouhsd.org/	Shafter-Wasco Irrigation District

Community Organization & Public Agencies	Secondary Stakeholder Group(s)	Website	KGA Member Entity Responsible for Outreach
Service Clubs			
Kiwanis Club of Taft	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	http://taftkiwanis.org/	West Kern Water District
Kiwanis Club of Shafter	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	http://www.kiwanisdiv33.com/skhome.htm	Shafter-Wasco Irrigation District
Rotary Club of Taft	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	https://portal.clubrunner.ca/2865/	West Kern Water District
Shafter Lions Club	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	Post Office Box 1264, Shafter, California 93263; Email: gtalvarado5@yahoo.com	Shafter-Wasco Irrigation District
Shafter Rotary Club	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	http://rotarydistrict5240.org/clubinfophoto/shafter	Shafter-Wasco Irrigation District
Taft Midway-Sunset Lions Club	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	123 N. 10th Street, Taft, California 93268; Telephone: (661) 763-4977	West Kern Water District
Wasco Elks Lodge	Agricultural Users, Domestic Well Owners, Surface Water Users, Public Water Systems	Telephone: (661) 758-2235	Shafter-Wasco Irrigation District
Industries			
California Independent Petroleum Association (CIPA)	Industrial (Oil Production)	Telephone: (661) 395-5287; Email: willie@cipa.org	Kern Groundwater Authority

D. Interested Persons List

SGMA Section 10723.4 "Maintenance of Interested Persons List" states: *"The groundwater sustainability agency shall establish and maintain a list of persons interested in receiving notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. Any person may request, in writing, to be placed on the list of interested persons."* In compliance with the SGMA requirement, the Kern Groundwater Authority maintains a list of interested persons, and routinely distributes meeting notices and relevant information to the stakeholders who have requested to be included.

Over 300 individuals have signed up or been added to the Interested Persons List, and the KGA will continue to grow this contact list through the process discussed in **Section V.A.4**.

III. Audience Survey and Mapping

Through ongoing communications and public education and outreach efforts described in **Section V**, primary and secondary stakeholders will have the opportunity to have a voice in the GSP development process. This section discusses in detail the preliminary discussion with primary stakeholders, and implementation of the Stakeholder Survey, which will be a valuable source in collecting feedback from target audiences who have vested interests in how the implementation of the GSP will affect their interests.

A. Stakeholder Survey

III.A.1 Identification of Stakeholder Issues, Interests and Challenges

Stakeholder issues, interests and anticipated challenges are routinely discussed in Board of Directors and Stakeholder Committee meetings. Stakeholder Committee members represent the interests of the secondary stakeholders identified for the KGA (**Table II-2**). Two stakeholder surveys were developed and circulated to solicit input to identify issues, interests and challenges stakeholders are facing and concerned about. **Table III-1** summarizes preliminary responses, which were taken into consideration during the GSP development process and used as a basis for the development of fact sheets and public meeting presentations for secondary stakeholder groups.

Table III-1. Stakeholder Issues, Interests & Challenges

Stakeholder Issues, Interests & Challenges	
Top Concerning Issues Affecting Groundwater:	• Economic impacts (loss of jobs, loss of complete industries, loss of tax revenue due to decrease in land values of fallowed ground) • Overpumping and the subsequent legislation (over-regulation) • Long term quantity and quality • Government regulations and involvement • Fallowing of farmland (loss of production) • Water allocations for domestic use vs. agriculture production with SGMA implementation • Dry wells
Top Concerns of SGMA:	• Economic impacts (loss of jobs, loss of tax revenue due to decrease in land values of fallowed ground) • New regulations (i.e. SGMA and ILRP), and the impacts on investments and livelihoods • Legal rights to groundwater (concerns of unequal representation amongst landowners) • Water usage (surface water vs. groundwater) • Decreased quality of food for California and the United States as a whole • Concerns that the agriculture industry will have to pay for SGMA implementation for all of the beneficial users of groundwater

III.A.2 Survey Questions

Secondary stakeholders needed to have an opportunity to be heard during the GSP development process, in addition to the involvement of the primary stakeholders who represent their interests. The Stakeholder Survey process is a way to gather information from these individuals. The process for conducting the Stakeholder Surveys is discussed in **Section V.A.4**. The final Stakeholder Surveys are included in **Appendix B**, in both English and Spanish.

III.A.2.1 Initial Stakeholder Survey

The initial Stakeholder Survey circulated by KGA and its members was based on survey questions recommended by the DWR, which are listed below. A memorandum with the survey results is included in **Appendix B.** The KGA Board of Directors adjusted the wording on a few of the questions:

1. Are you familiar with Sustainable Groundwater Management Act (SGMA) regulations?
2. Are you currently working on or discussing groundwater management in this region?
3. Do you own or manage/operate land in this region?
4. Do you manage water resources? If yes, what is your role?
5. What is your primary interest in land or water resources management?
6. Do you have concerns about groundwater management? If so, what are they?
7. Do you have requests or recommendations regarding groundwater management? If so, what are they?

The Kern Groundwater Authority incorporated additional questions into the survey to further define the needs and concerns of the users within the GSA boundary:

1. Where are you getting your water supply?: City or Community Water System, Surface, Groundwater, Both Groundwater & Surface Water, Unknown
2. Agriculture & Domestic Well Users: What is your well(s) depth?
3. Agriculture & Domestic Well Users: Has your well(s) ever gone dry? If so, when (month/year)?
4. If you are an Agricultural User, do you: Irrigate, Dry Farm, Graze Livestock, Other
5. How reliable is your current groundwater supply?
6. If you grow crops, do you use irrigation for frost protection?
7. Any other information the Kern Groundwater Authority should be aware of or take into consideration while developing the GSP?

If follow-up questions were needed further into the GSP development phase, a second Stakeholder Survey would have been developed and circulated amongst stakeholders who completed the initial round of surveys.

III.A.2.2 Agriculture-Focused Stakeholder Survey

A second Stakeholder Survey was developed and tailored specifically for agriculture stakeholders. Questions and options from the Ag-Focused Stakeholder Survey are listed below. A memorandum with the survey results is included in **Appendix B**.

1. We have included a map of the Kern Groundwater Authority irrigation and water districts. Please indicate below which districts you have land parcels. (check all that apply)
2. How many total acres do you farm (all land owned, leased and/or managed)?
3. In a typical year, how much of the following crops, animals or land do you manage/own? Options included: fruit trees, nut trees, row crows, seed crops, vegetables, grain, grapes, hay/alfalfa, livestock on pasture/rangeland, dairy (total head), food processor/production, or "other" land use.
4. Which of the following sources of water and management do you typically utilize under the following conditions (dry years, normal years, wet years)? Water source/management options included: irrigation through surface water only, irrigation through groundwater only, irrigation through a mixture of surface and groundwater, wastewater land applied, and no irrigation.
5. If you do use irrigation, which of the following methods of delivery do you use? Option included furrow/flood, sprinklers, drip, microsprinkler, center pivot, and "other."

6. In response to water scarcity, please indicate if you currently use the following practices and your likelihood to use the following practices in the future. Practices listed included: drill more wells, restore existing wells, make existing wells deeper, pump more groundwater than previous years, drip irrigation, water monitoring technology, fallow fields, soil moisture sensors, change to a less water intensive crop, reduce livestock stocking rates, leaf sampling to measure plant-water status, purchase additional water, purchase crop insurance, and "other."
7. Please rate the level of importance these potential groundwater conditions are to you (with "1" being the most concerning, "5" being the least concerning). If you have additional concerns, please indicate them in the "Other" category. Groundwater conditions listed for rating included: lowering of groundwater levels, reduction in groundwater storage, water quality degradation, local subsidence, depletions of surface water, and "other."
8. The following are a list of management options that have been used on the West Coast for water management. Please provide your level of preference for these types of management (ranging from strongly against to strongly support, and not familiar). Management options listed included: individual recharge credits (i.e. winter flooding), water metering, water trading through markets, public program highlighting farmers implementing water saving practices, farmer adoption of water management practices, district investment in conjunctive use infrastructure (i.e. water storage), groundwater replenishment fees, fixed quota for water pumping allocated to each farmer, incentives for water saving practices, moratorium on drilling new wells, permits for drilling new wells, and "other."
9. If groundwater is required in the future, which of the following monitoring methods would you prefer (ranging from strongly not preferred to strongly preferred)? Methods of determining water allocation listed included: well metering, use satellite estimates and ground truth, and use standard crop water requirement indexes.
10. Should disputes arise over SGMA implementation, what is your preferred means of reconciliation (ranging from strongly not preferred to strongly preferred)? Dispute options included: State Water Resources Control Board, groundwater sustainability agency, County Board of Supervisors, Superior Court system, arbitration, and "other."
11. If you have any additional information or feedback regarding SGMA, water management, or farming in Kern County that should be taken into consideration while developing the Groundwater Sustainability Plan, please provide the information below.

III.A.3 Stakeholder Survey Distribution

Printed and online distribution methods for the Stakeholder Survey are described in **Section V.A.3.2** and **Section V.A.4**. Surveys were part of the KGA's Board of Directors agenda every month to review results and discuss submitted stakeholder input. The result summaries from both surveys are include in **Appendix B**.

B. "Lay of the Land" Overview

Results from Stakeholder Surveys will be compiled into a "Lay of the Land Overview" to categorize the feedback received so the technical team can utilize the information during the GSP development phase. This data will be sorted by:

- Type of stakeholder
- Key interests related to groundwater

- Key issues (documented or specific issues of past events)
- Which section of the GSP is this applicable to?

Preliminary results from stakeholder surveys completed in April 2018 are listed in **Table III-1**. These results will be used as a basis for the development of fact sheets and key messages and talking points (**Section IV**).

III.B.1 Types of Stakeholders

Types of stakeholders with the greatest interests in the GSP development and resulting implementation efforts to reach groundwater sustainability include agricultural users, domestic well owners, municipal well operators, public water systems, environmental users, surface water users, and disadvantaged communities.

Stakeholder surveys are geared more specifically for agricultural users, domestic well owners, surface water users, and residents of disadvantaged communities. Representatives of municipal well operators, public water systems and environmental users are integral parts of the primary stakeholder group, and are a more specific, smaller target audience. Surveys will not be tailored specifically for their interests, as information can be more easily gained and addressed through one-on-one conversations and collaborative discussions.

III.B.2 Stakeholder Key Interests Related to Groundwater

The key interests of stakeholders related to groundwater within the KGA boundary include:

- Drinking water
- Domestic, everyday usage
- Agriculture – Farming, ranching (livestock)
- Industrial, food processing, oil production, power generation
- Recreational
- Environmental ecosystem management areas

III.B.3 Key Documented Issues

Several key documented water resources issues have affected, or have the potential to affect, the interests of stakeholders within the Kern Groundwater Authority boundary. As key documented issues arise throughout GSP development, public review and implementation phases, they will be added to this section.

- **Dry Wells –** Several private wells within Kern County have gone dry for various reasons including drought implications and poor infrastructure of the existing wells. Self-Help Enterprises and the County of Kern are working with owners to mitigate the situation.

IV. Messages and Talking Points

Key messages and talking points will be broken down by phases and stakeholder groups, as different factors and issues will affect different groundwater interests. These messages and talking points are also prone to evolve as the GSP is developed, leaving this section open to being amended and finetuned as communication and engagement efforts move forward.

Fact sheets reflecting key messages will be developed and tailored for the specific GSP development, public review and implementation phases, and made available for public education efforts described in **Section V.A.3.2**.

IV.A.1 Key Messages & Talking Points

IV.A.1.1 Universal Key Messages

Universal key messages will be a consistent part of fact sheets and talking points throughout all phases of GSP development, public review and implementation.

- What is SGMA
- Common Uses of Groundwater
- What is the Role of a GSA
- KGA Purpose Statement – Establish and execute a plan that will sustain and manage groundwater within the Kern Sub-basin in a way that is cost-effective, with minimal negative impacts to the beneficial uses and users.

IV.A.1.2 Phase 1: GSA Formation and Coordination

The Phase 1: GSA Formation and Coordination has been completed. During this phase, key messages centered around developing the Board of Directors, official formation of the GSA, and soliciting individuals who represent the interests of all beneficial usages and users of groundwater within the KGA boundary to fill the seats of the Stakeholder Committee.

IV.A.1.3 Phase 2: GSP Preparation and Submission

The first fact sheet will be developed and made available on the KGA website, as well as distributed at public outreach meetings and community organization presentations, and with stakeholder surveys. In addition to the universal key messages, the fact sheet for the GSP development and submission phase will include:

- Timeline of the GSP process
- Industry-related water usage – Common practices and conservation efforts (tailored specific to district stakeholders)
- Industry-related educational statistics for community and economic impacts (tailored specific to district stakeholders)
- Top concerns – Everyday usage/lifestyle impacts, economic impacts, land fallowing
- Direction on providing input/voicing concerns (outreach meetings, stakeholder surveys)
- Importance of imported water for people and economic viability

IV.A.1.4 Phase 3: GSP Review and Evaluation

Once the draft of the KGA's GSP is completed, a second fact sheet will be developed. This fact sheet will also consist of the universal key messages, while the rest of the content will be focused on:

- Timeline of the GSP process
- Main points/overview of the GSP
- Process for public review of GSP draft and providing comments to the KGA
- Additional key messages may be added for this phase.

IV.A.1.5 Phase 4: Implementation and Reporting

Once the KGA's GSP has been submitted to the DWR, the implementation phase will begin, and key messages will be developed with a focus on implementation efforts that affect the secondary stakeholder groups, which will likely result in more than one fact sheet. As with the previous phases, universal key messages will be included.

IV.A.2 Likely Questions or Issues and Responses

The "Likely Questions or Issues" list in **Table IV-1** will evolve through the GSP development, public review and implementation phases. This table will expand as additional questions surface throughout the phases, and responses will be updated as the KGA's GSP is developed and answers are more clearly defined.

Table IV-1. Likely Questions or Issues

Likely Question or Issue	Response	Phase
"Will I have to fallow my land?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1 & 2
"How can I voice my concerns about how SGMA is going to affect me?"	The public is invited to attend Stakeholder Committee meetings and Board of Director meetings to be informed about the progress of GSA and GSP development. Public outreach meetings will be held in 2018, and stakeholder surveys may be completed online via www.kerngwa.com, which will give the public a direct voice into the development of the GSP.	Phase 2
"How much water are we going to be able to pump?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1 & 2
"Are our ag pumps going to be metered? If so, who is going to pay for it?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1 & 2
"What types of management actions and/or projects can improve groundwater conditions?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1 & 2
"Can groundwater management activities improve water challenges in DACs?"	That information has not been determined yet, as we are in the preliminary stages of GSP development.	Phase 1 & 2

V. Venues for Engaging

There are a variety of opportunities, venues and methods for the Kern Groundwater Authority to connect with and engage stakeholders throughout GSA formation, GSP development, GSP review, and GSP implementation phases. Stakeholder groups identified in **Section II** will be engaged in communication efforts as detailed below.

A. Direct Stakeholder Outreach

V.A.1 Collaboration Meetings – Primary Stakeholders

As detailed in **Section II.A**, regular meetings with primary stakeholder groups will be held during their regularly scheduled times. Members of the public and partners from other local agencies are encouraged to attend Board of Directors and Stakeholder Committee meetings to voice their thoughts and concerns throughout the GSP development, public review and implementation phases. Meeting notices and agendas are routinely distributed to the Interested Parties List and are posted on www.kerngwa.com.

Primary stakeholder meetings are held:

- **Board of Directors Meetings –** Fourth Wednesday of every month at 8 a.m. at the Kern County Administration Building, located at 1115 Truxtun Avenue in Bakersfield, California.
- **Stakeholder Committee Meetings –** First Monday of each month at 3:30 p.m. at the Rosedale-Rio Bravo Water Storage District, located at 849 Allen Road in Bakersfield, California.

V.A.2 Educational/Outreach Public Meetings

V.A.2.1 Secondary Stakeholders

Educational/outreach public meetings will be scheduled for Phase 2: GSP Preparation and Submission, Phase 3: GSP Review and Evaluation, and Phase 4: Implementation and Reporting (see **Section VI** for the proposed meeting schedule). These meetings will be important as the GSP will affect all groundwater users within the KGA jurisdiction, and the impact of the SGMA implementation is significant. Stakeholders are already inquiring about the impacts of implementation, while many stakeholders are unaware of the SGMA. Spanish translation services will be available at educational/outreach public meetings.

- **Phase 2: GSP Preparation and Submission –** Public meetings held during Phase 2 were geared towards an overview of SGMA, overview of the GSP development process, public review and implementation (what stakeholders can expect), distribution of stakeholder surveys, and question/answer sessions. This segment of public meetings gave secondary stakeholders an opportunity to be involved in GSP development and share their thoughts and concerns. Possible venues within the KGA are listed in **Table V-1**.
- **Phase 3: GSP Review and Evaluation –** During Phase 3, the draft of the KGA's GSP was distributed for public review. During the public review period, public meetings were held at the same venues as during Phase 2 (**Table V-1**). Presentations included an overview of the GSP and gave stakeholders the opportunity to comment on the draft in a public forum.

- **Phase 4: Implementation & Reporting –** Public meetings will be crucial during Phase 4 and will likely be ongoing to educate stakeholders on implementation requirements and guide them through the steps to compliance and groundwater sustainability.

V.A.2.2 Community Organizations & Others

Community organizations, public agencies and other entities are listed in **Table II-3**, and will be contacted to schedule opportunities to present at their respective meetings throughout the GSP development phase. Presentations will include an overview on SGMA and why it is important to them, an explanation of the GSP development process, including an awareness of the public review period. In addition, the KGA will work with these organizations and agencies to distribute stakeholder surveys, public outreach meeting notices, and educational information via email distribution, social media posts, and printed materials.

V.A.2.3 Meeting Notification Process

Stakeholders will be invited to public meetings through distribution of meeting notices to KGA's district/member agency distribution lists, community organizations' contact lists, and press releases and public service announcements. Press releases will be distributed to local media outlets announcing the meeting dates, times and locations. Local community organizations, such as the Kern County Farm Bureau and Self-Help Enterprises, will be asked to distribute meeting notices via email blasts to their membership/contact lists. When implementation begins, and specific stakeholders need to be informed of upcoming compliance requirements, addresses of property owners within the KGA boundary can be obtained through the County of Kern. Postcards are most cost effective for mailing and can later be used to expedite meeting check-in and track attendance, if required during the implementation phases.

V.A.2.4 Ideal Venues

Venue locations will need to have a capacity to hold large audiences. The location list in **Table V-1** will be updated with additional information and other venue possibilities as meetings are scheduled, and venue availability and rental price is confirmed. KGA will work with disadvantaged communities and community organizations such as Self-Help Enterprises and Leadership Counsel for Justice & Accountability to hold outreach meetings at convenient times and locations within the DACs/SDACs.

Table V-1. Potential Public Meeting Venues & Locations

Venue	Location
Kern Ag Pavilion, Kern High School District	Bakersfield
Wasco Elk's Lodge	Wasco, Shafter
Shafter Veteran's Building	Wasco, Shafter
Arvin Veteran's Hall	Arvin

V.A.3 Printed Communication

V.A.3.1 Branding

Branding is defined as the process of creating distinctive and durable perceptions in the minds of a target audience. A brand is a specific look – a persistent, consistent, unique identity for an organization, making it easy for an audience to identify an organization through its consistent and frequent use of branding. The KGA has developed a brand that will be incorporated in all forms of communication and engagement with the public, which includes consistent usage of the official logo, fonts and colors. The KGA Branding Summary is included in **Appendix A**.

V.A.3.2 Printed Materials

Printed materials will incorporate the visual imagery established through branding efforts and will be tailored for specific means of communication throughout the phases of GSP development, public review and implementation. All printed materials will be translated into Spanish.

- **Fliers –** Fliers will be designed and tailored for secondary stakeholder audiences and will encompass infographics and text with key messages that are pertinent for that phase of GSP development. Distribution will be via website posting, direct mail, email, and direct distribution as handouts at schools, community organization meetings, KGA outreach meetings, or door-to-door. For outreach to DACs/SDACs, any fliers created will be available in both English and Spanish languages.
- **Fact Sheets –** Fact sheets will be developed and updated for each of the GSP phases and will include a section with an overview of SGMA facts, and development, public review and implementation timelines. Fact sheets will be available for download at www.kerngwa.com, distributed at public meetings and community organizations/entities meetings, and emailed to the Interested Parties List and other community organizations' email distribution lists. Fact sheets will be available in both English and Spanish languages.
- **Letter Correspondence –** When letter correspondence is necessary, particularly during the public review and implementation phases, letters will be distributed via email or direct mail. Letters will include pertinent facts and explanations that need to be communicated to specific stakeholder groups.
- **Presentation Materials –** Power Point presentations will be utilized at educational/outreach public meetings. If a Power Point isn't possible to display for a meeting, display boards printed at 24-inch x 36-inch or larger in size will be used and set up on easels. Handouts of presentations and smaller versions of display boards can be distributed to stakeholders in attendance, emailed to the Interested Parties list, and posted on www.kerngwa.com for access by stakeholders as a recap of the meeting.
- **Stakeholder Surveys –** Digital creation and distribution of Stakeholder Surveys is discussed in **Section V.A.4**. For stakeholders who do not have access to the Internet to complete Stakeholder Surveys online, hard copies were available at educational/outreach public meetings and were distributed via direct mail upon request. Water districts distributed surveys in the monthly invoices sent to their customers, and via email blasts sent to their members. A Spanish version was also created for distribution within DACs/SDACs. As hard copy results are received, they were added to the Google Form version of the Stakeholder Survey in-house to efficiently tabulate survey results.
- **Newsletter –** Annual or bi-annual newsletters will be created during the GSP implementation phase to inform stakeholders of compliance requirements and groundwater sustainability updates, opportunities and programs within the Kern sub-basin. The newsletter will be distributed to those on the Interested Parties List and will be finetuned to include others who have specific roles and compliance requirements during GSP implementation.
- **Other Printed Materials –** Other printed materials may be needed to be developed during the GSP development, public review and implementation phases. These documents will also be available in both English and Spanish versions.

V.A.4 Digital Communication

Digital communication outlets will also be designed to incorporate KGA's branding and will be a significant mode of communication through the GSP development, public review and implementation phases.

- **Website –** Public meeting notices, agendas and minutes of the Board of Directors and Stakeholder Committee meetings are posted on the KGA's website, www.kerngwa.com. This website serves as an integral resource for primary, secondary and other community stakeholders within the KGA's boundary. Electronic files of printed materials, presentations and other educational resources, and a direct link to the Stakeholder Survey (English and Spanish versions) are accessible via the website.

  As Fact Sheets are created during the development, public review and implementation phases, a webpage with the same content will be incorporated into the current website sitemap and will be updated as the Fact Sheet is updated/redesigned. This will serve as a way for stakeholders to easily educate themselves on the GSP process and phases.

- **Stakeholder Surveys –** Stakeholder surveys were discussed in **Section III.A**, and were used for the deliberate polling of secondary stakeholders to give them a direct voice in the GSP development phase. Stakeholder surveys were created via Google Forms, and links to English and Spanish versions of the survey are posted on the www.kerngwa.com website and were utilized in email blasts to the Interested Parties list. Google Forms is free of charge to use, and survey results were easily exported into Excel to sort through for the KGA's member agencies and districts. The distribution process of stakeholder hard copies is described in **Section V.A.3.2**, and a copy of the final survey (English and Spanish versions) is included in **Appendix B**.

- **Email Distribution –** As required by SGMA 10723.4 "Maintenance of Interested Persons List," KGA maintains a contact list and regularly distribute emails to those who have expressed interest in the GSA's progress. These emails consist of meeting notices and other documents that are pertinent to the KGA and communication efforts. This process will continue.

  As outreach meetings are held, the email distribution list will grow through direct contact with stakeholders. As this list expands, a Constant Contact account will be established to more easily send out email blasts of news, digital versions of the newsletter, and updates to relevant to the interests of primary and secondary stakeholders within the KGA. A "Stay Informed About the Kern Groundwater Authority" form is posted on www.kerngwa.com/contact-us.html so website visitors can sign up for the email distribution list directly.

  Email blasts for meeting notices, stakeholder surveys, public review notices, and other crucial information will be coordinated with community organizations and stakeholder groups by utilizing their distribution lists. Examples of these organizations are Kern County Farm Bureau, Self-Help Enterprises, chambers of commerce, and irrigation districts within the KGA boundary. A complete working list of organizations are listed in **Table II-3**.

- **Social Media –** Coordination for social media posts announcing upcoming meetings, stakeholder surveys, public review notices, and other crucial information will be coordinated with public agencies, community organizations and stakeholder groups who operate social media sites through Facebook, Instagram, Twitter, and others. A working list of these organizations and the number of followers are listed in **Table V-2**.

Table V-2. Public Agencies & Community Organizations Social Media Outlets

Community Organization	Social Media Outlet/URL	Number of Followers
Arvin Chamber of Commerce	Facebook: @ArvinChamber	101
Audubon California	Facebook: @audubonca	134,044
Bakersfield Host Lions Club	Facebook: @bakersfieldhostlions	512
California Citrus Mutual	Facebook: @CaliforniaCitrusMutual	1,056
California Women for Agriculture – Kern County	Facebook: @Kern-County-California-Women-for-Agriculture	341
Center for Race, Poverty & the Environment	Facebook: @CRPE.EJ	3,992
City of Shafter	Facebook: @CityOfShafter	3,771
Community Water Center	Facebook: @communitywatercenter	1,722
County of Kern	Facebook: @CountyofKern	1,182
Ducks Unlimited	Facebook: @BakersfieldDucksUnlimited	619
Greater Lamont Chamber of Commerce	Facebook: @lamontchamberkern	953
Kern County Cattlewomen	Facebook: @KCCattleWomen	899
Kern County Cattlemen's Association	Facebook: @Kern-County-Cattlemens-Association	119
Kern County Farm Bureau	Facebook: @KernCountyFarmBureau	1,025
Kern County Farm Bureau Young Farmers and Ranchers	Facebook: @KernYoungFarmersAndRanchers	546
Leadership Counsel for Justice and Accountability	Facebook: @Leadership-Counsel-for-Justice-and-Accountability	865
Self-Help Enterprises	Facebook: @selfhelpenterprises	2,570
Sequoia Riverlands Trust	Facebook: @sequoiariverlands	1,928
Shafter Chamber of Commerce	Facebook: @shafterchamberofcommerce	698
Shafter Lions Club	Facebook: @shafterlions	226
Tejon Ranch Conservancy	Facebook: @tejonranchconservancy	4,410
The Nature Conservancy in California	Facebook: @natureconservancycalifornia	29,930

V.A.5 Media Coverage

Press releases and public service announcements (**PSA**) will be written and distributed to the media list of local newspaper publications, and television/radio stations. These press releases and PSAs will focus on notification of public engagement opportunities such as targeted stakeholder meetings, stakeholder survey circulation, public review/comment processes and opportunities, and GSP implementation.

Direct story pitches will be made when necessary via direct communication with news outlets throughout GSP development and implementation phases. These story pitches will focus on GSP development status

updates, how public input is being used, and general overview of SGMA and how it will affect stakeholders (residents and industry) within the KGA boundary.

Table V-3. Kern County Media Outlets

Media Outlet	Coverage Area
Arvin Tiller	Arvin-Lamont
Bakersfield Californian	Bakersfield
Kern Business Journal	Kern County
Ridgecrest Daily Independent	Ridgecrest
Taft Independent	Taft
Taft Midway Driller	Taft
The Shafter Press	Shafter, Kern County

VI. Implementation Timeline

The timeline for implementing the KGA's Communication & Engagement Plan will be broken down by phase:

- Phase 1: GSA Formation and Coordination – 2015 through 2017 (**Figure VI-1**)
- Phase 2: GSP Preparation and Submission – 2017 through 2019 (**Figure VI-2**)
- Phase 3: GSP Review and Evaluation – 2019 through 2020 (**Figure VI-3)**
- Phase 4: Implementation and Reporting – 2020 and ongoing

The timelines for Phase 1, Phase 2 and Phase are complete, but the timeline for Phase 4 will be developed following as implementation progresses.

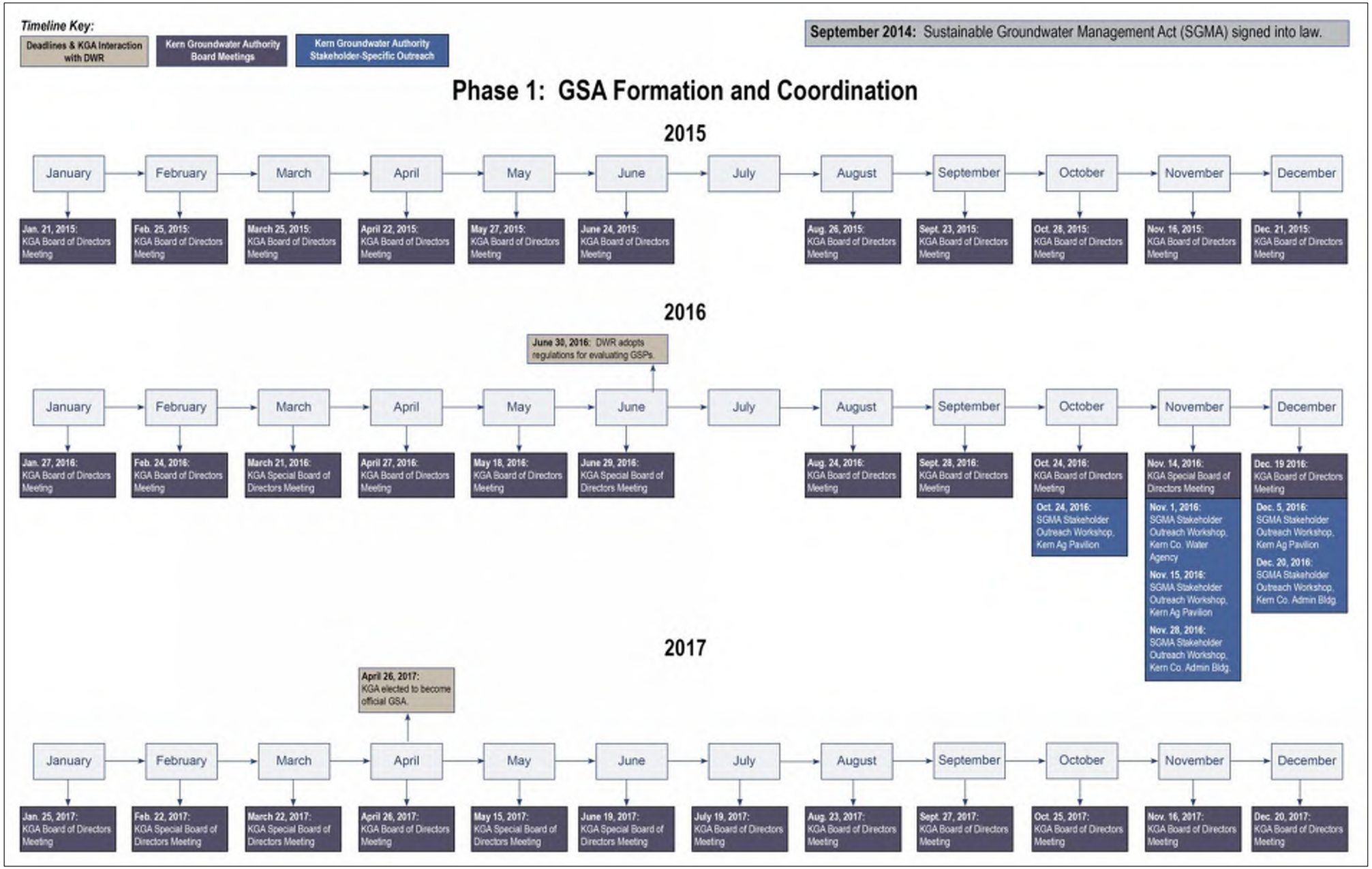


Figure VI-1. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 1: GSA Formation and Coordination

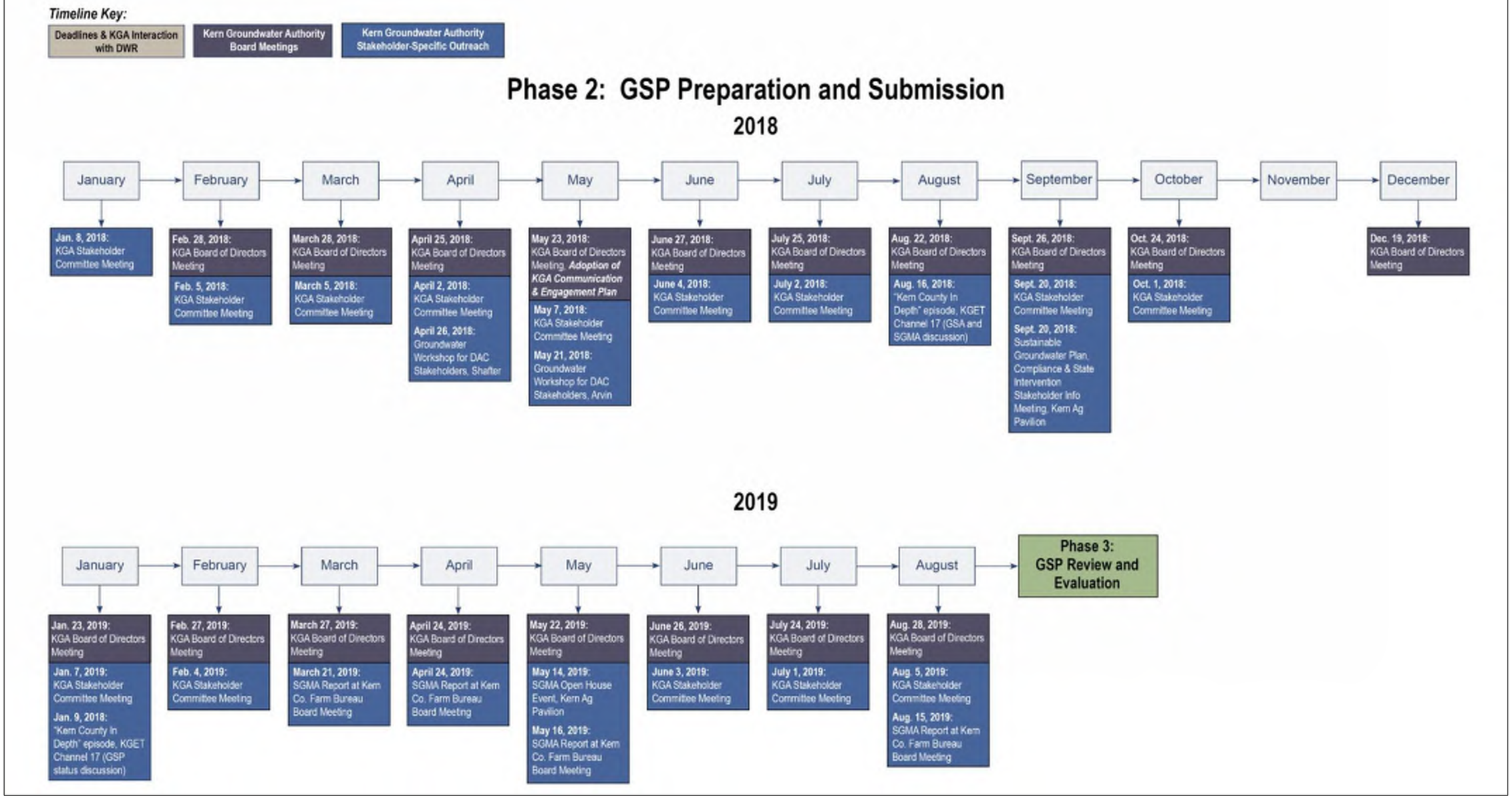


Figure VI-2. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 2: GSP Preparation and Submission, and Phase 3: GSP Review and Evaluation

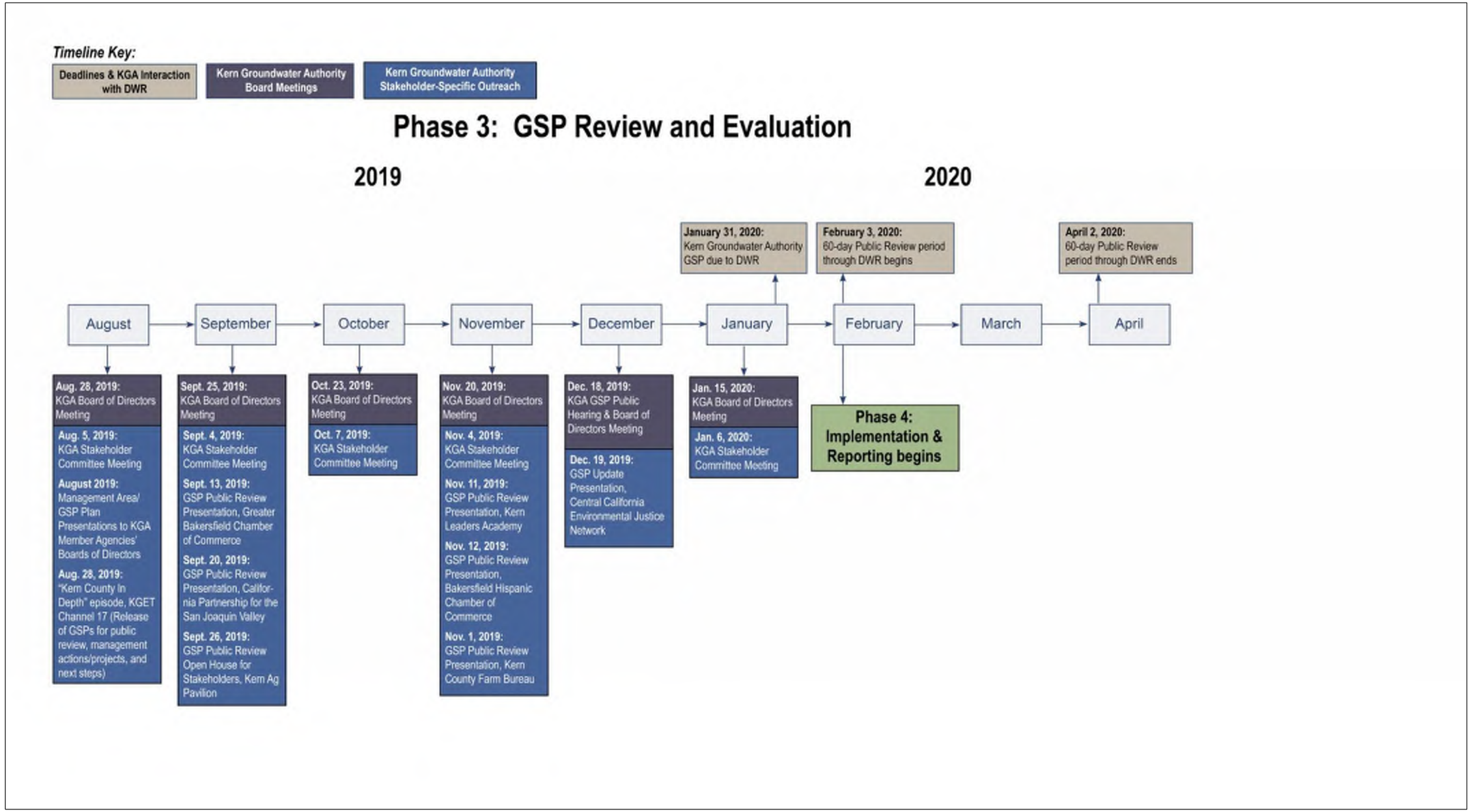


Figure VI-3. Kern Groundwater Authority's Communication & Engagement Timeline – Phase 3: GSP Review and Evaluation

VII. Evaluation and Assessment

A. Evaluation and Assessment Process

Having an established "checks and balances" process is essential in keeping public outreach goals on target. SGMA and the resulting GSP will affect everyone within the sub-basin, and outreach efforts must be all-encompassing. To evaluate and assess how outreach efforts are performing as compared to the goals and objectives detailed in the Communication & Engagement Plan, the Kern Groundwater Authority has established a process:

VII.A.1 Monthly Outreach Reports to Planning Manager

The Public Outreach Coordinator will provide monthly updates to the Planning Manager and Board of Directors (through board meeting attendance or memorandums). These updates will include, but will not be limited to:

- Status of upcoming outreach events, and recaps of past outreach events
- Results and status updates of stakeholder surveys
- Communication & Engagement Plan milestone updates/revisions
- Review/input and approval of printed materials (fliers, fact sheets, talking points, etc.)

VII.A.2 Quarterly Milestone Review

Once per quarter, a more in-depth discussion with the Stakeholder Committee and/or Board of Directors for feedback regarding communication and engagement efforts for the stakeholder groups the specifically represents. These discussions will cover:

- What has worked well?
- What hasn't worked as planned or could be finetuned for more effective results?
- Lessons learned
- Outreach needs that should be added to the implementation timeline
- Next steps

Following the quarterly review with the Stakeholder Committee and/or Board of Directors, the KGA's Planning Manager and Public Outreach Coordinator will meet to review public outreach status updates of tasks outlined in the adopted Communication & Engagement Plan, budget analysis, and feedback from the Board of Directors and/or Stakeholder Committee. Milestone updates will also be discussed, as necessary, to keep up to date with GSP development and implementation phases, and then taken to the Stakeholder Committee for discussion and subsequent approval.

Appendix A

Kern Groundwater Authority Branding Summary

Kern Groundwater Authority Branding Summary

Color Scheme

- Dark Blue ("Kern"): CMYK (96-91-45-54); RGB (21-25-58)
- Black ("Groundwater Authority" and lines): CMYK (0-0-0-100); RGB (35-31-32)

Appendix B

Stakeholder Surveys

KERN GROUNDWATER AUTHORITY

Stakeholder Survey

Date: _____

Stakeholder Type (check all that apply):

☐	Agricultural User	☐	Domestic Well Owner/User	☐	Municipal Well Operator
☐	Public Water Systems	☐	Local Land Use Planning Agency	☐	Environmental User
☐	Surface Water User	☐	Native American Tribe	☐	Disadvantaged/Rural Community Resident
☐	City Resident	☐	Food Processor	☐	Industrial User/Oil Producer
☐	Entity monitoring and reporting groundwater elevations in all or part of the groundwater basin				

Note: Please complete your name and contact information if you'd like to be added to the GSA's email and mailing list for future updates and information regarding Sustainable Groundwater Management Act (SGMA) and the Kern Groundwater Authority.

Name: _____

Address: _____

City: _____ **State:** _____ **Zip:** _____

Email: _____ **Telephone:** _____

1. **Are you familiar with Sustainable Groundwater Management Act (SGMA) regulations?** ☐ Yes ☐ No

2. **Are you currently working on or discussing groundwater management in this region?** ☐ Yes ☐ No

3. **Do you own or manage/operate land in this region?** ☐ Yes ☐ No

4. **Where are you getting your water supply?**
   ☐ City or Community Water System ☐ Surface ☐ Groundwater
   ☐ Both Groundwater & Surface Water ☐ Unknown

5. **Agriculture & Domestic Well Users: What is your well(s) depth?** _____

6. **Agriculture & Domestic Well Users: Has your well(s) ever gone dry?** ☐ Yes ☐ No
   If yes, when (month/year)? _____

7. **If you are an Agricultural User, do you:** ☐ Irrigate ☐ Dry Farm ☐ Graze Livestock
   ☐ Other: _____

8. **How reliable is your current groundwater supply?** _____
   _____
   _____

9. **If you grow crops, do you use irrigation for frost protection?** ☐ Yes ☐ No

10. **Do you manage water resources?** ☐ Yes ☐ No
    If yes, what is your role? _____

11. What is your primary interest in land or water resources management? _____

12. Do you have concerns about groundwater management? ☐ Yes ☐ No

If so, what are they? _____

13. Do you have requests or recommendations regarding groundwater management? ☐ Yes ☐ No

If so, what are they? _____

14. Any other information the Kern Groundwater Authority should be aware of or take into consideration while developing the Groundwater Sustainability Plan (GSP)?

Please return completed surveys to the Kern Groundwater Authority by emailing tbarton@ppeng.com, faxing to (661) 479-7172, or mail to Kern Groundwater Authority, 1800 30th Street, Suite 280, Bakersfield, CA 93301.
Stakeholder Surveys may also be completed online by visiting www.kerngwa.com.

KERN GROUNDWATER AUTHORITY

Encuesta de Partes Interesadas

Fecha: _____

Tipo de Interesado (marque todas que apliquen):

☐	Usuario agrícola	☐	Propietario / usuario de pozo doméstico	☐	Operador municipal de pozos
☐	Sistema de agua público	☐	Agencia local de planificación del uso de la tierra	☐	Usuario ambiental
☐	Usuario de agua superficial	☐	Tribu native americana	☐	Residente de comunidad desventajada/ rural
☐	Residente de la ciudad	☐	Procesador de alimentos	☐	Usuario industrial/Productor de petróleo
☐	Entidad que monitorea y reporta elevaciones de aguas subterráneas en toda o parte de la cuenca de agua subterránea				

Nota: Por favor complete su nombre y la información de contacto si desea ser agregado a la lista de correo electrónico de la GSA y lista de correo para futuras actualizaciones e información sobre la Ley del Manejo Sostenible del Agua Subterránea (SGMA) y la Autoridad de Aguas Subterráneas de Kern (KGA GSA).

Nombre: _____

Dirección Postal: _____

Ciudad: _____ **Estado:** _____ **Código postal:** _____

Correo Electrónico: _____ **Teléfono:** _____

1. **¿Está usted familiarizado con las regulaciones de la ley de Manejo Sostenible del Agua Subterránea (SGMA)?** ☐ Sí ☐ No

2. **¿Está usted actualmente involucrado en actividades o discusiones Sobre el manejo de aguas subterráneas en esta regíon?** ☐ Sí ☐ No

3. **¿Usted es propietario o administra/opera tierra en esta región?** ☐ Sí ☐ No

4. **¿De dónde recibe su suministro de agua?**
   ☐ Sistema de agua de la ciudad o la comunidad ☐ Superficie ☐ Agua subterránea
   ☐ Agua subterránea y superficial ☐ No sé

5. **Usuarios de pozos Agrícolas Y Domésticos: ¿Cuál es la profundidad de su pozo(s)?** _____

6. **Usuarios de poza Agrícolas Y Doméesticos: ¿Alguna vez se ha secado su pozo(s)?** ☐ Sí ☐ No
   ¿Si la respuesta es sí, cuándo (mes/año)? _____

7. **Si eres un usuario agrícola, qual haces:** ☐ Irrigar ☐ Granja seca ☐ Pastoreo
   ☐ Otro: _____

8. **¿Qué tan seguro es su suministro de agua subterránea, corrientemente ?** _____

   _____

   _____

9. **Si cultiva, ¿utiliza el riego para la protección contra las heladas?** ☐ Sí ☐ No

10. **¿Usted administra recursos de agua?** ☐ Sí ☐ No
    Si la respuesta es sí, ¿cuál es su papel? _____

11. ¿Cuál es su interés principal en el manejo de recursos de agua o tierra? _____

_____

_____

_____

12. ¿Tiene preocupaciones acerca el manejo de las aguas subterráneas? ☐ Sí ☐ No

Si la respuesta es sí, ¿cuáles son? _____

_____

_____

_____

_____

_____

_____

13. ¿Tiene used alguna recomendación sobre el manejo de agua subterráneas? ☐ Sí ☐ No

Si la respuesta es sí, ¿cuáles son? _____

_____

_____

_____

_____

14. ¿Tiene used alguna otra información pertinente que debería tener en cuenta el Kern Groundwater Authority GSA para desarroler el Plan de Sostenibilidad de Aguas Subterránease (GSP)?

_____

_____

_____

_____

_____

_____

_____

_____

Por favor regrese la encuesta terminada al Kern Groundwater Authority GSA enviando un corre electrónico a tbarton@ppeng.com , manduando un fax al (661) 478-7172, o por correo a Kern Groundwater Authority GSA, 1800 30th Street, Suite 280, Bakersfield, CA 93301.

Esta Encuesta de Partes Interesadas también se puede completer visitando la página www.kerngwa.com.

130 N. Garden Street
Visalia, CA 93291-6362
Tel: (559) 636-1166
Fax: (559) 636-1177
www.ppeng.com

Memorandum

To:	Kern Groundwater Authority Board of Directors
From:	Trilby Barton, Public Outreach Coordinator, Provost & Pritchard Consulting Group
Subject:	Stakeholder Survey Results – Final Report
Date:	December 12, 2018

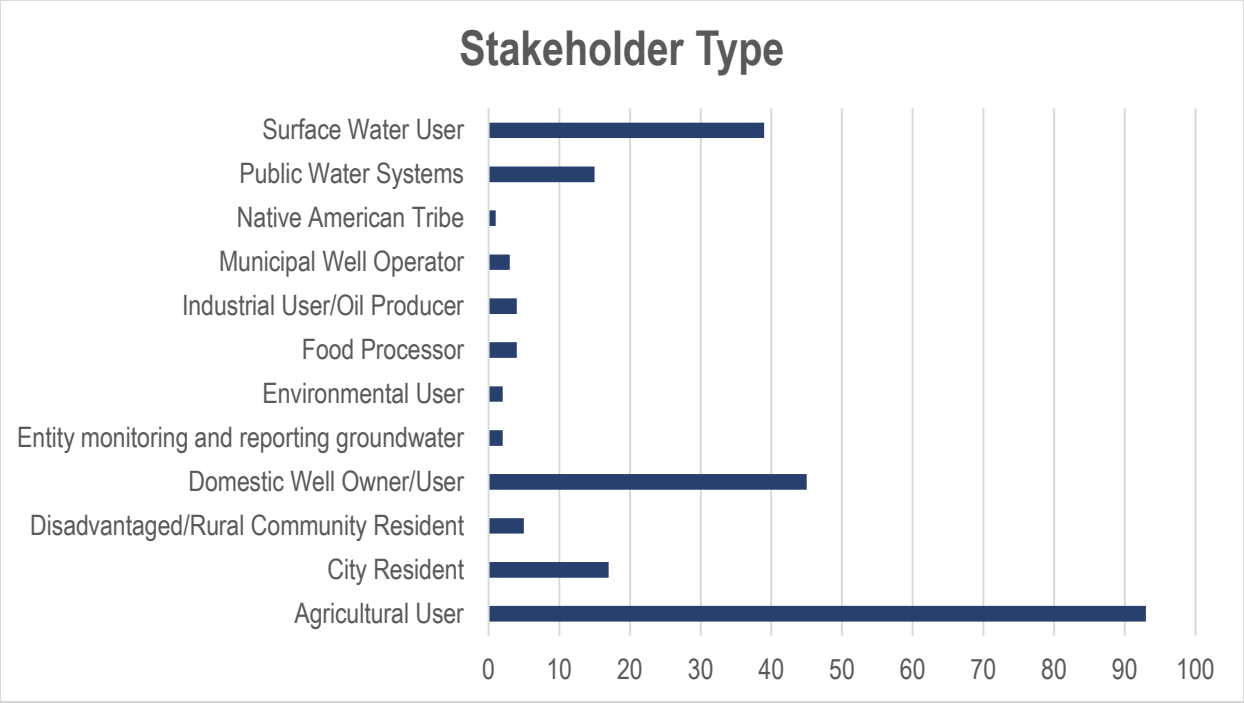
Hard copies and the link to the online version of the Kern Groundwater Authority's Stakeholder Survey (in both English and Spanish) were circulated throughout Kern County. For the final report, the data was sorted through, and duplicate entries were removed. **Kern Groundwater Authority received a total of 123 responses**.

Reponses were received from nearly all stakeholder types identified in the Kern Groundwater Authority's Communication & Engagement Plan. Most responses were received from agricultural users, with domestic well owner/users and surface water users, and city residents following.

Overall, stakeholders are primarily concerned about the economic impacts that SGMA will have on the agriculture and industrial groundwater users within the Kern Groundwater Authority boundaries.

This memo summarizes the data and comments received from the stakeholders who completed the survey.

Final Report of Kern Groundwater Authority Stakeholder Survey Results

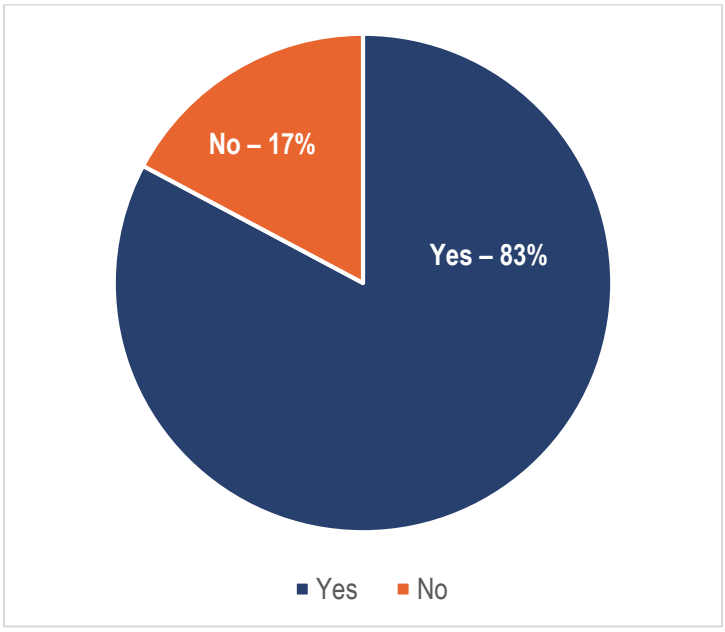


Stakeholder Type Summary:

Agricultural User	93	Domestic Well Owner/User	45
Municipal Well Operator	3	Public Water Systems	15
Local Land Use Planning Agency	0	Environmental User	2
Surface Water User	39	Native American Tribe	1
Disadvantaged/Rural Community Resident	5	City Resident	17
Food Processor	4	Industrial User/Oil Producer	4
Entity monitoring and reporting groundwater elevations in all or part of the groundwater basin			2

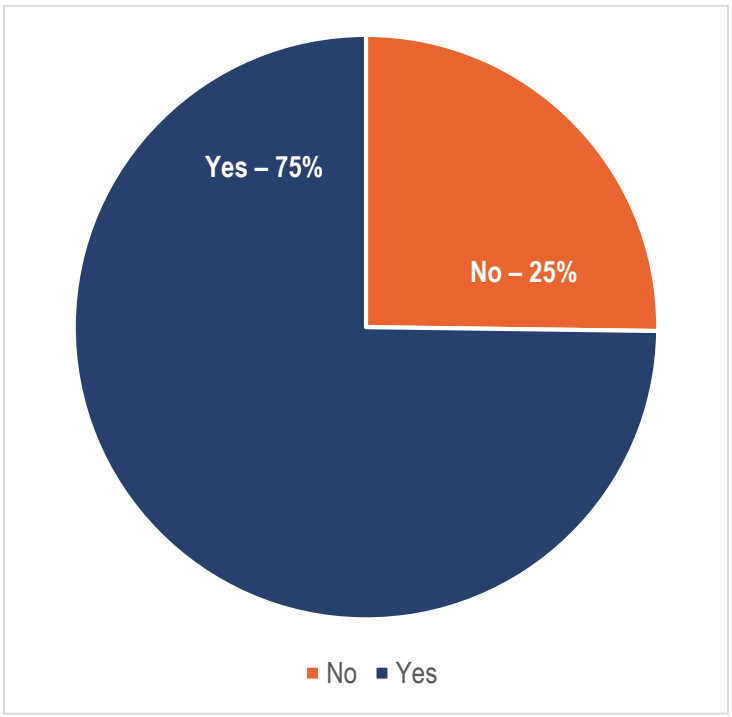
1. Are you familiar with Sustainable Groundwater Management Act (SGMA) regulations?

(122 responses)

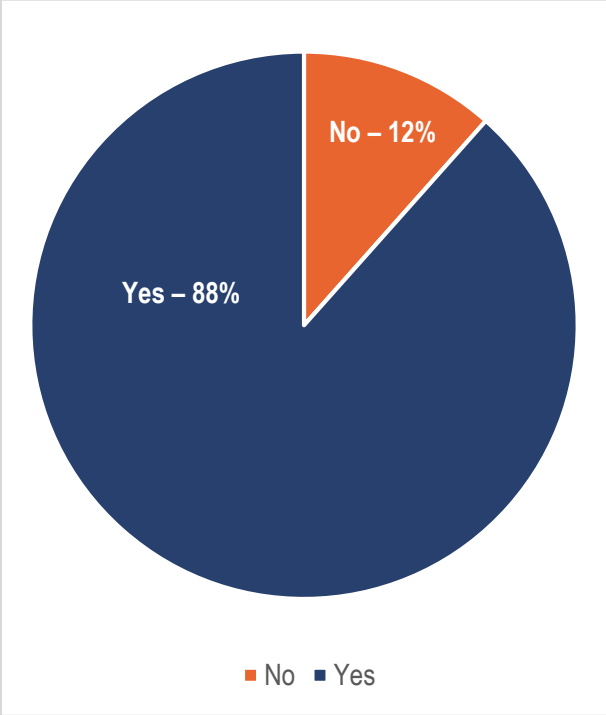


2. Are you currently working on or discussing groundwater management in this region?

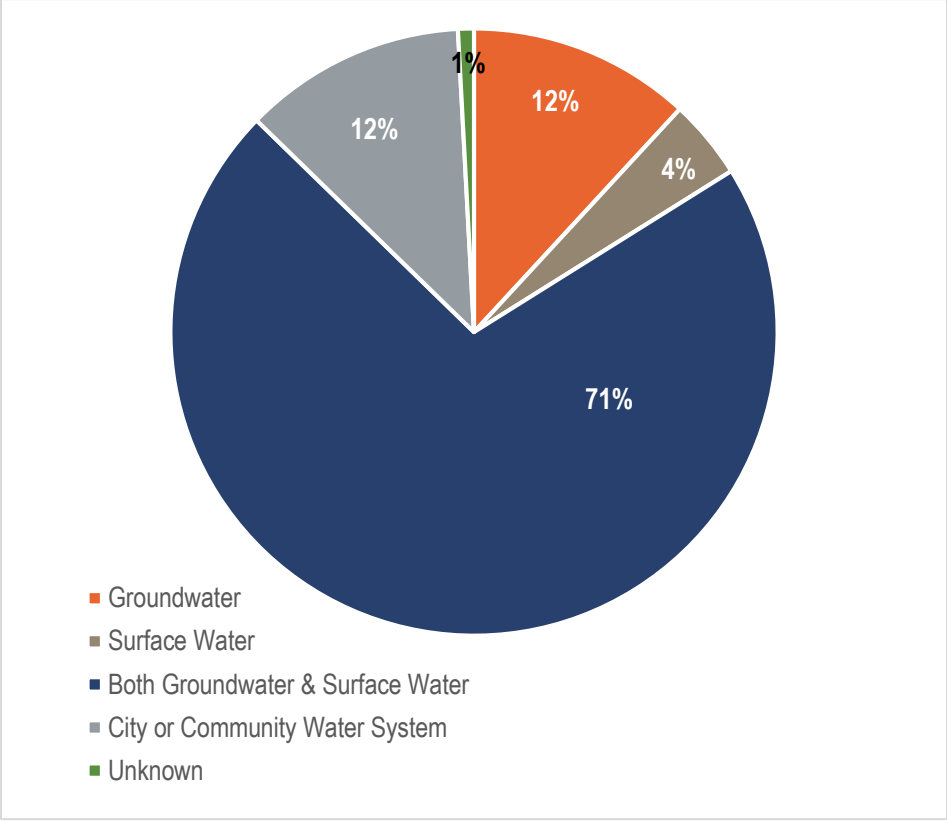
(119 responses)



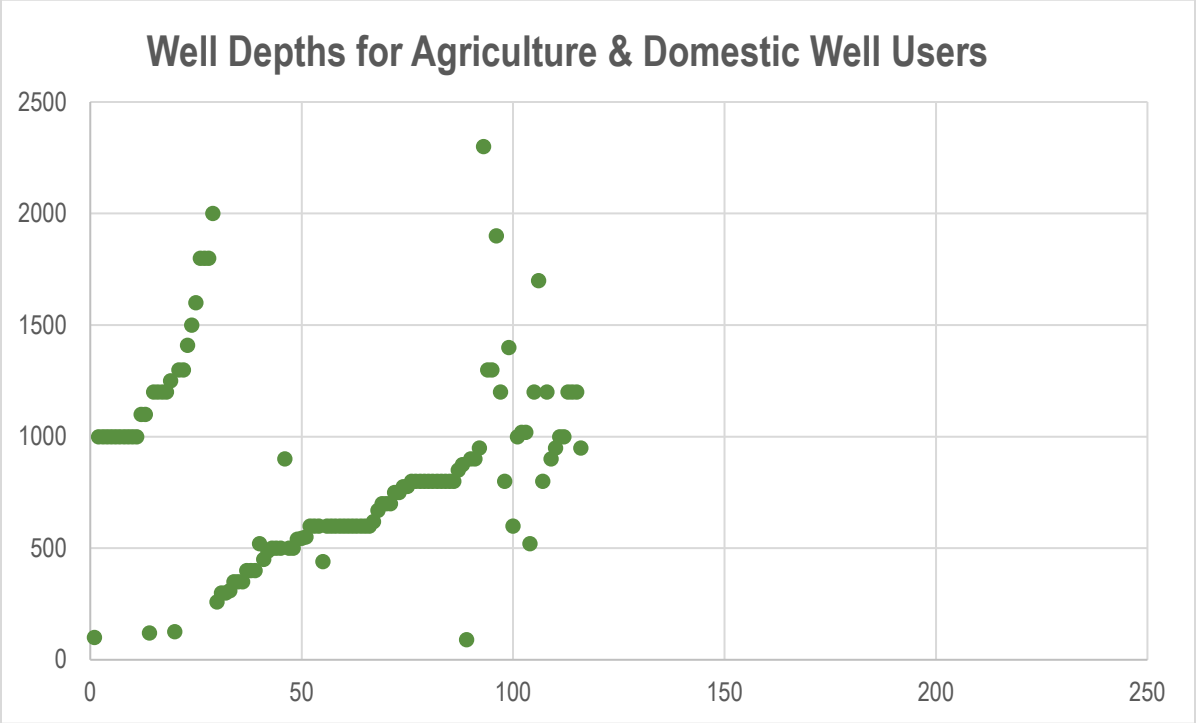
3. Do you own or manage/operate land in this region? *(121 responses)*



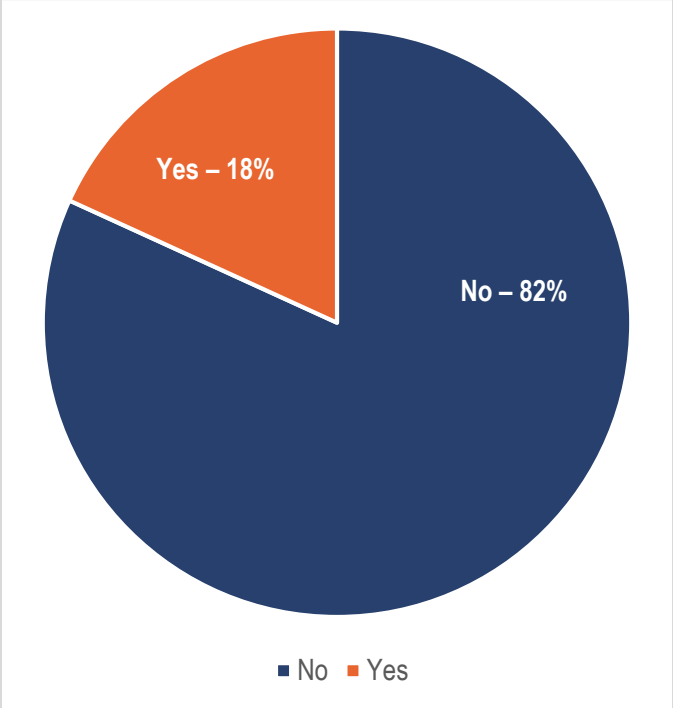
4. Where are you getting your water supply? *(118 responses)*



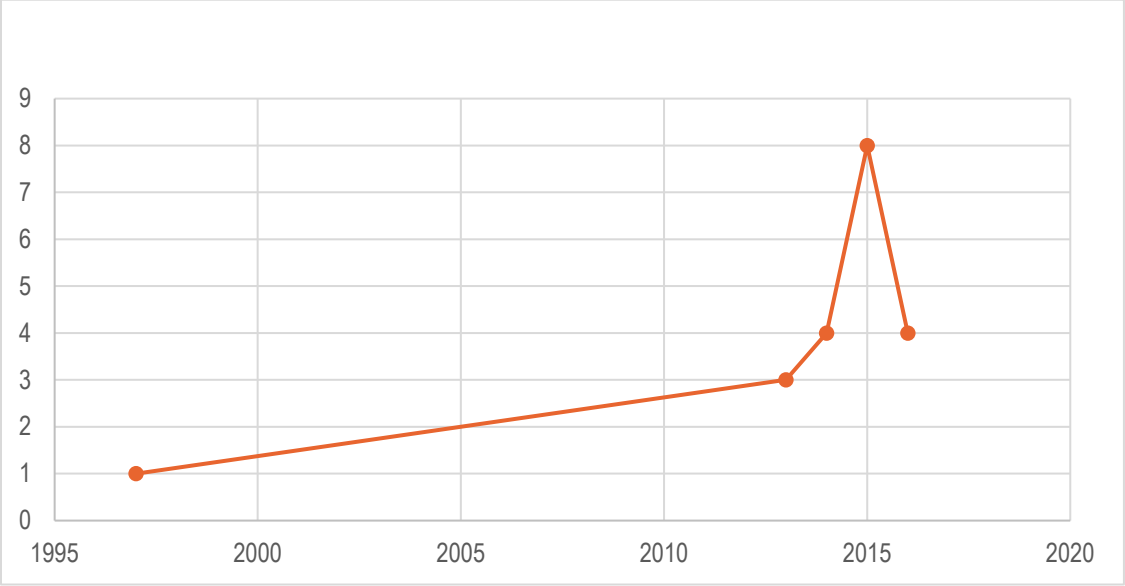
5. Agriculture & Domestic Well Users: What is your well(s) depth? *(92 responses)*



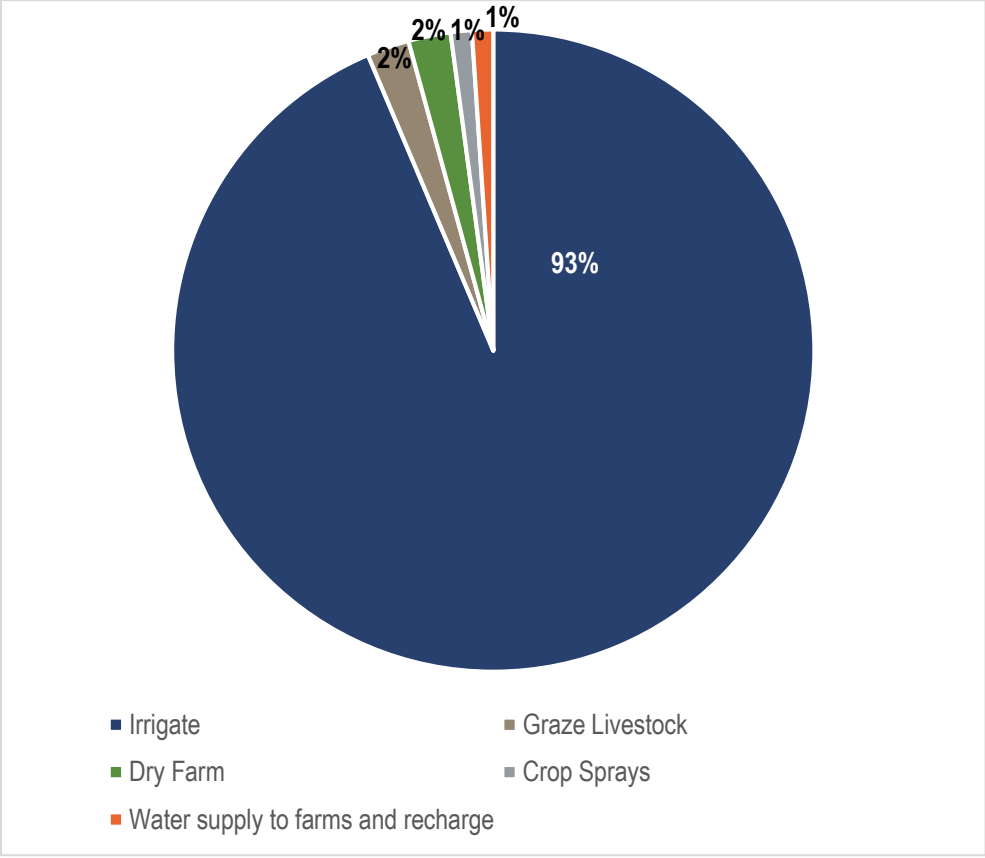
6. Agriculture & Domestic Well Users: Has your well(s) ever gone dry? *(99 responses)*



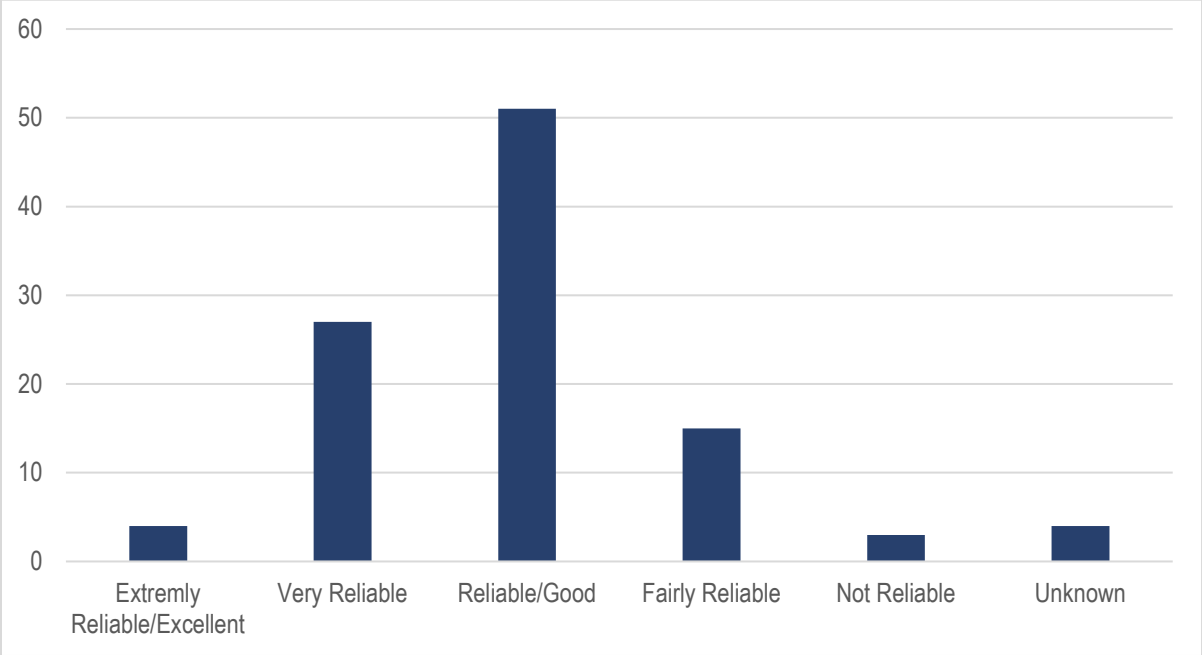
If yes, when? *(20 responses)*



7. If you are an Agricultural User, do you: *(94 responses)*



8. How reliable is your current groundwater supply? *(104 responses)*



Additional comments regarding groundwater reliability:

Currently receiving decent district water so not pumping too much, although it's early in our season

We rely on combination of surface water from AEWSD and Wheeler Ridge-Maricopa districts, and groundwater from wells on our property.

Supplied through district

Standing water level did not drop even during drought.

I've only used my well one time in 25 years

It has been reliable. Serves small residential units that do not have yards, one-room units, one-bedroom units, no washer hookup, serves retired and migrant workers.

It is reliable, however lower aquifer levels increase contamination levels for nitrates, which recently forced us to shut down a municipal well.

Part of Arvin-Edison. No wells on our property but have district wells.

Our water districts have historically done a good job providing water to our ranches. While our water levels have dropped, they are still providing adequate water.

Reliable because I've spent money on them and have maintained them

Reliable in conjunction with surface water

Reliable, but water quality is a bit poor on some wells.

Reliable, pump lowered 2016 in response to drought

Production has stayed steady for 10+ years

Well is for domestic use only, poor quality water but reliable

We feel our current groundwater supply is reliable at this time.

Water deep but well are troublesome

Water supply is not a problem it is basin standards not met.

Average 350 gallons

Unknown given the state's undelivered water

Water quality concerns are becoming more important each year for the current groundwater supply.

Fairly reliable as we invested significant capital in 2013 and 2014 to rehab most of our older wells.

Relatively reliable. Had to extend bowls on one well.

Sufficient for our current needs

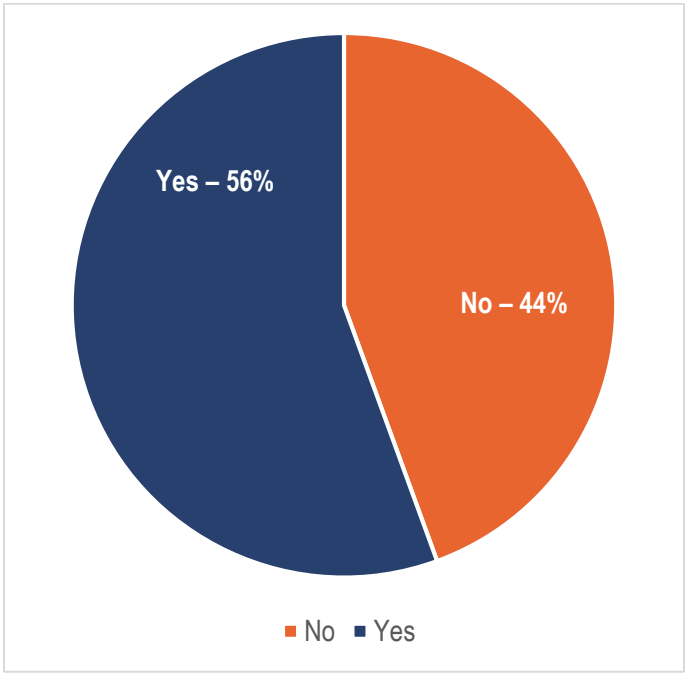
Sufficient for supplemental supply for surface water in most years

Variable. One well is reliable, another is iffy

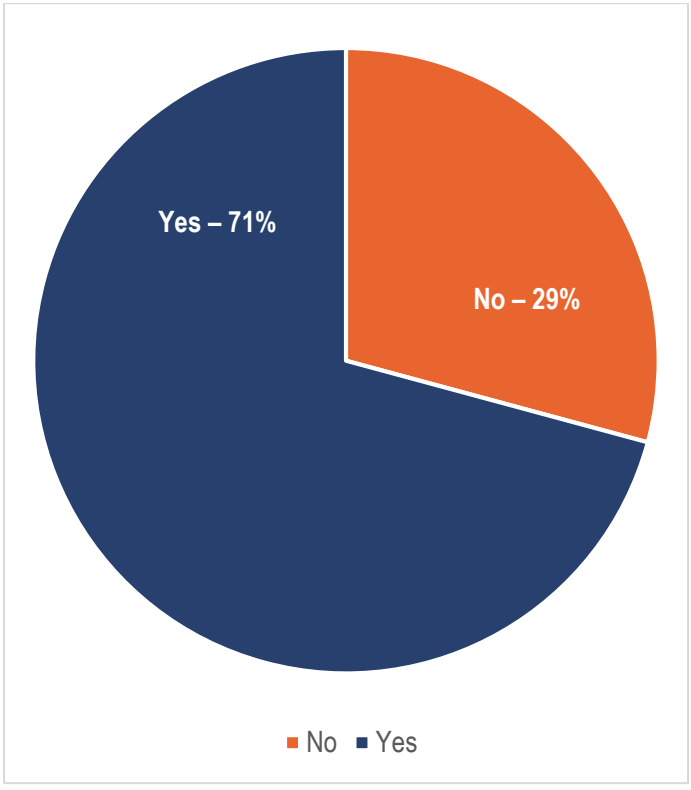
Volume is ok, quality becomes the issue.

Groundwater supply has decreased in quality over the last couple years rapidly.

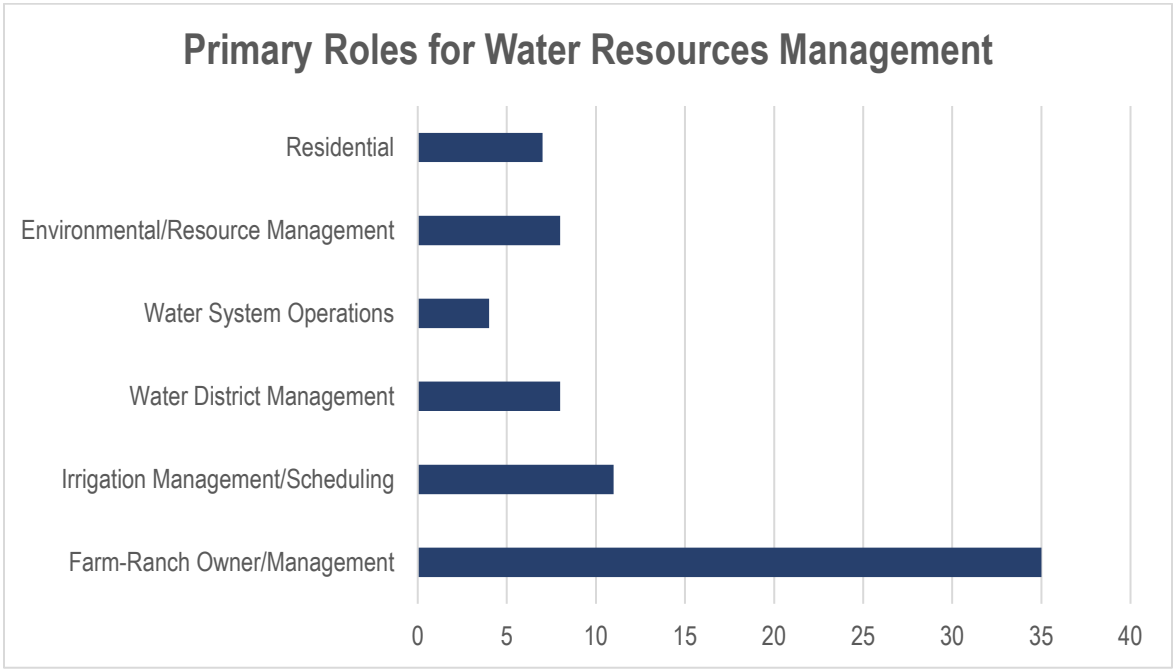
9. If you grow crops, do you use irrigation for frost protection? *(99 responses)*



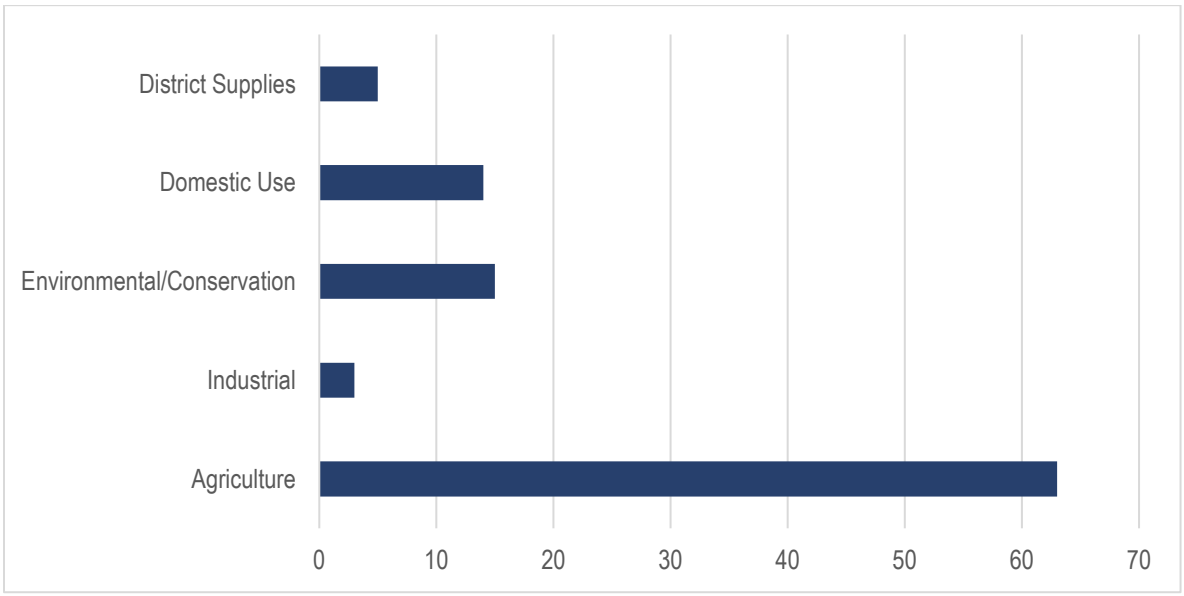
10. Do you manage water resources? *(113 responses)*



If yes, what is your role? *(73 responses)*



11. What is your primary interest in land or water resources management? *(100 responses)*



Additional comments regarding primary interests in land or water resources management:

Continued supply of quality & quantity to farm my property

Ensuring our farming operations continue to have access to irrigation water to maintain our crop production.

Farm Management and water for future generations.

Farming is my livelihood. Without water I can't do what I do.

Future availability for my ranch and all other farmers.

Future water availability. Restrictions on pumping groundwater.

Having enough water for personal use and for growing crops

Having enough water to farm our ground

I am a farm banker. SGMA will drastically affect my customers and my bank.

I have a strong interest in water resource management as we farm a large number of permanently planted acreage. We have invested a lot of money into the development of permanent crops and have made efforts to effectively manage our water use as efficiently as possible.

I want to grow crops. I want to continue to live on my farm using well water.

Ensuring adequate supply for our perennial crops

Long term sustainability of farmland (productive)

Maintaining local and personal control with the least outside regulation possible.

My hope is to be able to farm well into the future. If we don't become sustainable in the near future, we won't have a farming option in a couple years.

Producing crops and staying in business

Making sure we have enough water to grow our crops to feed the world

Sustainability and cost, sustainability for future food production, sustainability for water supplies in agriculture

Preparing information on SGMA for CEO and farm managers to make decisions on planting and long-term business planning

That I be able to continue to irrigate my crops

That water remains available for irrigation

To conserve & use less water to get the same production results

To conserve options for water usage when consider crops

To continue to farm without fallowing acreage

Without water land is invaluable. We employ 3,000 people out of a 21,000-person town. If we fallow our lands, we and every other company will not have enough work for the people.

to use water most economically

As an industrial user, need to ensure continued access to volume of groundwater necessary for operations

Keeping water available for my business

Survival of business

Conservation and efficiency of resources

Finite and necessary resource

For water resources to get used properly

Safety, health and environmental professional

My primary interest is managing both surface and groundwater as efficiently and effectively as possible while remaining cognizant of the value of the resources, both land and water.

Need help getting resources for management in using groundwater

Subsidence

Regulation and water

To know & understand the rules/regulations up and coming. Also, to connect with others that are interested in monitoring solutions as we are in this business

Use water wisely

compliance

Follow up with membership in water coalitions.

Continuing to secure, affordable, reliable and high-quality groundwater for the city of Wasco.

Domestic water for low income families

In a community that has a well for our only water source.

Making sure we have enough water to provide the residents of the city

Making sure small systems needs are met and not forgotten alongside larger water users.

Providing quality drinking water and notification to customers

Quality of water.

to do away with the environmentalists and let fish swim for themselves

To have adequate supply of surface and/or ground water to be able to grow and sustain my permanent crops.

To irrigate all the permanent crops, trees and vines with maximum efficiency in use of available water so that I do not run short of water and that trees do not suffer in any way.

We make our living by growing crops. We have land payments, taxes, high costs in well drilling that we must pay for. Therefore, we must be able to continue to farm so we continue to use our resources in a productive yet not wasteful manner.

We make our living growing crops and we need to be able to maintain our land for survival, therefore, we have always tried to manage our water to our best ability.

We need water to be able to farm in the central valley.

Small disadvantaged community with one well and 18 connections.

That we always have clean and enough water

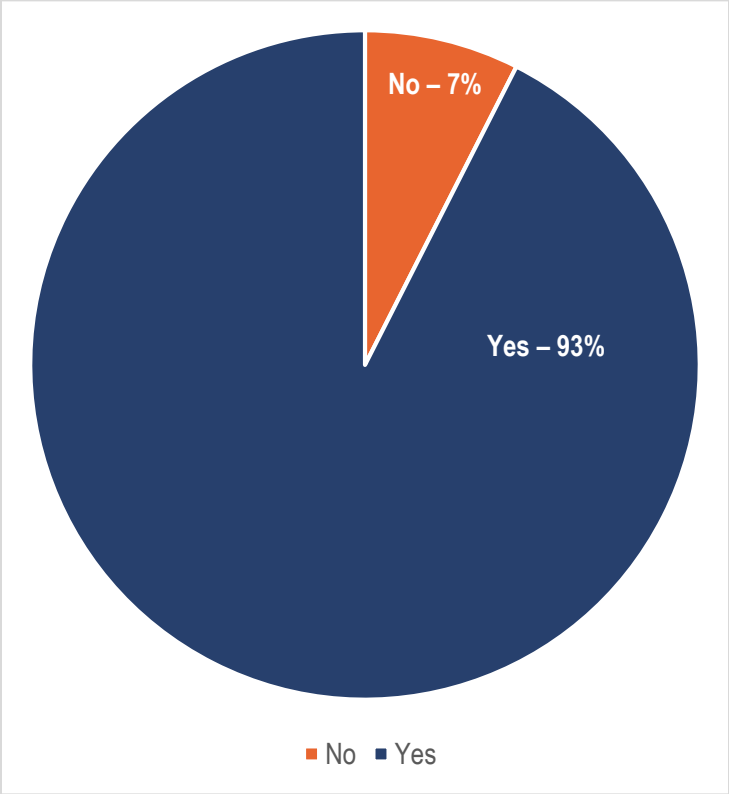
To continue uninterrupted municipal and farm use.

To have water when needed that is safe for drinking, cooking, etc.

Why do residents have to ration water (weekly watering schedules) while our groundwater is being pumped into the California Aqueduct and sent to LA or elsewhere?

United States

12. Do you have concerns about groundwater management? *(107 responses)*



If so, what are they? *(91 responses)*

That the ability to pump groundwater will be taken away.

Amounts we can pump and quality.

As a white zone owner, I am concerned about how we are going to reach sustainability and still make a living.

As the Public Works Director of a city that provides municipal water, I have a direct interest in groundwater. All of our water is supplied via groundwater wells.

Availability

Bureaucrats can raise my rates or cut me off from water.

Concern with endangered species act and how it's the reason for SGMA.

Concerned that private land owners will be burdened with record keeping and reporting to regulatory agencies.

Defining rainfall as groundwater so land can be taxed

Delivery system statewide

Fallowing ground and hurting the economy

Future groundwater pumping restrictions. Who is going to mandate groundwater pumping restrictions?

Government control

Government interference

Government involvement

Government regulation and interference

Government regulations and involvement

Granite Construction has several rural sites which depend exclusively on groundwater resources. Our concern is primarily that as SGMA rules are implemented our sites' operations are not materially impacted.

How much control will the government enforce upon growers? What practical experience do any of the

Need a great deal of underground water storage programs and a fair, effective water trading mechanism in the San Joaquin Valley basins.

Need more surface water and stop sending rainfall out to the Pacific Ocean.

No new water storage has been constructed in over 50 years, now we will be told how much we can pump. That would be a great idea and a must for the future IF we had enough water storage to farm for the year in tough years too! Legal issues are greatly reducing our surface water also. We make payments on our ground and need to farm every inch of it. We can't be cut short because we don't have water.

Over regulation

Over watering

Overpumping and the subsequent legislation. Over regulation.

Quality and supply

Quality of water

Recycling of wastewater for household and industrial users

Running out of water and creating an enforcement where smaller growers can't compete

Scientifically-based determination of sustainable yield of basin/sub-basin & management areas

SGMA limitations

SGMA poses significant challenges, and the uncertainty around how it will be implemented is concerning

SGMA, Sacramento politicians, Water Quality Control Board, DWR, oil industry contamination, etc.

Shortage

Someone will tell me I cannot pump water for my permanent crops

Subsidence in Tulare County reducing Friant Kern Canal capacity

Sustainability

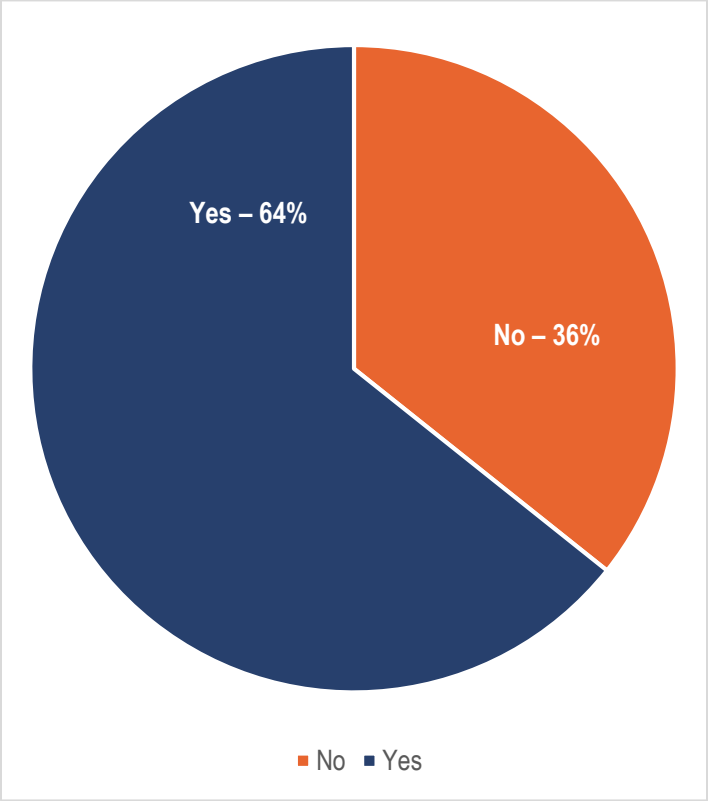
Sustainability - keeping our groundwater within our basin

government agencies/employees and/or mandator's have in the day to day irrigation practices, field experience?	
How much will government control cost us in money and loss of property rights?	That assumptions made regarding subsidence are in alignment with modeling being done by the subsidence team at DWR.
How will it be regulated? Who is appointed to the committee that ultimately will decide how water will be allocated?	That in dry years when there is inadequate surface water, we won't be able to draw enough groundwater to grow and/or sustain my permanent crops.
I am concerned that in the future I will be restricted in my use of groundwater during periods of drought. I do not consider groundwater as a primary source of water but as a reserve to be used in case of drought to augment restricted surface water availability.	That significant farm land acreage in my region will be taken out of production.
I am concerned that SGMA will become a method for taxation without representation or services.	That the state doesn't come in too heavy-handed, and that they allow us to work into SGMA over time.
I am concerned with our ability to continue to farm the permanent acreage we have developed. I am concerned that a GSP might lack a certain level of flexibility to allow for the transfer of pumping credits across the County or not allow for a proper phase in period that would allow a market to develop for water and/or water credits.	That the underground water basin is sufficient for Kern and not all used for Los Angeles
I fear the overdraft is too big of a problem in the Valley. Subsidence is another major concern.	That the water is protected from any type of contamination
I feel the average person does not feel the importance of farming and would prefer to take away our water and sell it to places like Los Angeles. We seem to already have allowed districts to drill wells and pump water out from underneath us to sell out of our area.	The irrigation canal that has replenished water levels for 100 years has been dry the last several years.
I hope within SGMA we are flexible in amounts we can pump to survive through the dry years	The limits will be put on small domestic users that may not be large enough to be heard.
I think evapotranspiration satellite technology will help balance our water use with taxation to the land user for overuse than trying to meter and police all our wells.	The prioritization of surface water allocation between the public, agriculture and the environment. Need more surface water deliveries to correct groundwater overdraft. Any reduction in irrigable acres needs to allow for viable economic adjustment over an extended timeframe.
I understand the reasoning behind SGMA, and sustainability is needed, but it needs to be combined with advocacy for more surface water. It was lack of surface water that caused the issues we face: if our surface water supply was more reliable, agriculture would not need to use as much groundwater.	To know what the water level is and how much water we can use and for how long
I understand we must manage our groundwater, I do not understand why some districts have been able to pump water out from underneath us and send it to LA. Also growers that have been allowed to plant on the westside where there has never been ag, only to help drain our groundwater. Those of us that have paid high dollars for ground that has both ground and surface water are now being punished.	To make sure water is available to meet demands of farming
If we can actually get a plan in action in time	Water usage is low for almonds
If we do not increase the supply of surface water by raising the level of existing reservoirs and making	We already do a good job with conservation in agriculture. Any more reduction in groundwater

more reservoirs to catch every drop of rain water, no matter how many restrictions we put on groundwater we cannot solve the problem. The only solution to solve the groundwater problem is to make more surface water available.	supply will have a direct correlation to a reduction of jobs. It would decimate many communities throughout the valley.
I'm afraid the government will over regulate and make it impossible to farm efficiently.	We are approaching the deadline for monitoring each location. Self Help will be helping us. Our concern is always the cost. My second concern is that it requires a great deal of time for small mutual water companies to comply with all the regulations.
Individuals vs. subbasin	We must manage water to survive.
Insufficient supply for our perennial crops due to extraction restrictions/limitations and/or restricted surface water.	We need more surface water.
Is SGMA going to limit our availability to access groundwater as a source of agriculture irrigation water? If it does, how will we obtain water in order to maintain our permanent crops of almonds and pistachios?	We need reliable surface water restored to our area so that groundwater recharge can offset groundwater pumping.
It appears that state water management problems are landing squarely on the shoulders of farming. This is going to put most small farmers out of business while corporate farming and municipalities thrive. This is a big mistake.	We paid for our well and shouldn't have to show how we use our water to grow our crops. We are all drip & fan jets, so yes we save and do not waste water
Lack of flexibility upon GSP implementation	What costs will be involved to comply? What limits will there be and on what acreage? Metering and monitoring, reporting regulations.
Long term quantity and quality	What will be the end result in restrictions and when?
Long term sustainable use of groundwater	Will there be a prioritization? Others vs. food? Who decides my future? Will I have enough water to grow my crops? If my surface water is curtailed outside of my control, will I be able to make up for that short fall by using my well as needed? Will there be a water market developed to purchase extra water?
Making sure that the rights of property owners are not over looked to solve this issue.	Will we be stopped from pumping our agricultural wells when our permanent crops need water?
Might run out of water on our domestic well and we don't have another source	Will we get enough water?
Monitor the oil wells because they can pollute the entire underground water system.	Will we have water? What regulatory issues? Loss of production of farm land
More government regulations	Yes, limiting groundwater consumption will limit the acres that can be farmed on well water as a primary source. Surface water quality trends are also in a decline and a higher reliance on low quality water gives me pause.
My concern with SGMA is the fact that our groundwater pumping will be limited in conjunction with not getting full allocation of surface water. I understand overdrafting has caused many issues like poor water quality, land subsidence and a water table that continues to drop. But if our groundwater pumping is cut and our surface water is cut, what are we supposed to do with our investment into permanent crops.	

13. Do you have requests or recommendations regarding groundwater management?

(98 responses)



If so, what are they? *(65 responses)*

Allow farmers more input. We aren't interested in depleting our resources.

Allow more imported water into our region from the north.

An even playing field for all participants

Banking, trades, surface water exchanges, all would help implementation by giving farmers book to adapt

Better communication of GSP development/GSA communication with individual growers

Bring in more surface water to make up for the pending cutbacks on pumping.

Build storage so we can save groundwater!!!

continue communication

Delete land from the Kern water basin that does not have any useable underground water.

Depending on SGMA implementation specifics, we need the ability to bank and trade water as much as possible.

Develop a method of transferring rights to groundwater (i.e. so-called pumping credits). Before

Make it cost effective.

Make sure growers have access to enough groundwater to grow their crops.

More groundwater banking, restore SWP water deliveries to 100%/

More proactive groundwater storage programs within each GSA, including any assessments required for water acquisition and infrastructure.

More water storage reservoirs

None with SWID (who sent us this survey), but many with Semitropic Water District

On-farm recharge is vital to long-term sustainability.

Please continue providing information on SGMA and how it will affect day-to-day farmers who may not be as inclined to "self-education" as most.

Please help local farmers with water or to build new wells.

Possibly opening up a resource or management division for small water mutuals.

Quality of water

limiting extractions outright, attempt to achieve sustainability through the means (i.e. fallowing program, tax on excess extraction, etc.), recharge programs

Develop a water market! Allow water transfers among other water users, farmers. Require the environmentalists to play their part.

Do not constrain groundwater availability to ag users.

Educated, practical, honest people making decisions.

Fixing the Friant so we can receive surface water

Flexibility

Focus on maximum flexibility that will still obtain groundwater equilibrium. GSA should help (where possible) to establish a free market where water and/or water credits can trade among land owners.

Get the state water infrastructure brought up to present day needs and standards.

How will the city manage groundwater so residential usage is managed, not just taxed? Crops before grass.

I admire the GSA's efforts and urge the GSA to continue involving the diverse set of stakeholders that have been engaged so far.

If the state of California wishes to regulate groundwater pumping, then the state and federal systems should guarantee any shortage in the form of surface water deliveries.

Implement groundwater banking credits, ensure areas not within irrigation districts pick up slack as they have not been paying into groundwater banking programs, look at ways to implement wastewater reuse from Bakersfield if possible.

Import more surface water.

Increase surface flows so we are less dependent on groundwater.

Increase surface water flows to reduce dependency on groundwater.

Rely on water districts

Request to be kept in the loop on any issues that may affect the City of Wasco's water supply.

Rural operations and construction projects often only have access to groundwater for operations/dust suppression. We are interested in flexibility of points of extraction (for construction purposes) and insuring that evaluations of current usage include both our construction and mining operations (this is often overlooked in basin usage evaluation as we are neither an agricultural nor residential/municipal service user).

We need flexibility in dry years.

Stop watering the fish.

That we as agricultural water users do our best to utilize surface water but be allowed to pump enough groundwater to grow our crops. I would suggest allowing a certain amount of groundwater to be used annually but averaging it out over a five-year period allow for drier and wetter years.

When we get plenty of surface water, no one would like to pump groundwater by spending so much money in drilling deep wells and electric motors.

The small domestic users keep their water rights.

There should be an equal conservative effort to water storage and infrastructure as regulating SGMA. We can limit pumping but let's figure out a way to capture water throughout the state and increase our efficiency with surface water.

To maintain the right to pump or sell the groundwater now and in the future.

Please put farming as a top priority for water use in the state of California.

To work together to create a plan for a sustainable aquifer

Vote for right-minded politicians, state and federal

We growers conserve as much water as possible. I see the city of Bakersfield wasting water every day – seven days a week, 365 days a year, and nothing has changed since SGMA has come about. What more restrictions will be placed on all farmers? What restrictions will be placed on all non-farm users? Who is exempt? The prison's "CDCR" (California Department of Corrections) wastes millions of gallons

of water per year. Who will address this issue? I am a prior correctional officer, I saw the waste firsthand."

Involve the small communities in decisions

We need to be able to go into this cautiously and not make big cuts at once.

We need to stop allowing our groundwater to leave our county. If its pumped here, it should stay here.

Keep us informed in a timely manner.

We should not over-react and limit that amount of pumping we do too drastically. It should be done slowly and monitored.

We want to see resource management at the basin-level with uniform and consistent methodologies (e.g., accounting, analysis etc.) Sufficient stakeholder engagement and facilitation are of concern as well.

Leave as is, just monitor.

What methods can we use to control groundwater?

Leave me alone. My use of water does not affect anyone in the San Joaquin Basin.

Whatever basin plan is approved, the adjustments to land and water use relationships are implemented over the longest period of time allowed by law.

Less government involvement and flawed environmental agendas

While M&I and ag need to work together, it can't turn into a situation where ag just gets the leftovers that environmental and M&I don't want.

Let us know in advance if you will be stopping us from using our wells.

14. Any other information the Kern Groundwater Authority should be aware of or take into consideration while developing the Groundwater Sustainability Plan? *(41 responses)*

Allow groundwater use averaging over a five-year span.

Quality of water

Board meetings get too in the weeds. Need a place for higher level policy discussion.

Should be district-based not basin-based

Small rural county communities need access to potable water - much of the water is naturally or chemically contaminated. Large cities deal with the problem better due to financial ability. Small systems cannot.

Businesses and livelihoods are at stake. No one is going to be regulated out of business without a fight.

Somehow consider the sizeable investment that growers (perennial crops, especially) have in their crops and development of infrastructure (i.e. irrigation and trellising), and their desire (need) to preserve the value of this investment, such that as many options as possible will need to be explored to accomplish this.

California needs more water storage like dams to help with water management

Stop the west side (that has never had water) from pumping water out from underneath us and sending it to LA and letting the two largest growers in the area from monopolizing it. Stop Semitropic Water District from drilling more wells just to send the water out of Kern County.

Conservation should be for all.

Thank you in advance for you work. You are doing a great service for our industry. It does not go unnoticed.

Continue to provide as much feedback as possible with regards to possible direction of GSP so that we are able to better plan for future knowing how/if a market for water will be developed.

That producing food products are crucial to people of our state and country, whether they realize it or not, and should be protected the best we can.

Do what you can to let public know it's the environmentalists that stop the pumps that have created the current groundwater problems. Work to change the regulations and let the fish fend for themselves.

Don’t have us do unnecessary paperwork. Some of us are just small entities and just want to make a living.

Groundwater should remain a reserve to be used in periods of restricted water availability from the CVP and SWP.

Groundwater pumping should be phased in very slowly (20-50 years): 1) To better monitor groundwater levels and replenishment over time; 2) To better understand where replenishment flows originate for each basin; 3) To allow farmers time to rotate out of permanent crops; 4) To allow water markets and pumping right markets to be formed within basins or water districts.

Groundwater shall not be a marketable resource to be exported or sold across county lines.

I am trying to understand current hydrological inflows and outflows of the area, so not at this point although this will change soon.

I feel that every water user in the state should submit a water management plan just like ag. If you use water in your home and/or business, you should be required to fill out a report just like the state is asking of us (farmers). I feel this is a one-sided implementation of SGMA, I would also like to see the restrictions placed on all consumers be the same across the board. If Sacramento is serious about a fix, this is a fair and impartial way of doing it. I doubt any of this will be taken seriously and implemented across the board, but I remain hopeful

Integration of management areas within basin those with surface vs those dependent on groundwater only.

Is land that is converted from ag to homes helpful for the district?

Much land that has no useable groundwater and has no effect on the basin has been included in the basin boundary.

My groundwater level has not changed substantially in many years.

No, if the action suggested above is taken, we do not need anything else to do at present we are not hitting the target. We are only beating around the bush, or I can say we are putting the cart before the horse.

Our situation took a long time to develop and will take commitment, patience and time to resolve.

Permanent crops are harder to lose than fallowing row crops or alfalfa!

That no restrictions should be put on pumping groundwater from those orchards and vineyards which do not get any district irrigation water, otherwise those orchards and vineyards will die, and part of California will become desert. That will be a big state and national loss.

The loss of jobs, complete industries, the tax base from the working class, housing developments; consumption by more homes means less water for ag.

The required amount of water to farm different crops should not be determined by the GSA or the districts. Farmers/users should have that right.

The runoff from rainfall on the West side of Kern County does not get into the basin groundwater supply. The groundwater that comes from fractured shale formations does not affect the water supply or quality in the basin.

Use common sense, not agenda-driven emotions.

We have several people in our GSA continuing to use groundwater and not surface water. This must be addressed.

We look to be active in developing viable on-farm recharge.

We need transitional pumping.

When I shower, my skin stings, this hasn't always been true. I'm concerned that the water is irritating my skin and making my psoriasis worse.

With so many different standing water depths across the country don't take a one-size fits all.

Without the help from Self Help Enterprises, we would be out of water and with no hope since it is a disadvantaged community. Elizabeth B. has been a wonderful helper.

Yes, now will small growers be able to meet the need of the crop if limits are mandated on how much water we can pump? Large growers and farmers can leave part of their land fallow and use that water on another area of their ranch to meet their water needs.

Yes, start campaigning to do away with saving the delta smelt.

Agriculture Stakeholder Survey

Please return completed surveys to the Kern Groundwater Authority by emailing tbarton@ppeng.com, fax to (661) 479-7172, or mail to Kern Groundwater Authority, 1800 30th Street, Suite 280, Bakersfield, CA 93301.

Stakeholder Surveys may also be completed online by visiting www.kerngwa.com.

Date: _____

Note: Please complete your name and contact information if you'd like to be added to the GSA's email and mailing list for future updates and information regarding Sustainable Groundwater Management Act (SGMA) and the Kern Groundwater Authority.

Name: _____

Address: _____

City: _____ **State:** _____ **Zip:** _____

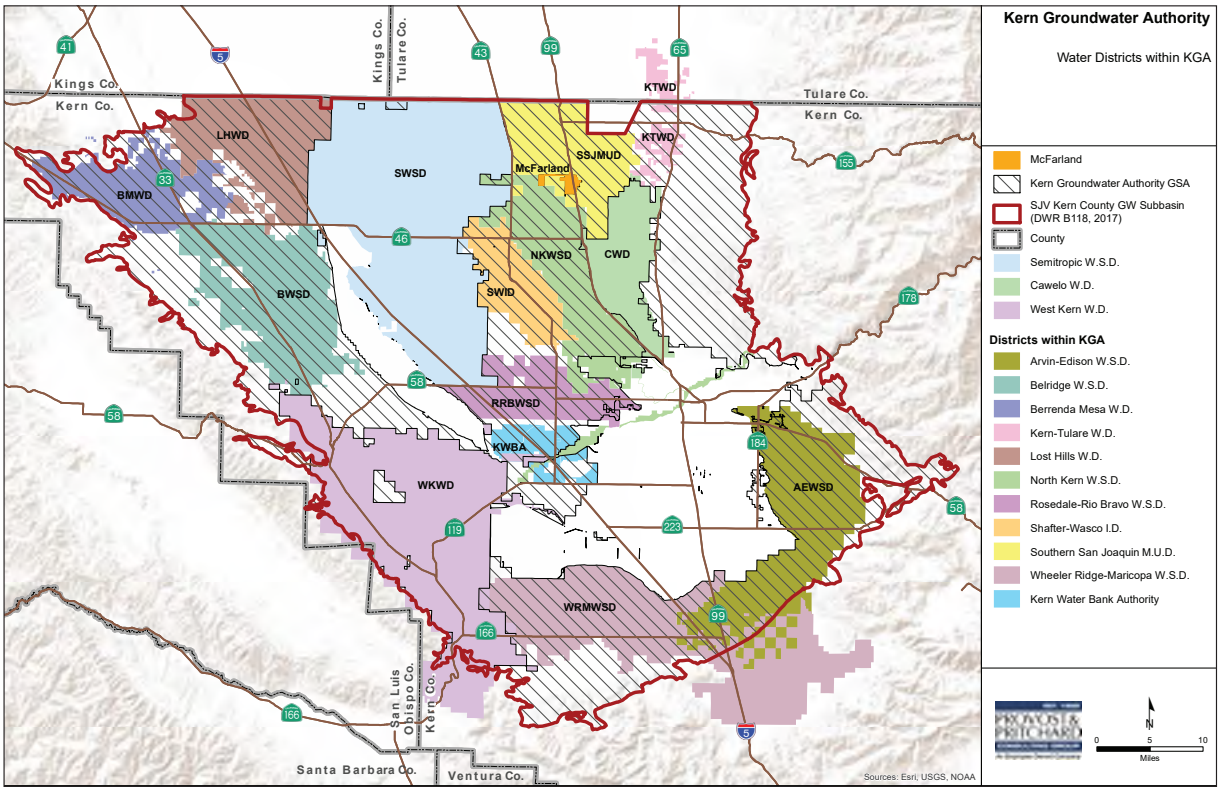
Email: _____ **Telephone:** _____

APN(s) for lands farmed/managed: _____

_____

1. **We have included a map of the Kern Groundwater Authority irrigation and water districts. Please indicate below which districts in which you have land parcels.** ***Check all that apply.***

- ☐ Arvin Community Services District (ACSD)
- ☐ Arvin-Edison Water Storage District (AEWSD)
- ☐ Cawelo Water District (CWD)
- ☐ City of Shafter
- ☐ County of Kern
- ☐ Kern County Water Agency (KCWA)
- ☐ Kern-Tulare Water District (KTWD)
- ☐ Kern Water Bank Authority (KWBA)
- ☐ North Kern Water Storage District (NKWSD)
- ☐ Rosedale-Rio Bravo Water Storage District (RRBWSD)
- ☐ Semitropic Water Storage District (SWSD)
- ☐ Shafter-Wasco Irrigation District (SWID)
- ☐ Southern San Joaquin Municipal Utility District (SSJMUD)
- ☐ Tejon-Castaic Water District (TCWD)
- ☐ West Kern Water District (WKWD)
- ☐ Westside District Water Authority (WDWA)
- ☐ Wheeler Ridge-Maricopa Water Storage District (WRMWSD)



2. **How many total acres do you farm (all land owned, leased and/or managed)?:** _____

3. **In a typical year, how much of the following crops, animals or land do you manage/own?**

Crop or Land Type	Acres Managed or Owned
Fruit trees	
Nut trees	
Row crops	
Seed crops	
Vegetables	
Grain	
Grapes	

Crop or Land Type	Acres Managed or Owned
Hay/alfalfa	
Livestock on pasture/rangeland	
Dairy *(total head)*	
Food Processor/Production	
Other land use *(please indicate)*:	

4. **Which of the following sources of water and management do you typically utilize under the following conditions?**

Water Source/Management	Dry Years	Normal Years	Wet Years
Irrigation through surface water only			
Irrigation through groundwater only			
Irrigation through a mixture of surface and groundwater			
Wastewater land applied			
No irrigation			

5. **If you do use irrigation, which of the following methods of delivery do you use?** ***Check all that apply.***

☐ Furrow/flood ☐ Sprinklers ☐ Drip ☐ Microsprinkler ☐ Center pivot

☐ Other *(please indicate)*: _____

6. **In response to water scarcity, please indicate if you currently use the following practices and your likelihood to use the following practices in the future.**

Practice	Currently Use	Future Use					
		Very Unlikely	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely	Very Likely
Drill more wells							
Restore existing wells							
Make existing wells deeper							
Pump more groundwater than previous years							
Drip irrigation							
Water monitoring technology							
Fallow fields							
Soil moisture sensors							
Change to a less water intensive crop							
Reduce livestock stocking rates							
Leaf sampling to measure plant-water status							
Purchase additional water							
Purchase crop insurance							
Other:							

7. **Please rate the level of importance these potential groundwater conditions are to you *(with "1" being the most concerning, 5 being the least concerning)*. If you have additional concerns, please indicate them in the "Other" category.**

Groundwater Condition	Rating of Concern
Lowering of groundwater levels	
Reduction in groundwater storage	
Water quality degradation	
Local subsidence	
Depletions of surface water	
Other *(your opinion)*:	
Other *(your opinion)*:	

8. **The following are a list of management options that have been used on the West Coast for water management. Please provide your level of preference for these types of management:**

Management Option	Strongly Against	Against	Somewhat Against	Somewhat Support	Support	Strongly Support	Not Familiar
Individual recharge credits (i.e. winter flooding)							
Water metering							
Water trading through markets							
Public program highlighting farmers implementing water saving practices							
Farmer adoption of water management practices							
District investment in conjunctive use infrastructure (i.e. water storage)							
Groundwater replenishment fees							
Fixed quota for water pumping allocated to each farmer							
Incentives for water saving practices							
Moratorium on drilling new wells							
Permits for drilling new wells							
Other *(your opinion)*:							
Other *(your opinion)*:							

9. **If groundwater monitoring is required in the future, which of the following monitoring methods would you prefer?**

Method of Determining Water Allocation	Strongly Not Preferred	Not Preferred	Somewhat Not Preferred	Somewhat Preferred	Preferred	Strongly Preferred
Well metering						
Use satellite estimates and ground truth						
Use standard crop water requirement indexes						

10. Should disputes arise over SGMA implementation, what is your preferred means of reconciliation?

Dispute Option	Strongly Not Preferred	Not Preferred	Somewhat Not Preferred	Somewhat Preferred	Preferred	Strongly Preferred
State Water Resources Control Board						
Groundwater Sustainability Agency						
County Board of Supervisors						
Superior Court System						
Arbitration						
Other:						

11. If you have any additional information or feedback regarding SGMA, water management or farming in Kern County that should be taken into consideration while developing the Groundwater Sustainability Plan (GSP), please provide the information below:

Please return completed surveys to the Kern Groundwater Authority by emailing tbarton@ppeng.com, fax to (661) 479-7172, or mail to Kern Groundwater Authority, 1800 30th Street, Suite 280, Bakersfield, CA 93301.

Stakeholder Surveys may also be completed online by visiting www.kerngwa.com.

130 N. Garden Street
Visalia, CA 93291-6362
Tel: (559) 636-1166
Fax: (559) 636-1177
www.ppeng.com

Memorandum

To:	Kern Groundwater Authority Board of Directors
From:	Trilby Barton, Public Outreach Coordinator, Provost & Pritchard Consulting Group
Subject:	Ag-Focused Stakeholder Survey Results – Monthly Progress Report
Date:	June 21, 2019

Hard copies and the link to the online version of the Kern Groundwater Authority's Ag-Focused Stakeholder Survey are being circulated throughout Kern County. The survey has been distributed by member districts and is available online at www.kerngwa.com. **To date, Kern Groundwater Authority has received 68 responses**. This memo summarizes the responses received to date.

Progress Report of Kern Groundwater Authority Stakeholder Survey Results

1. Please indicate which irrigation/water district in which you have land.

(68 responses, multiple answers per respondent)

District Name	Number of Responses	District Name	Number of Responses
Arvin Edison Community Services District	0	Rosedale-Rio Bravo Water Storage District	6
Arvin-Edison Water Storage District	10	Semitropic Water Storage District	9
Cawelo Water District	4	Shafter-Wasco Irrigation District	30
City of Shafter	2	Southern San Joaquin Municipal Utility District	31
County of Kern	4	Tejon-Castaic Water District	0
Kern County Water Agency	2	West Kern Water District	2
Kern-Tulare Water District	5	Westside District Water Authority	5
Kern Water Bank Authority	3	Wheeler Ridge-Maricopa Water Storage District	3
North Kern Water Storage District	8		

2. How many total acres do you farm (all land owned, leased and/or managed)?

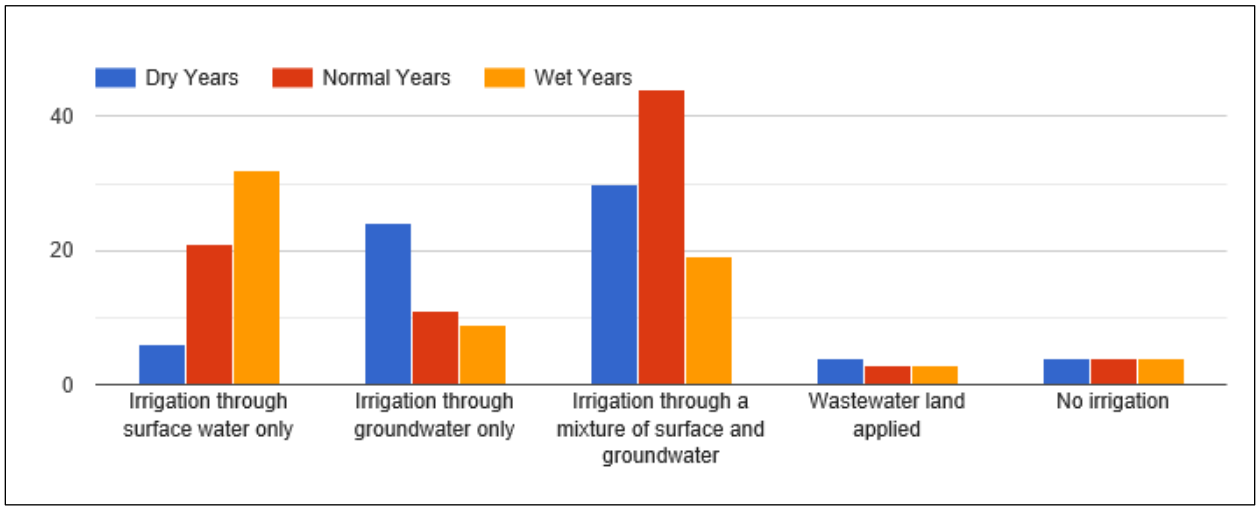
(58 responses)

Total Acres Farmed	Total Acres Farmed	Total Acres Farmed
4	207	1,000
8	220	1,160
17	230	1,200 (x2)
20	235	1,250 (x2)
35	254	1,500
39.25	257	1,722
40	266	1,921.27
42.21	280	2,044
54	350	2,630
55	370	3,000
56.5	375 (x2)	3,500
100 (x2)	467	4,415
135.33	516	5,000
143	600	6,000
155	640	15,000
156	770	29,000
160	825	
161.82	890	

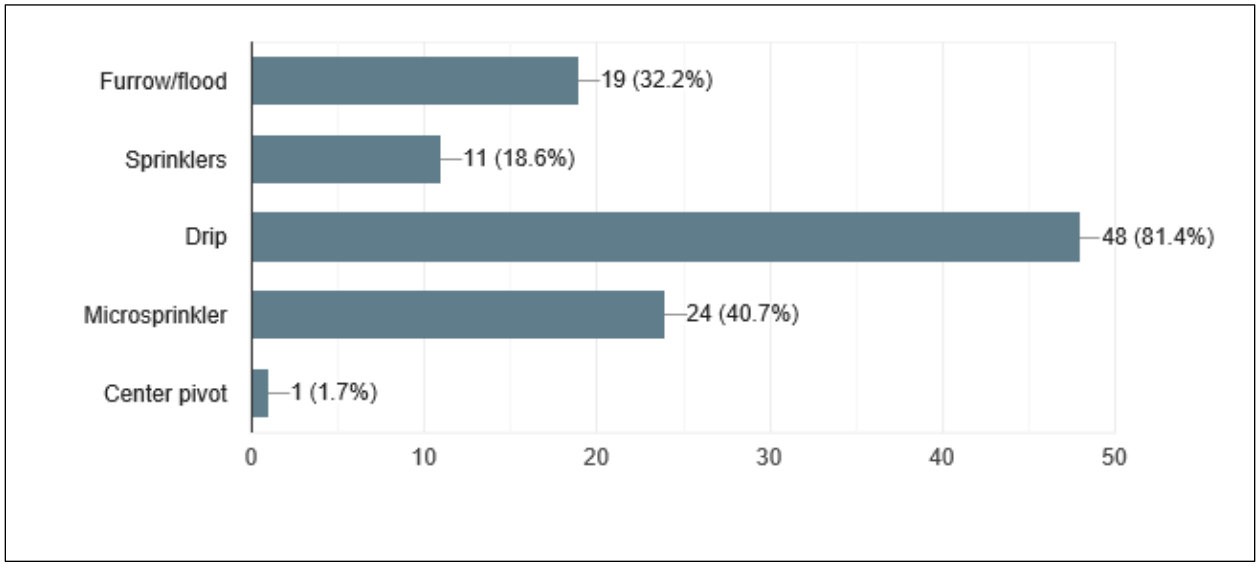
3. In a typical year, how much of the following crops, animals or land do you manage/own?

Crop or Land Type	Acres Managed or Owned	Crop or Land Type	Acres Managed or Owned
Fruit trees	Ranges from 5-6,000 acres *(23 responses)*	Grapes	Ranges from 100-1,500 acres *(9 responses)*
Nut trees	Ranges from 8-15,000 acres *(47 responses)*	Hay/alfalfa	Ranges from 17-1,000 acres *(8 responses)*
Row crops	Ranges from 65-3,000 acres *(8 responses)*	Livestock on pasture/rangeland	Ranges from 4-17,000 acres *(4 responses)*
Seed crops	*0 responses*	Dairy (total head)	*0 responses*
Vegetables	70-1,500 acres *(2 responses)*	Food Processor/Production	*0 responses*
Grain	Ranges from 250-2,000 acres *(6 responses)*	Other land use (please indicate):	Ranges from 20 to 681 acres of fallowed ground *(3 responses)*

4. Which of the following sources of water and management do you typically utilize under the following conditions?



5. If you do use irrigation, which of the following methods of delivery do you use? Check all that apply. *(59 responses)*



6. In response to water scarcity, please indicate if you currently use the following practices and your likelihood to use the following practices in the future. *(Table lists number of responses.)*

Practice	Currently Use	Future Use					
		Very Unlikely	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely	Very Likely
Drill more wells	6	14	10	6	5	4	6
Restore existing wells	11	12	3	4	9	7	5
Make existing wells deeper	3	14	11	9	8	2	2
Pump more groundwater	7	7	8	3	13	5	7

Practice	Currently Use	Future Use					
		Very Unlikely	Unlikely	Somewhat Unlikely	Somewhat Likely	Likely	Very Likely
than previous years							
Drip irrigation	35	4	1	1	5	5	17
Water monitoring technology	28	2	1	3	6	4	18
Fallow fields	4	11	14	3	4	9	1
Soil moisture sensors	27	2	1	2	7	6	13
Change to a less water intensive crop	4	24	8	7	2	4	1
Reduce livestock stocking rates	1	14	4	1	2	0	4
Leaf sampling to measure plant-water status	13	4	3	2	12	11	4
Purchase additional water	11	5	6	4	7	12	13
Purchase crop insurance	23	3	1	4	6	8	16
Other: *(5 responses)*	Bank water and purchase water credits; Vacant land for sale; Bank water; Groundwater recharge; deep root irrigation						

7. **Please rate the level of importance these potential groundwater conditions are to you** *(with "1" being the most concerning, 5 being the least concerning).* **If you have additional concerns, please indicate them in the "Other" category.** *(Table lists number of responses.)*

Groundwater Condition	Rating of Concern *(1 most concerning, 5 least concerning)*				
	1	2	3	4	5
Lowering of groundwater levels	37	21	2	4	0
Reduction in groundwater storage	28	16	11	4	6
Water quality degradation	13	15	21	9	5
Local subsidence	16	12	11	6	17
Depletions of surface water	43	9	6	2	5

Other *(your opinion)*: There is no potable water under the surface of our land in the white area. We do not have any wells, or use any groundwater, but have been included in the basin anyway. The drinking water for our livestock comes from springs located in the mountains outside of the basin.

It is all politics!!!!! California has plenty of water, use common sense!!

Get rid of the "enviros"; to hell with the fish

Limiting access/use

To rid bureaucratic time wasters; to rid enviros stopping the pumps

Worry about Semitropic groundwater degradation and other areas in our district

Government interferences

8. The following are a list of management options that have been used on the West Coast for water management. Please provide your level of preference for these types of management: *(Table lists number of responses.)*

Management Option	Strongly Against	Against	Somewhat Against	Somewhat Support	Support	Strongly Support	Not Familiar
Individual recharge credits (i.e. winter flooding)	3	2	1	6	17	25	3
Water metering	11	10	8	12	12	8	1
Water trading through markets	4	5	5	8	13	24	4
Public program highlighting farmers implementing water saving practices	2	0	3	12	23	21	1
Farmer adoption of water management practices	2	1	1	9	24	26	0
District investment in conjunctive use infrastructure (i.e. water storage)	3	0	1	3	12	41	1
Groundwater replenishment fees	14	10	13	10	6	3	7
Fixed quota for water pumping allocated to each farmer	24	8	9	11	6	1	2
Incentives for water saving practices	2	2	0	16	18	20	3
Moratorium on drilling new wells	13	12	16	5	3	2	4
Permits for drilling new wells	5	6	8	8	22	10	3
Other *(your opinion)*:	None						

9. If groundwater monitoring is required in the future, which of the following monitoring methods would you prefer? *(Table lists number of responses.)*

Method of Determining Water Allocation	Strongly Not Preferred	Not Preferred	Somewhat Not Preferred	Somewhat Preferred	Preferred	Strongly Preferred
Well metering	17	8	7	9	17	5
Use satellite estimates and ground truth	7	12	15	11	6	2
Use standard crop water requirement indexes	5	10	13	15	6	5

10. Should disputes arise over SGMA implementation, what is your preferred means of reconciliation? *(Table lists number of responses.)*

Dispute Option	Strongly Not Preferred	Not Preferred	Somewhat Not Preferred	Somewhat Preferred	Preferred	Strongly Preferred
State Water Resources Control Board	18	9	5	7	0	13
Groundwater Sustainability Agency	7	2	5	15	16	8
County Board of Supervisors	20	12	4	6	9	2
Superior Court System	23	16	2	4	4	3
Arbitration	3	11	3	9	4	2
Other *(4 responses):* I want the state to delete our land from the basin boundary, then I will not have any dispute to reconcile; Stop running water to the Pacific Ocean; A farmer-controlled Advisory Board						

11. If you have any additional information or feedback regarding SGMA, water management or farming in Kern County that should be taken into consideration while developing the Groundwater Sustainability Plan (GSP), please provide the information below: *(14 responses)*

Allow water banking where it is easiest conveyed and allow those groundwater banking credits to be used in the basin where it is need. If a white area landowner is able to purchase water and can bank it in Arvin or Lost Hills allow this to happen vs spending hundreds of thousands of dollars to convey that water to the particular area where is will be pumped out of. Use the Kern River as a water bank and who ever leaves the water in the river gets the credit for their district no matter where is actually is recharged too. It's one Basin. Why spend millions building additional water banks and conveyance systems when you have the best recharge ground and conveyance system already in place. In addition, think how beautiful our city could be if we had water running though the river more often. WORK TOGETHER for solutions that is best for the basin and allow those benefits to be spread across to all the districts who contribute to the solution.

Important that market is established that allows for creation of an asset (water pumping credit) that can be traded in open market. This would (hopefully) cause water to be used for highest and best use and still allow for flexibility we need in industrial agriculture.

Need ground water

No new water storage has been constructed in over 30 years. Now we will be told how much we can pump. It would of great advantage for our future if we had enough water storage to farm our crop during tough years. Legal issues are greatly reducing our surface water! We make payments on our ground and we need to farm every inch of it. We can't be cut short because of a lack of water. Build a storage so we can save ground water!

Pretty well explained above, we do not have any wells within the basin boundary, do not use any groundwater, do not have any farming and do not want to be included in any of the water wars.

We should have an aggressive program promoting groundwater recharge wherever and whenever possible.

I'm not in support of mega growers only buying farmland in order to resell water to places like L.A. to make a killing off of. Needs to be against the law and downright illegal. The extra water should go to farmers or storage for drought years... not to make profit on!!!

Water trading through markets seems like our best option. Also, connecting farms with conservation easements to facilitate retiring their land.

Work more closely with oil field-produced water and pipe it to other water districts.

Ensure growers fully understand current water consumption. At this point most growers don't have a strong handle on water use which leads to fear of SGMA implementation. Although fearful for agriculture, a program such as this is necessary. With current estimates, groundwater credits and groundwater markets will allow farming to continue in one method or another.

Best to have all district board presidents meet quarterly to work out ways to exchange any surplus water and to work out the details.

Give us the water. Don't send the water out to the ocean. Don't send water to fish that have not been in the area for over 50 years.

I know we can't keep depleting our underground basin, but we need to increase storage and use a more common-sense approach for water. Stop flushing our water to sea.

Some of the proposals presented are ridiculous. Mitigation features presented - farmers paying for municipal wells and housing (rural) well development.

Farmers aren't the end users of water. Consumers are. We are efficient and food is a basic need for survival. It's a shame our state has the best farm land in the world wants to eliminate the profession. We're highly regulated more so than anywhere else in the world. Farming for a century on our land and living on it and investing in, it's hard to move away.

Appendix C

List of Kern Groundwater Authority Public Outreach Efforts

List of Kern Groundwater Authority Public Outreach Efforts

Throughout the SGMA process, the Kern Groundwater Authority held public outreach efforts to engage stakeholders in the development of the Groundwater Sustainability Plan. These KGA-wide meetings and events are listed by phase in a timeline format in Figure VI-1, Figure VI-2, and Figure VI-3, and are listed below in **Table C-1**. Supporting materials for all events and meetings are available at www.kerngwa.com.

The KGA member agencies also held district-specific outreach efforts during the process, and those events and meetings are noted in their specific chapters of the GSP.

Table C-1. List of KGA Public Outreach Efforts

Meeting/Event	Date/Location
2015	
KGA Board of Directors Meeting	January 21, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	February 25, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	March 25, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	April 22, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	May 27, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	June 24, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	August 26, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	September 23, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	October 28, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	November 16, 2015, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	December 21, 2015, Kern County Administration Building, Bakersfield
2016	
KGA Board of Directors Meeting	January 27, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	February 24, 2016, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	March 21, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	April 27, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	May 18, 2016, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	June 29, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	August 24, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	September 28, 2016, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	October 24, 2016, Kern County Administration Building, Bakersfield
SGMA Stakeholder Outreach Workshop	October 24, 2016, Kern Ag Pavilion, Bakersfield
KGA Special Board of Directors Meeting	November 14, 2016, Kern County Administration Building, Bakersfield

Meeting/Event	Date/Location
SGMA Stakeholder Outreach Workshop	November 1, 2016, Kern County Water Agency, Bakersfield
SGMA Stakeholder Outreach Workshop	November 15, 2016, Kern Ag Pavilion, Bakersfield
SGMA Stakeholder Outreach Workshop	November 28, 2016, Kern County Administration Building, Bakersfield
SGMA Stakeholder Outreach Workshop	December 5, 2018, Kern Ag Pavilion, Bakersfield
SGMA Stakeholder Outreach Workshop	December 20, 2018, Kern County Administration Building, Bakersfield
2017	
KGA Board of Directors Meeting	January 25, 2017, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	February 22, 2017, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	March 22, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	April 26, 2017, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	May 15, 2017, Kern County Administration Building, Bakersfield
KGA Special Board of Directors Meeting	June 19, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	July 19, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	August 23, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	September 27, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	October 25, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	November 16, 2017, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	December 20, 2017, Kern County Administration Building, Bakersfield
2018	
KGA Stakeholder Committee Meeting	January 8, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Stakeholder Committee Meeting	February 5, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	February 28, 2018, Kern County Administration Building, Bakersfield
KGA Stakeholder Committee Meeting	March 5, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	March 28, 2018, Kern County Administration Building, Bakersfield
KGA Stakeholder Committee Meeting	April 2, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	April 25, 2018, Kern County Administration Building, Bakersfield
Groundwater Workshop for Disadvantaged Community Stakeholders	April 26, 2018, Shafter
KGA Stakeholder Committee Meeting	May 7, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
Groundwater Workshop for Disadvantaged Community Stakeholders	May 21, 2018, Arvin
KGA Board of Directors Meeting	May 23, 2018, Kern County Administration Building, Bakersfield
KGA Stakeholder Committee Meeting	June 4, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield

Meeting/Event	Date/Location
KGA Board of Directors Meeting	June 27, 2018, Kern County Administration Building, Bakersfield
KGA Stakeholder Committee Meeting	July 2, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	July 25, 2018, Kern County Administration Building, Bakersfield
"Kern County In Depth" – Television program discussion of the establishment of GSAs and SGMA overview	Aired August 16, 2018, KGET Channel 17 (reran on Saturdays for four subsequent weeks, segment archive links on KGET website)
KGA Board of Directors Meeting	August 22, 2018, Kern County Administration Building, Bakersfield
KGA Stakeholder Committee Meeting	September 20, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
Sustainable Groundwater Plan, Compliance & State Intervention Stakeholder Informational Meeting	September 20, 2018, Kern Ag Pavilion, Bakersfield
KGA Stakeholder Committee Meeting	October 1, 2018, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	October 24, 2018, Kern County Administration Building, Bakersfield
KGA Board of Directors Meeting	December 19, 2018, Kern County Administration Building, Bakersfield
2019	
KGA Stakeholder Committee Meeting	January 7, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
"Kern County In Depth" – Television program discussion of Kern County withdrawal from KGA and status of GSPs	Aired January 9, 2019, KGET Channel 17 (reran on Saturdays for four subsequent weeks, segment archive link on KGET website)
KGA Board of Directors Meeting	January 23, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
KGA Stakeholder Committee Meeting	February 4, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	February 27, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
SGMA Report at Kern County Farm Bureau Board Meeting	March 21, 2019, Kern County Farm Bureau, Bakersfield
KGA Board of Directors Meeting	March 27, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
SGMA Report at Kern County Farm Bureau Board Meeting	April 24, 2019, Kern County Farm Bureau, Bakersfield
KGA Board of Directors Meeting	April 24, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
SGMA Open House Event	May 14, 2019, Kern Ag Pavilion, Bakersfield
SGMA Report at Kern County Farm Bureau Board Meeting	May 16, 2019, Kern County Farm Bureau, Bakersfield
KGA Board of Directors Meeting	May 22, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
KGA Stakeholder Committee Meeting	June 3, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield

Meeting/Event	Date/Location
KGA Board of Directors Meeting	June 26, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
KGA Stakeholder Committee Meeting	June 3, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Stakeholder Committee Meeting	July 1, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	July 24, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
KGA Stakeholder Committee Meeting	August 5, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
SGMA Report at Kern County Farm Bureau Meeting	August 15, 2019, Kern County Farm Bureau, Bakersfield
KGA Board of Directors Meeting	August 28, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
"Kern County In Depth" – Television program discussion of the release of the GSPs, management actions/projects, and next steps	Original air date August 28, 2019, KGET Channel 17 (reran on Saturdays for four subsequent weeks, segment archive link on KGET website)
Management Area/GSP Plan Presentations to KGA Member Agencies' Board of Directors	August 6, 2019, Kern Water Bank August 8, 2019, Kern-Tulare Water District and Cawelo Water District August 13, 2019, Rosedale Rio-Bravo Water Storage District August 14, 2019, Wheeler Ridge-Maricopa Water Storage District, Semitropic Water Storage District, Shafter-Wasco Irrigation District, and Tejon Castac Water District August 15, 2019, Arvin-Edison Water Storage District and Eastside Water Management Area August 20, 2019, North Kern Water Storage District August 21, 2019, Southern San Joaquin Municipal Utility District, Kern County Water Agency, and Westside District Water Authority August 27, 2019, West Kern Water District August 28, 2019, Kern Groundwater Authority
KGA Stakeholder Committee Meeting	September 4, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
GSP Public Review Presentation	September 13, 2019, Greater Bakersfield Chamber of Commerce
GSP Public Review Presentation	September 20, 2019, California Partnership for the San Joaquin Valley
GSP Public Review Open House for Stakeholders	September 26, 2019, 5:30-7 p.m., Kern Ag Pavilion, Bakersfield
KGA Board of Directors Meeting	September 25, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
KGA Stakeholder Committee Meeting	October 7, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	October 23, 2019, Greater Bakersfield Chamber of Commerce, Bakersfield
KGA Stakeholder Committee Meeting	November 4, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
GSP Public Review Presentation	November 11, 2019, Kern Leaders Academy
GSP Public Review Presentation	November 12, 2019, Bakersfield Hispanic Chamber of Commerce

Meeting/Event	Date/Location
KGA Board of Directors Meeting	November 20, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
GSP Public Review Presentation	November 21, 2019, Kern County Farm Bureau
KGA GSP Public Hearing & Board of Directors Meeting	December 18, 2019, Klein, DeNatale & Goldner Law Offices, Bakersfield
GSP Update Presentation	December 19, 2019, Central California Environmental Justice Network
KGA Stakeholder Committee Meeting	January 6, 2019, Rosedale-Rio Bravo Water Storage District, Bakersfield
KGA Board of Directors Meeting	January 15, 2020, Klein, DeNatale & Goldner Law Offices, Bakersfield

Attachment D

Summary of Public Comments

Commentor	Ref #	Comment	Response
Kern Groundwater Authority Received Comments			
Kern County Farm Bureau	FB-1	The Kern County Farm Bureau (KCFB) is submitting this letter on behalf of its members expressing the open and transparent process that the Kern Groundwater Authority (KGA) provided during the development of the Groundwater Sustainability Plan (GSP) required under the Sustainable Groundwater Management Act (SGMA).	Comment Noted.
Kern County Farm Bureau	FB-2	During the last two plus years of the KGA's formation and subsequent development of the GSP, the KGA has attended and presented monthly to the KCFB's board, members, and guests. Most importantly, with the approval of the KCFB, the KGA continuously sought input, recommendations, and suggestions from the KCFB members. In addition to these efforts, the KGA partnered with the KCFB to hold several "Open House" workshops with the Department of Water Resources (DWR) and State Water Board staff in attendance as willing participants thus providing the KCFB's members and all other beneficial users of groundwater in the Kern Subbasin the opportunity to talk one-on-one with staff.	Comment Noted.
Hancock Farmland Services	HFS-1	The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area.	There is no allocation of native yield at this time. The use of the native yield at this time is a component of developing a basic water budget. The water model for the Kern subbasin describes in detail the native yield and how the water model derives to the Kern subbasin number. There are no determination of any water rights or allocations.
Hancock Farmland Services	HFS-2	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Comment Noted. See Kern Water Bank Authority Response
Hancock Farmland Services	HSF-3	GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration.	Remote sensing is also another mechanism that is being explored at this time. The KGA is working with DWR to amend a current grant program to accommodate the usage of those funds to begin the development of a program to establish remote sensing systems.
Westchester	WGIM-1	The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area.	Comment noted. See Hancock Farmland Services HFS-1 response.
Westchester	WGIM-2	… GSAs and MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible without creating undesirable results, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity.	Comment Noted: The KGA also agrees with the recommendation to utilize the best available data and science.
Westchester	WGIM-3	As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated and consistent across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled).	Comment Noted: Each individual management area and GSA have different water supplies, water amounts and water banking projects thus the coordination occurred during the development of the water model for future projections. SGMA requires to respect water rights.
Westchester	WGIM-4	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Comment Noted: See Kern Water Bank Authority response
Westchester	WGIM-5	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater.	The GSAs in the Kern County subbasin are currently engaged in the development of a coordinated basin-wide data management system (DMS). That process has just begun with the submittal of an application to DWR for Prop 68 grant funds. As that moves forward, the design of the DMS is vital to the management/tracking of groundwater and surface water use.
Westchester	WGIM-6	GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration.	Comment Noted: See Hancock Farmland Services HSF-3 response
Wonderful Orchards	WO-1	It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource.	Comment Noted: See Hancock Farmland Services HFS-1 response
Wonderful Orchards	WO-2	In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield.	Comment Noted: See Hancock Farmland Services HFS-1 response
Wonderful Orchards	WO-3	In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin.	Comment Noted: The KGA will continue to hold stakeholder workshops throughout the implementation of the GSP.
Wonderful Orchards	WO-4	Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	Comment Noted: Water Markets are mentioned in several individual management area plans as management projects/actions. As a basin, the discussion is continuing between GSAs. The KGA will continue to hold stakeholder workshops throughout the implementation of the GSP.
Wonderful Orchards	WO-5	GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity	Comment Noted: See Westchester WGIM-2
Wonderful Orchards	WO-6	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Comment Noted: See Hancock Farmland Services HFS-2 response
Wonderful Orchards	WO-7	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater.	Comment Noted: See Westchester WGIM-5 response.
Dept of Fish and Wildlife	DFW-1	The Department recommends continued data collection to reduce uncertainty around shallow groundwater, and concurrently, around the presence of GDEs. Until such time as a GOE can be verified through field work or increased resolution of groundwater mapping reliant on hydrologically robust baselines, the Department recommends including all potential GDEs in the MAP as beneficial users of groundwater	Comment Noted. The KGA management area plans that have the condition of shallow groundwater have addressed. See Semitropic, Arvin-Edison and Westside management area plans for those areas indicated in the comment letter dated 11-25-2019.

Commentor	Ref #	Comment	Response
Dept of Fish and Wildlife	DFW-2	i. Revise the sustainable management criteria and accompanying narrative by accounting for undesirable results for environmental beneficial users of groundwater. Clarify how species and habitat groundwater needs were considered in the identification of sustainable management criteria. ii. Revise sustainable management criteria to reflect a 'Critically Overdrafted' subbasin designation by seeking to improve current groundwater conditions rather than allowing for continued aquifer depletions over the next two decades.	Comment Noted. The process in developing the Sustainable Management Criteria was an open door policy at several workshops, public KGA board meetings and open house workshop with all the GSAs in the Kern subbasin. Significant and undesirable results are based on local conditions as required not as a best case.
Dept of Fish and Wildlife	DFW-3	The Department recommends that the GSP clarify locations of existing shallow groundwater monitoring wells used to create the shallow groundwater elevation contour map provided within the MAP (Figure 2-27). Additionally, the figure should show overlap potential GDEs with shallow monitoring well locations to vet vegetation groundwater reliance. This figure and associated information would clarify monitoring data gaps and serve as an assessment tool when verifying GDEs.	Comment Noted. The KGA management area plans that have the condition of shallow groundwater have addressed.
Dept of Fish and Wildlife	DFW-4	Many of the Duck Clubs in the MAP area are currently supported by the Department'sCalifornia Waterfowl Habitat Program to ensure the adequate maintenance of habitat critical to wetland-dependent species. Implementation of pumping allowances identified in Figure 5-3 would eliminate all wildlife value associated with these wetlands. To continue to share in the support of this valuable public benefit, the Department recommends that the Semitropic Water Storage District Groundwater Sustainability Agency create additional pumping allowances and/or supplemental water supply opportunities for lands that support wetland habitat. The Department also requests confirmation that all Department-owned lands within Semitropic Water Storage District jurisdiction (see Comment #1) will be granted an equitable native groundwater yield allocation under new Landowner Water Budget management actions (starting page 187).	Comment Noted. The KGA management area plans that have the condition of shallow groundwater have addressed.
The Nature Conservancy	TNC-1	Section 2.1.5.1 Description of Beneficial Uses and Users in the Basin (p. 23) California Water Code §1305(f) defines beneficial uses of waters of the State as including "preservation and enhancement of fish, wildlife, and other aquatic resources and preserves." Section 2.1.5.1 states that beneficial users are stakeholders who have an interest in or need groundwater use. The discussion focuses on active groundwater pumpers but does not mention environmental uses or environmental stakeholders. Section 2.2.1.4 focuses on criteria for determination of groundwater with beneficial use for human consumption or mineral extraction, but omits references in the California Water Code to environmental beneficial uses. **Please describe the other beneficial uses and users of groundwater in the Subbasin identified by the Water Code including: GDEs; managed wetlands; Protected Lands, including preserves, wildlife refuges, conservation areas, recreational areas and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, recreation and navigation.**	Comment Noted. In the KGA Communication and Engagement Plan beneficial users are described including environmental organizations such as the ones that are mentioned in the comment.
The Nature Conservancy	TNC-2	Section 2.2.1.4 Kern County Subbasin Boundaries, Criteria for the Extent of Groundwater with Beneficial Use in the Subbasin (p. 40) The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. **Please identify any environmental uses and users of groundwater in the plan area, and take particular note of the species with protected status. The following are resources that can be used:** **- Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/;** **- A list of freshwater species located in the Kern County Subbasin in Attachment C of this letter; and** **- The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB)**.	Comment Noted. See individual management area plans for those areas that have species and habitats.
The Nature Conservancy	TNC-3	Section 2.1.2 Plan Area Setting (pp. 13-14) The GSP provides a description of the groundwater well types and well density; however, there is no discussion of instream flow requirements, if any, or how the water infrastructure is in compliance with regulatory requirements to protect species of concern in the surface waters within the Subbasin. **Please provide a description of any current and planned instream flow requirements or regulatory requirements for protection of species of concern in the Kern River, Poso Creek and Caliente Creek. If there are no requirements in place or planned, then please state that in the GSP.**	Comment Noted. See individual management area plans for those areas that have those surface water indicated. Also, the Kern River is not located within the KGA jurisdictional boundary, see KRGSA for additional information.
The Nature Conservancy	TNC-4	Section 2.1.3 Existing Plans in the Plan Area (pp. 14-15) This section summarizes the Kern County General Plan and general plans for cities within the GSP area. The plan descriptions are focused on goals and policies directly related to groundwater resources and do not include policies and goals related to surface water resources that may be connected to groundwater. **We suggest adding a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a description of any land use or environmental plans relevant to wetlands, aquatic resources and other GDEs and ISWs and their relationship to the GSP. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands around the Kern Wildlife Refuge, aquatic resources and other GDEs and ISWs.**	Comment Noted. The General Plan goals and policies are under the jurisdiction of the planning public agency thus the KGA nor any management area plan has the authority to change/adopt any policies requested. The KGA and the individual management area plans where the planning public agenices are located within are communicating about the general plan updates coming in 2020 and when there is a general plan amendment occurring.
The Nature Conservancy	TNC-5	Section 2.1.3 Existing Plans in the Plan Area (pp. 14-15) This section is focused on discussion of agriculture and irrigation needs, demands, and types of irrigation, and the groundwater resources policies and goals in general plans. It does not include any other applicable land use or environmental plans that may contain information relevant to the GSP and ISWs. This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**	Comment Noted. The Metropolitan Bakersfield Habitat Conservation Plan is located within the jurisdiction of the KRGSA. Currently, there are no known HCPs or NCCPs adopted within the KGS jurisdiction boundary.

Commentor	Ref #	Comment	Response
The Nature Conservancy	TNC-6	Section 2.1.4 Existing and Ongoing Water Resource Programs (pp. 15-19) Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater *and related surface conditions* (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, additional information on water use management and monitoring programs relevant to wetlands, sensitive or critical habitat, and GDEs and their relationship to the GSP should be provided. **- Please provide a description of resource management plans, monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals, and list them in Table 2-1.** **- The Critical Habitat for Threatened and Endangered Species website maintained by US Fish and Wildlife Service (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e 265ad4fe09893cf75b8dbfb77) identifies multiple lands with endangered and threatened species in the Subbasin, for instance, Buena Vista Lake Ornate Shrew (Sorex ornatus relictus) occurs within the area. Please review and discuss the potential groundwater reliance of critical species in the Subbasin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.** **- Other GDEs and sensitive habitats. Please include a discussion of any monitoring programs related to GDEs and sensitive habitats.**	Comment Noted. Table 2-1 are those programs that the member agencies of the KGA are being implemented within each management area. Since the State and Federal are not members of the KGA their responsbilities are not listed. The table information was provided by the member agencies and for more detail information see individual management area plans where GDEs and sensitive habitat are located.
The Nature Conservancy	TNC-7	Section 2.1.4.4 Well Permitting Process (p. 20) and Section 2.1.4.5 Plan Elements from CWC Section 10727.4 (g) Well Construction Policies (p. 21) These sections discuss the Kern County Public Health Services Department Water Well Program, which issues permits to construct, reconstruct, and destroy water wells. The discussion does not provide any details regarding the potential effects of the permitting and construction of new wells on aquifer systems, GDEs and ISWs. **- Please discuss that future well permitting and well construction must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.** **- Please state how the well permitting process incorporates protection of GDEs and ISWs within the Subbasin.** **- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). Please include a discussion of the need for well permitting programs to comply with this requirement.**	Well permits within the Subbasin are issued by the Kern County Public Health Services Department and will continue under SGMA, meaning that Kern County retains jurisdiction over the issuing of water well permits. The County has implemented a supplmental well application for SGMA that is distributed to the KGA/GSAs in the Kern subbasin for the individual management area plan or GSA to contact the applicant of the well permit to advise of the local groundwater conditions and consideration of local measurable objectives and minimum threasholds prior to the construction of the well. The process developed for well permits was coordinated with all the GSAs in the Kern subbasin and Kern County to limit as much impacts to all beneficial users within the Kern subbasin. The process has been in existence for over a year and has assisted new water well applicants to understand SGMA prior to investing in the construction of new water wells.
The Nature Conservancy	TNC-8	Section 2.2.1.5 Bottom of Subbasin (p. 41) The bottom boundary of the Subbasin should be more precisely defined in accordance with DWR guidance. As noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12- 23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions." Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom. This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary. **Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom. If the bottom boundary of the Subbasin has not been clearly defined in certain management areas, please identify this as a data gap and elaborate in the monitoring section how and where additional observations can be made to reconcile this data gap.**	Comment Noted. The basin is defined within the Basin Setting. See individual management area plans.
The Nature Conservancy	TNC-9	Section 2.2.1.6 Principal Aquifers and Aquitards (pp. 44-53) The GSP includes a relatively robust description of the geologically diverse aquifers in the Subbasin with differing zones of confined, semiconfined and unconfined groundwater conditions, in addition to "shallow zones" stated to be present locally in the northwestern and southern portions of the central Subbasin. The GSP states these are "not a part of active groundwater extraction, but data are included in the groundwater conditions section of this report to evaluate changes over time." On page 53, environmental users are identified as beneficial groundwater users of the primary aquifers in the Subbasin. Please note that a Principal Aquifer is defined in the GSP regulations as including "aquifers or aquifer systems that store, transmit, and yield significant … quantities of groundwater to … springs, or surface water systems" (23 CCR §351(aa). As such, if the shallow aquifer interacts with surface water systems or provides groundwater necessary to sustain GDEs or other environmental beneficial users, it should be considered a Principal Aquifer. No description, data or information is provided regarding the potential effect of groundwater extraction from groundwater production aquifers on the uppermost shallow aquifers and groundwater bearing zones, whether perched aquifers exist, and how the shallow aquifers or zones are connected to and interact with surface water and GDEs. **Please provide additional description of the shallow aquifers within the Subbasin including characteristics of interconnections with surface water and GDEs, vertical groundwater gradients, connections with underlying production aquifers, and the resulting potential interaction of groundwater pumping with ISWs and GDEs. Please state whether localized perched aquifers are present in the Subbasin. Describe any data gaps. The function and significance of the Shallow Aquifers that provide groundwater to ISWs and GDEs should be summarized in Table 2-3.** **Please describe whether the existence of Aquifer Exemptions has any bearing or implications related to environmental beneficial uses of groundwater.**	Comment Noted. In the Kern subbasin, shallow aquifers are not aquifers that interconnect with the surface as is indicated in the cross sections in the GSP and individual management area plans. See individual management area plans where shallow aquifers are located within for specific actions to be taken by the management area plan.
The Nature Conservancy	TNC-10	Section 2.2.1.7 Data Gaps and Uncertainty (p. 53) **If data are not present to produce the information requested in the comment above, please clearly identify this as a data gap. Please elaborate in the monitoring section how and where additional observations are to be conducted in order to address this data gap.**	Comment Noted. See individual management area plans where shallow aquifers are located within for specific actions to be taken by the management area plan.
The Nature Conservancy	TNC-11	Section 2.2.1.8 Cross Sections (pp. 54-55) Regional basin-wide geologic cross sections are provided in Figures 2-19a through 2- 19g. These cross-sections do not include a graphical representation of the manner in which the very shallow groundwater or perched water may interact with ISWs or GDEs that would allow the reader to understand this topic. **Please include near- surface cross sections or insets that depict the conceptual understanding of shallow groundwater and ISW interactions at different locations, including perched and regional aquifers and GDEs.**	Comment Noted.
The Nature Conservancy	TNC-12	Section 2.3.1.1 Elevation and Flow Directions (pp. 64-66) This section states that the depth to groundwater in the Shallow Zone ranges from 5 to 25 feet. Inference is made that groundwater levels in the Shallow Zone is relatively constant and is typically perched on fine grained sedimentary units and likely disconnected from the productive aquifer system. No specific data or hydrogeologic analysis is provided to substantiate these important claims. **Please provide any available stratigraphic data, hydrograph data, pumping test data or other information to substantiate these claims. If the data are not available, please identify this as a data gap.**	Comment Noted. Made changes to add additional data references.

Commentor	Ref #	Comment	Response
The Nature Conservancy	TNC-13	Section 2.3.7 Interconnected Surface Water Systems (pp. 88-90) The regulations [23 CCR §351(o)] define ISWs as "surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted." "At any point" has both a spatial and temporal component. Even short durations of interconnection between groundwater and surface water can be crucial for surface water flow and support of environmental users and uses of groundwater and surface water. ISWs can be either gaining or losing. The text states (p. 88) that "Within the Subbasin, there are no interconnected natural surface water systems in monitored areas associated with the pumping zone of the regional aquifer system" and "Since the advent of groundwater pumping in the Subbasin and subsequent impoundment and regulation of flow of the Kern River, groundwater levels near the river are no longer connected with the river bed by a continuous saturated zone." However, the data provided to substantiate these broad claims cover only portions of the surface water flow system. The models cited as substantiation were not constructed for the purpose of identifying potential ISWs and GDEs, but are regional models constructed for supply management. In fact, the text also states (p. 90) that the Kern River has gained flow during some years and the upper reach of the Kern River in the Subbasin has been identified as gaining. The connection between surface water and groundwater is mentioned as a data gap in Section 2.3.7.4 (p. 90). Furthermore, the depth to water in the shallow aquifer is quite shallow as discussed above (5 to 20 feet below ground surface), which strongly suggests that interaction between the shallow aquifer and surface water may be occurring. Because there are uncertainties in the hydraulic connection between rivers / streams and shallow groundwater, ISWs should not be disregarded in the GSP. The GSP regulations require reliance on the best available information and clear identification of data gaps when sufficient information is not available.	Comment Noted. Kern River is not within the jurisdiction of the KGA. Please review the information related to the Kern River in the KRGSA GSA for further specific details.
The Nature Conservancy	TNC-13 (Cont)	**Please provide additional data or analysis to substantiate the nature of the hydrologic relationship between the shallow aquifer and production aquifers and ISWs. If data are not available to verify that such a connection does not exist, acknowledge where ISWs may exist and identify appropriate sustainable management criteria, monitoring networks and management actions for sustainable ISW management or to address data gaps. Data could include groundwater level data from shallow or nested monitoring wells, comparison of stream stages to groundwater levels, modeling information or additional gaging data. Please elaborate how and where additional observations (shallow monitoring wells, stream gauges, and nested / clustered wells) along surface water features can be used to address data gaps in the Monitoring Network section of the GSP to improve identification of ISWs rather than prematurely disregarding them in the GSP.**	Comment Noted. Additional information provided.
The Nature Conservancy	TNC-14a	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) We applaud KGA for using the NCCAG database, developed through a collaboration between DWR, California Department of Fish and Wildlife (CDFW) and TNC, to identify potential GDEs, and then evaluate the NCCAG results to identify GDEs; however, the approach used is based on narrative analysis and quantitative data are not used. In addition, no determination is presented as to which NCCAG polygons represent GDEs. **Please refer to Attachment D of this letter for best practices in using groundwater data to verify whether NCCAGs are GDEs.**	Comment Noted. During the development of the Basin Setting, several workshops were held to seek input/information from beneficial users to better work together and accommodate their concerns. The Basin Setting was first posted on the KGA website in May 2019.
The Nature Conservancy	TNC-14b	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) The text states (p. 91): "Groundwater potentiometric surfaces from Kern Fan Monitoring Reports (KCWA, 2016) indicate that underlying aquifers are not connected with stream channels. Some flow in the Kern River, as well as in Poso Creek and other mountain-front creeks, is likely to be sustained periodically by release of bank storage (surface water stored in stream banks), but the underlying groundwater is too deep to sustain flow in the valley floor." This contradicts the statements on page 90 that the Kern River has gained flow during some years and the upper reach of the Kern River in the Subbasin are identified as gaining. If there are insufficient groundwater level data in the upper aquifer where gaining reaches are located or where bank storage is inferred to occur, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gaps will be addressed.**	Comment Noted. See response above. See individual management area plans for those plans that are identifying data gaps and how the plans are going to manage going forward.
The Nature Conservancy	TNC-14c	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) The text states (p. 92): "The conditions in the center of the Subbasin suggest that the groundwater production aquifer does not reach the shallow subsurface. The production aquifer lies at depths that prevent surface water expressions or accessibility for vegetation." **Please support this statement with specific groundwater level data that indicate a gap in the saturated zone between the production aquifers and shallow groundwater, and define the extent of the NCCAG dataset polygons that are excluded from consideration as GDEs on this basis.**	Comment Noted. See individual management area plans for more detailed information addressing GDEs in their management area.
The Nature Conservancy	TNC-14d	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) The text states (p. 92): "Based on the NCCAG dataset along the margins of the Subbasin where spring-fed streams exist, further confirmation is needed to evaluate the presence of GDEs." If there are insufficient groundwater level data in the upper aquifer where these stream-fed springs exist, then the NCCAGs in these areas should be included as GDEs in the GSP until data gaps are reconciled in the monitoring network. **Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gap will be resolved.**	Comment Noted. See indivudal management areas plans for specific handling of data gaps.
The Nature Conservancy	TNC-14e	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) Because data gaps have been identified in Section 2.2.1.7 (p. 53) Section 2.3.7.4 (p. 90) and Section 2.3.8.2 (p. 92) related to shallow groundwater conditions and the identification of ISWs and GDEs within the Subbasin, final determination of the extent of GDEs in the Subbasin has yet to be completed. **Please revise the GDE analysis in the GSP by conducting more substantial, data-based evaluation focusing on GDE identification in the GSP, clearly identify which NCCAG polygons are excluded, which polygons are determined to be GDEs and which polygons are uncertain at this time and will be verified as data gaps are address.** SGMA defines GDEs as "ecological communities and species that depend on *groundwater emerging from aquifers or on groundwater occurring near the ground surface*" (emphasis added). **Confirmation of GDEs should be performed based on depth to groundwater in the shallow zone, and additional information provided as to whether the shallow zone may be affected by groundwater withdrawal from the production aquifers. Please refer to Appendix D of this letter for best practices for using groundwater data to verify a connection to groundwater.**	Comment Noted. See response to comments above relating to GDEs and specific impacts/relationship to shallow zones. See individual management area plans for specific handling of data gaps.
The Nature Conservancy	TNC-14f	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) In the scientific literature, it is generally acknowledged that GDEs can rely on groundwater for *some or all* of their requirements (emphasis added). GDEs can rely on multiple water sources simultaneously and at different temporal and/or spatial scales (e.g., precipitation, river water, reservoir water, soil moisture in the vadose zone, groundwater, applied water, treated wastewater effluent, urban stormwater, irrigated return flow). SGMA defines GDEs as "ecological communities and species that depend on groundwater *emerging from aquifers* or on groundwater occurring near the ground surface" (emphasis added). **Therefore, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a potential connection to groundwater exists for the wetlands mapped in Attachment H of the GSP. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify whether ecosystem decline or recovery is correlated with groundwater levels.**	Comment Noted.
The Nature Conservancy	TNC-14g	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) Very little description is provided regarding the nature and function of identified GDEs in the west-central and south-central portions of the Subbasin, their potential sensitivity to groundwater and surface water supply changes, or their relative habitat value. **We recommend the inclusion of a discussion regarding the nature and characteristics of GDEs.**	Comment Noted.
The Nature Conservancy	TNC-14h	Section 2.3.8 Groundwater-Dependent Ecosystems (pp. 90-92) **Please provide information on the historical or current groundwater conditions near the GDEs or the ecological conditions present.** Refer to GDE Pulse (https://gde.codefornature.org or Attachment E of this document) or other locally available data (e.g. leaf area index, evapotranspiration or other data developed from remote sensing) and depth to groundwater trends in and around GDE areas, as well as trends in plant growth (e.g., NDVI) and plant moisture (e.g., NDMI). Below is a screenshot example of data available in GDE Pulse for NC Dataset polygons found in the Subbasin.	Comment Noted.

Commentor	Ref #	Comment	Response
The Nature Conservancy	TNC-14i	**We recommend an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized.**	Comment Noted.
The Nature Conservancy	TNC-14j	**Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs. Some organisms rely on uplands and wetlands during different stages of their lifecycle.** Resources for this include the list of freshwater species located in the Subbasin that can be found in Attachment C of this letter, the Critical Species Lookbook, and CDFW's CNDDB database.	Comment Noted.
The Nature Conservancy	TNC-15	Section 2.4 Water Budget (p. 92) The GSP refers to Attachment J for water budget information. In Attachment J, Section 3.7.1 discusses the development of evapotranspiration (ET) rates for each land cover type (p. 11). **Please provide a breakdown of ET for native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities). Please evaluate the spatial relationship of native vegetation ET to NCCAG polygons to determine the groundwater use by this beneficial user for inclusion in the water budget. Identify any data gaps and outline the actions needed to address them.**	Comment Noted. The ETc rates for the entire Kern subbasin were coordinated with satellite data and provided to each individual management area and GSA to evaluate their individual areas. The data obtained from the ITRC- METRIC study covers the entire Kern subbasin. The Kern subbasin water modeling budget provides an overview of the data. To review more specific ETc beakdown, please see individual management area plans or GSA.
The Nature Conservancy	TNC-16a	Section 3.1 Sustainability Goal (p. 139) The sustainability goal of the Kern County Subbasin is to "Achieve sustainable groundwater management…Maintain its groundwater use within the sustainable yield of the basin…Operate within the established sustainable management criteria…maintain sustainability over the implementation and planning horizon." The GSP regulations (23 CCR §354.24) require that "[t]he Plan shall include a description of the sustainability goal, … a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved … and maintained … ." The stated sustainability goal recites regulatory requirements and does not provide a description of the goal relative to the basin setting and beneficial uses. The goal does not mention environmental uses and users of groundwater and does not mention undesirable results. **Please clarify the sustainability goal and expand its description to ensure that all beneficial uses and users of groundwater are identified as being protected from undesirable results, and in particular, include GDEs, ISWs and related critical habitats.**	Comment Noted. The Sustainability Goal was coordinated/developed for the entire Kern County subbasin which includes all beneficial uses and users located within the Kern County subbasin. The KGA held workshops seeking input into the development of the Sustainability Goal as well as held a Board meeting to seek additional input prior to finalizing. During those meetings, it was addressed that the Sustainability Goal is for the benefit of all beneficial uses and users in the Kern Subbasin and environmental is considered a beneficial user.
The Nature Conservancy	TNC-16b	**Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be specifically included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included.**	Comment Noted. See responses above concerning relationship of beneficial uses and users to the Sustainability Goal. No statement is required concering addressing pre-SGMA impacts.
The Nature Conservancy	TNC-16c	The GSP states that there is no ISW connectivity for the Kern River; however, there isn't any data, analysis and / or other information provided to support this broad conclusion. **Please include ISWs in the Sustainability Goal until/unless sufficient data is available and provided to verify the status of ISWs.**	Comment Noted. The Kern River is not located within the jurisdictional boundary of the KGA, see the KRGSA for more detailed information.
The Nature Conservancy	TNC-16d	GDEs are dependent, in part, on suitable water quality; however, the GSP only considers water quality for irrigation and domestic use. **Given that there are potential GDEs in the Subbasin and that they may be affected by water quality, they should be included in the Sustainability Goal and addressed in the Water Quality section.**	Comment Noted. It is stated that water quality could affect beneficial users in the Kern subbasin and are addressed in the GSP as well as in the individual management area plans. GDEs are considered beneficial users.
The Nature Conservancy	TNC-17	Section 3.2 Minimum Thresholds and Measurable Objectives (pp. 145-150) Minimum thresholds and measurable objectives for chronic lowering of groundwater levels, reduction of groundwater storage and degraded water quality do not include environmental beneficial users, such as ISWs or GDEs. **For each of these applicable sustainable management criteria, please include a discussion of GDEs (see comments under checklist items 16-20) and whether the minimum thresholds, measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. Please modify Section 3.2.2 to specifically address impacts from degraded water quality to the plant and wildlife communities within GDEs.**	Comment Noted. The development of the minimum thresholds and measureable objectives were established based on the impacts to all beneficial uses and users within the Kern subbasin. Specifications to just address plant and wildlife was considered as the thresolds and objectives were being set. For more specific information see indvidual management area plans.
The Nature Conservancy	TNC-18	Section 3.2.2.2 Potential Effects of Chronic Lowering of Groundwater Levels (p. 141) GDEs are a beneficial user of groundwater in the Subbasin. **Unless evidence is provided to verify the exclusion of GDEs please modify this section of the GSP to identify GDEs as one of the beneficial uses and users of groundwater that could experience significant and unreasonable effects as a result of chronic lowering of groundwater levels.**	Comment noted. See response to comments above.
The Nature Conservancy	TNC-20	Section 3.1.5 (Undesirable Results for depletion of) Interconnected Surface Water (p. 144) The GSP states (p.144) that "Though many studies have been conducted in the Subbasin, including in areas such as the Kern River and Poso Creek, results do not show evidence of surface water within the Subbasin to be interconnected. As there are no known natural interconnected surface water systems within the KGA boundary, this sustainability indicator is not included in this GSP." As noted in the prior comments, several areas have been identified as potential ISWs and GDEs, and substantial data gaps exist. As such, the above statement contradicts other information provided in the GSP, and serves as an acknowledgement of data gaps. It is not an appropriate basis for removing this sustainability indicator from the GSP under the GSP regulations. **Unless evidence is provided to verify the exclusion of GDEs and ISWs, please modify this section of the GSP to include a statement that 1) there are potential ISWs, and 2) provide an assessment of potential undesirable results.**	Comment Noted. See indivudal management areas plans for specific handling of data gaps.
The Nature Conservancy	TNC-21	Section 3.1.5 (Undesirable Results for depletion of) Interconnected Surface Water (p. 144) The GSP states (p.144) that "… there is no interconnected surface water under the influence of groundwater pumping in the principal aquifer in this area and no impacts to interconnected surface water have been observed." As noted in the prior comments, areas of shallow groundwater and gaining stream reaches are known to exist in the Subbasin. No quantitative data have been provided to assess the extent of hydraulic connection between shallow groundwater and the underlying production aquifers. As such, the above statement is insufficiently supported by data and is actually a substantial data gap. **Unless evidence is provided to verify the potential influence of groundwater extraction on GDEs and ISWs, please modify this section of the GSP to include a statement that the data are insufficient to assess whether GDEs can experience significant and unreasonable effects as a result of groundwater extraction in the Subbasin and provide an assessment of potential undesirable results. Please also identify that existing data gaps will be addressed and the presence or absence of GDEs will be verified with monitoring wells screened at the appropriate depths.**	Comment Noted.
The Nature Conservancy	TNC-22	Section 3.2 Undesirable Results (for each sustainability indicator) (pp. 139-144) This section only describes undesirable results relating to human beneficial uses of groundwater and neglects environmental beneficial uses / users that could be adversely affected by chronic groundwater level decline or other undesirable results. **Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results.**	Comment Noted. As the Undesirable Results were being developed and considered all beneficial uses and users were considered. There were several workshops seeking information/input during the development period.
The Nature Conservancy	TNC-23a	Section 3.2 Undesirable Results (for each sustainability indicator) (pp. 139-144) The GDE Pulse web application developed by TNC provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC Dataset polygons within the Subbasin. Over the past 10 years (2009- 2018), some NC Dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. **Please review these spatial patterns and, where possible, correlate them with water level trends. Any indications of adverse trends and any data gaps should be identified.**	Comment Noted.
The Nature Conservancy	TNC-23b	**For each identifiable GDE unit with supporting hydrological datasets, please include the following: - Plot and provide hydrological datasets; - Define the baseline period in the hydrologic data; - Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater; and - Explore cause-and-effect relationships between groundwater changes and GDEs.**	Comment Noted.
The Nature Conservancy	TNC-23c	**For identifiable GDE units without supporting hydrological datasets please describe data gaps and / or insufficiencies.**	Comment Noted.
The Nature Conservancy	TNC-23d	**Compile and synthesize biological data for each GDE unit by: - Describing biological resources for each GDE unit; and - Describing data gaps / insufficiencies.**	Comment Noted.

Commentor	Ref #	Comment	Response
The Nature Conservancy	TNC-23e	**Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:** **- Cause-and-effect relationships between potential ISWs and GDEs with groundwater conditions** **- Impacts to potential ISWs and GDEs that are considered to be "significant and unreasonable;"** **- Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities;** **- Land uses should include recreational uses (e.g., fishing/hunting, hiking, boating); and** **- Property interests should include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves.**	Comment Noted.
The Nature Conservancy	TNC-24	Section 3.3 Monitoring Network (pp. 150-169) The GSP proposes to coordinate and use existing monitoring networks of Kern Groundwater Authority and its districts / member agencies for groundwater elevations and storage, groundwater quality, and land subsidence. The text (p. 151) states that the monitoring network will monitor impacts to the beneficial uses and users of groundwater and goes on to state that "*depletions of interconnected surface water are not pertinent to the monitoring network.*"(emphasis added) As discussed in previous comments, unless data are provided to support this broad statement, due to uncertainties in the hydraulic connection between rivers / streams and GDEs with shallow groundwater, ISWs and related GDEs should not be disregarded in the GSP. The GSP should include a description of how groundwater conditions will be monitored to assess the potential effects of groundwater withdrawals on ISWs and GDEs. In addition, this section should include a description of how hydrological data gaps and insufficiencies will be addressed in the monitoring network. **Please modify the description of the monitoring network to provide methodologies, data and other information to address the data gaps associated with GDEs and ISWs. This modification should include 1) locating new wells that are appropriately screened to detect changes in groundwater levels in the uppermost water table and the connectivity of GDEs and ISWs with the upper unconfined or shallow zone aquifer; and 2) identifying or installing additional stream gauges in areas where there is potential for ISWs and GDEs. Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs.**	Comment Noted. The development of the monitoring network was established based on the benefits/impacts to all beneficial uses and users within the Kern subbasin. As has been stated previously, environmental is considered a beneficial use in the Kern subbasin and as such was considered in the development of the monitoring network. Several Stakeholder workshops were held during the development of the monitoring networl seeking input from all beneficial users. The locating of new wells and additional stream gauges are addressed in individual management area plans and GSAs. The monitoring network is considered an adaptive management plan and will be addressed annually as data is obtained and submitted to DWR. This data will be available as it becomes available.
The Nature Conservancy	TNC-25	Section 3.3 Monitoring Network (pp. 150-169) As stated above in the comments for Checklist Items 8-10, **please address data gaps along the Kern River and tributary creeks identified earlier in the GSP in this section of the GSP to improve ISW mapping in companion or future GSPs (e.g., through shallow monitoring wells, stream gauges, and nested/clustered wells).**	Comment Noted. The Kern River is not located within the jurisdictional boundary of the KGA, see the KRGSA GSP for more detailed information.
The Nature Conservancy	TNC-23a	Section 4 Projects and Management Actions (p. 175) Table 4-1 in this chapter lists many important projects and management actions including allocation changes, imports, surface water diversions, pumping allowances, conveyance and recharge projects, and addition of percolation basins; however, the descriptions only identify benefits to water level, groundwater storage, water quality and water supply. Maintenance or recovery of groundwater levels and construction of recharge facilities may have potential environmental benefits. It would be advantageous to recognize these benefits so as to demonstrate multiple benefits from a funding and prioritization perspective. - **For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue.** - If ISWs and GDEs will not be adequately protected by the listed projects and management actions, **please consider additional management actions and projects targeted for protecting ISWs and GDEs.** - **Please describe how the projects and management actions will be evaluated to assess whether adverse impacts to GDEs may occur and/or will be mitigated or prevented.** - For examples of case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/	Comment Noted. Management projects/actions are to the benefit of all beneficial uses and users within the Kern subbasin. The costs associated to the management projects/actions will also be considered as costs to all beneficial uses and users as well. This process will occur during the implementation period of 20 years and with transparent and open conversations/workshops. Please see indivudal management areas plans for specific management projects/actions pertaining to GDEs and ISW.
Leadership Counsel	LC-1	The Draft GSP is Incomplete, and Must Include Additional Information For the Public to Evaluate the GSP	The KGA GSP includes a summary of all the management area plans. For specific information pertaining to drinking water impacts on disadvantaged communities and protected groups, please review the individual management area plans. During the development of the management area plans, each KGA member engaged in stakeholder out reach to those communities/groups located within their area. Also, two disadvantaged communities are represented on the KGA board of directors who have voiced/voted their concerns during the entire process. The KGA held Stakeholder meetings to engage and seek input from all beneficial uses and users during the development of the KGA GSP and management area plans.
Leadership Counsel	LC-2	The Kern Groundwater Authority GSA Is Responsible for the Disproportionate and Disparate Impacts That Its Policies and Activities Will Have on Disadvantaged Communities Belonging to Protected Groups	Comment noted. Please see response LC-1
Leadership Counsel	LC-3	The Coordination Agreement Does Not "Explain How the Plans Implemented Together, Satisfy the Requirements of the Act."	The Coordination Agreement follows the requirements of SGMA and provides a dispute Resolution within the agreement.
Leadership Counsel	LC-4	Inadequate Consideration of Public Input Undermines the Validity and Efficacy of the Draft GSP	Disadvantaged communities are represented on the KGA board of directors. These directors have been active in voicing/voting their concerns through the entire process has been instrumental in providing their insights for their communities. The KGA held several workshops during all hours of the day, provided stakeholder surveys in both English and Spanish at those workshops as well as on-line (see the Communication & Education Plan for those events). As the implementation process moves forward, the KGA and its members plan to continue the insights from all communities.
Leadership Counsel	LC-5	The Kern Subbasin Undesirable Results Do Not Comply with Existing Law	Comment noted. The KGA developed the GSP in compliance with all requirements and believe it will achieve sustainability as defined by SGMA.
Leadership Counsel	LC-6	The GSP's Minimum Thresholds and Measurable Objectives Are Not Adequate	As stated in the response in LC-1, the management area plans provide greater detail on how the minimun thresholds and measurable objectives were developed in their area. The KGA GSA and its management area plans are adaptive planning documents which allow for the adjustment of minimum thresholds and measurable objectives as the implementation process begins. Any adaptive management will be the result of stakeholde input and consideration of beneficial use.
Leadership Counsel	LC-7	The Monitoring Network is Inadequate With Respect to Groundwater Levels and Groundwater Quality	Comment noted. The KGA developed the GSP in compliance with all requirements and believe it will achieve sustainability as defined by SGMA.
Leadership Counsel	LC-8	Current Projects and Management Actions are Inadequate	The KGA members developed projects and management actions in order to achieve sustainability as defined by SGMA. The KGA GSP is an adaptive management planning document that will be reviewed annually with a 5 year update. Each management area plan under the direction of the managers has vented all their individual management projects/actions in their workshops looking for input from all beneficial users.
Leadership Counsel	LC-9	The GSA Must Clearly Commit to a Drinking Water Protection Program for the Kern Subbasin	Comment noted. Thank you for your comment and we took it under consideration.

Commentor	Ref #	Comment	Response
Leadership Counsel	LC-10	Recharge In or Near Disadvantaged Communities and Domestic Well Clusters	Comment noted. Please see response LC-8
Leadership Counsel	LC-11	Establish Pumping Buffer Zones That Protect Disadvantaged Communities and Clusters of Domestic Wells	Comment noted. Please see response LC-1 & LC-8
Leadership Counsel	LC-12	Warning Against a Groundwater Market	Comment noted. The KGA appreciates the comment, considered its content but respectfully does not agree with the conclusion.
Leadership Counsel	LC-13	Multi-benefit projects	Comment noted. Please see response LC-1 & LC-8
Leadership Counsel	LC-14	Funding of Projects and Management Actions	Comment noted. The KGA appreciates the comment, considered its content but respectfully does not agree with the conclusion.
Leadership Counsel	LC-15	The Draft GSP Threatens to Infringe on Water Rights	Comment noted. The KGA appreciates the comment, considered its content but respectfully does not agree with the conclusion.
Leadership Counsel	LC-1	The Draft GSP Conflicts with the Reasonable And Beneficial Use Doctrine	Comment noted. The KGA appreciates the comment, considered its content but respectfully does not agree with the conclusion.
Leadership Counsel	LC-1	The Draft GSP Conflicts with the Public Trust Doctrine	Comment noted. The KGA appreciates the comment, considered its content but respectfully does not agree with the conclusion.
Arvin Edison Water Storage District Received Comments			
Leadership Counsel	3	The Draft GSP is Incomplete, and Must Include Additional Information For the Public to Evaluate the GSP	• The Arvin-Edison MA Plan includes complete information on consideration of drinking water impacts as disadvantaged communities, sustainable management criteria, and Projects and Management Actions (P/MAs) • See further comment responses below. • See KGA response to this comment for further information.
Leadership Counsel	3	The Kern Groundwater Authority GSA Is Responsible for the Disproportionate and Disparate Impacts That Its Policies and Activities Will Have on Disadvantaged Communities Belonging to Protected Groups	• See KGA response to this comment.
Leadership Counsel	4	The Coordination Agreement Does Not "Explain How the Plans Implemented Together, Satisfy the Requirements of the Act"	• See KGA response to this comment.
Leadership Counsel	5	Inadequate Consideration of Public Input Undermines the Validity and Efficacy of the Draft GSP	• See comment response below. • See KGA response to this comment for further information.
Leadership Counsel	6	The GSP states that the JPA was "written to provide open …communication to all beneficial users," and "each member of the KGA held their own outreach programs and opportunities for beneficial users to participate in the development of their individual management area plans, which is included in their individual management area plans;"17 however, this was not the case. For example, the member agency that has jurisdiction over residents with whom we work in the GSA area, the **Arvin-Edison Water Storage District**, did not adequately reach out to disadvantaged community residents or include their feedback in their GSP. For example, the **Arvin WSD's** website contains no information on SGMA or GSP meetings. We understand from conversations with staff that the agency sent notices to its list serv, but there is no way to sign up for the list serv on the website, and without knowing when and where meetings are occuring the public could not go to a meeting to sign up and be added to the interested parties list serv. Therefore the GSA's choice to delegate GSP development to member agencies did not provide an open and transparent process as required under SGMA.	AEWSD conducted substantial stakeholder outreach and engagement during the Arvin-Edison Management Area Plan (MA Plan) development process. This outreach is described in in **Section 5.5** of the MA Plan, as well as the Stakeholder Communication and Engagement Plan (SCEP) included as **Appendix E**. AEWSD outreach efforts included: •letters sent to all landowners and all interested parties; •distribution and compilation of a Stakeholder Survey (direct mail in AEWSD billing statements); •AEWSD website does include an email and AEWSD Executive Secretary maintains a list of interested parties for mass emails regarding notices; •Multiple AEWSD/ACSD informational meetings with flyers mailed and emailed ahead of time, including one to LCJA on 29 May 2019; •Multiple letters sent to all Public Water Systems in the MA Plan area; •Site visits to certain well owners to discuss domestic well status and location and regarding development of a monitoring network; •Letters to "white land" owners; •Multiple public stakeholder workshops, some held in triplicate (including with some outside of regular business hours) in the City of Arvin with Spanish language translation. The group Self Help Enterprises (SHE) attended and presented at three of the workshops. The above outreach efforts are in addition to those performed by the KGA. **A list of meetings during which GSP and SGMA were discussed is included in Appendix E of the MA Plan, which was updated to reflect additional recent meetings.** This includes 39 public meetings of the AEWSD Board between 2/9/2016 and 11/12/2019 where opportunity was provided for public comment. The topic of stakeholder engagement was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA. **Additional information on the stakeholder engagement process was added to Section 5.5.2.** ACSD's outreach efforts during the MA Plan development process included: • April 3, 2017: ACSD Board Meeting • April 17, 2017 ACSD Board Meeting • May 1, 2017 ACSD Board Meeting • November 6, 2017 ACSD Board Meeting • December 18, 2017 ACSD Board Meeting • January 3, 2018 ACSD Board Meeting • April 2, 2018 ACSD Board Meeting • May 7, 2018 ACSD Board Meeting • May 21, 2018 ACSD Board Meeting • September 24, 2018 ACSD Board Meeting • November 5, 2018 ACD Board Meeting • November 19, 2018 ACSD Board Meeting • January 22, 2019 ACSD Board Meeting • March 4, 2019 ACSD Board Meeting • April 1, 2018 ACSD Board Meeting • July 15, 2019 ACSD Board Meeting • September 3, 2019 ACSD Board Meeting • Since May 6, 2019 General Manager Updates Board of Directors every meeting on all Kern Basin GSA's Manager's Meetings or other meetings and items pertaining to SGMA.
Leadership Counsel	6 - 7	The **Arvin-Edison Water Storage District ("Arvin-Edison WSD")** states in its GSP ("**Arvin GSP**") that it considered disadvantaged communities by engaging representatives of the Arvin CSD ("Arvin CSD"), which contains disadvantaged community residents; by creating a Stakeholder Communication and Engagement Plan; and by "welcom[ing] public participation" at stakeholder workshops, **Arvin-Edison WSD** board meetings, **Arvin CSD** board meetings, KGA GSA events and meetings, a stakeholder survey, letters to landowners, and small or one-on-one meetings with individual stakeholders.18 However, as a community-based organization working directly with residents in Arvin, we were not included in these conversations until August 15, 2019 when we attended the **Arvin- Edison WSD** Board meeting where they presented their GSP chapter to its board for approval. Residents we work with did not have any knowledge of the GSP development process in the **Arvin-Edison Management Area.** They had heard about SGMA, but had a minimal understanding of what it entailed and were not aware of their local GSP development.	• ACSD is a co-author of the Arvin-Edison MA Plan and was directly involved in its preparation. Specific portions of the MA Plan that were prepared by and/or pertain to the ACSD area are listed in **Section 4.** • As described in **Appendix E** of the MA Plan, SHE, a community development organization focused on low-income communities, worked alongside AEWSD and ACSD on stakeholder outreach matters and SHE representatives were present at stakeholder workshops. AEWSD provided Spanish language translation services. • Because AEWSD does not provide water service to any Arvin residents, it does not "serve a substantial number of non-English speaking people" and therefore the Bilingual Service Act, mentioned in the LCJA letter, does not apply to AEWSD. • ACSD also worked directly with other community organizations and groups regarding SGMA, including Committee for a Better Arvin (CBA) a subgroup of the Center for Race Poverty and the Environment. CBA sent a support letter on December 3, 2019 describing the active ways in which ACSD/AEWSD involved then in the SGMA process. • Residents of the City of Arvin were sent flyers announcing informational meetings by direct mail and electronic mail (see **Appendix E**). • Records of meeting attendance show that several attendees identified themselves as Arvin residents (see **Appendix E**). • Residents that work directly with LCJA are encouraged to request a meeting with AEWSD/ACSD for a GSP update or other district purposes.
Leadership Counsel	7	Additionally, as mentioned above, **Arvin-Edison WSD** did not maintain a list of interested parties that the public could access; their website contains no sign-up, and no meeting notices or agendas about GSP development meetings were published in any publicly available fora. In addition to this violation of public engagement requirements under SGMA, the members agency did not follow the Brown Act by publishing public meeting notices and agendas before meetings, and does not have agendas or meeting minutes on its website so that such materials are available to the public.19	• The SCEP Section 4 describes the process for stakeholder identification by AEWSD and the KGA. A list of interested parties was identified in the SCEP and continuously updated during the MA Plan development process. • AEWSD website does include an email address that would provide anyone to be included as an interested party • All AEWSD customers and interested parties are on the AEWSD list serv and thus receive announcements from AEWSD, including meeting announcements and agendas. • Engagement of ACSD customers was handled by ACSD, in coordination with SHE and other community organizations, including CBA. • AEWSD follows all applicable public noticing requirements. The topic of public noticing and Brown Act compliance was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA. • References made to Kern River GSA appear to be an error however future stakeholder engagement will follow the SCEP as outlined in **Appendix E**
Leadership Counsel	8	The Kern Subbasin Undesirable Results Do Not Comply with Existing Law	• The Undesirable Results definitions in the Arvin-Edison MA Plan were developed in accordance with existing law (SGMA). • See KGA response to this comment for further information.
Leadership Counsel	11	The GSP's Minimum Thresholds and Measurable Objectives Are Not Adequate	• See comment response below. • See KGA response to this comment for further information.

Commentor	Ref #	Comment	Response
Leadership Counsel	12	The KGA GSA did not ensure that minimum thresholds created by member agencies considered the interests of all beneficial user groups, or prioritize the security of drinking water in the subbasin, in developing minimum thresholds. For example, the **Arvin-Edison Management Area GSP** did not consider the impact on drinking water users in setting its minimum thresholds. The A**EWSD Management Area Draft GSP** details how it calculated historical water lows and divided the Management Area into four sections based on historical low groundwater levels and agency jurisdiction, and how it adjusted the minimum thresholds to protect the canal that brings surface water to farmers.39 However, in did not evaluate or consider how many wells could go dry from its proposed minimum thresholds, or adjust for effects on drinking water. Therefore it did not consider impacts on drinking water beneficial users, or ensure the protection of drinking water as a the highest beneficial use of water.	• AEWSD did evaluate potential impacts of Minimum Thresholds on dewatering of wells, including an assessment of how many wells could potentially be dewatered (see **Section 14.1.1** and **Figures SMC-4** and **SMC-5**). • ***Section 18.1.6 of the MA Plan includes discussion of development of an Impacted Well Mitigation Program (also referred to as a Well Dewatering Mitigation Program) to address potential impacts arising from low groundwater levels, and has been updated to include more information on the types of mitigation that may be included in the program.*** • The topic of groundwater level SMCs and analysis of potential well impacts was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA. • ACSD worked in conjunction with AEWSD in regard to minimum thresholds levels. ACSD believes these thresholds would be sufficient with respect to adequate water quality based on our well completion report.
Leadership Counsel	14 - 15	As in the case of groundwater levels, it is clear that the GSA has not considered the potential impact on drinking water users, in particular disadvantaged communities who are less able to afford solutions to treat contaminated drinking water. This has resulted in minimum thresholds and measurable objectives like those in the Arvin GSP, which will only be monitoring for compliance with sustainable management criteria in one well location, and has set the minimum threshold at the drinking water MCL for the contaminant, and the measurable objective at 75% of the MCL. The member agency is only monitoring for compliance with arsenic standards, despite the agency's knowledge of the existence of "nitrate…total dissolved solids (TDS), boron, iron and manganese…within or near the **Arvin-Edison Management Area** above drinking water standards and/or agricultural water quality goals."	• AEWSD did conduct an extensive analysis of water quality based on the available data (see **Section 8.5** and **Figures GWC-9 through GWC-13**, and **Appendix H**) and in consultation with representatives of beneficial users of the water (e.g., ACSD). • Arsenic is the one constituent identified by ACSD as having the potential to be influenced by groundwater management activities, and was thus selected for use as a Sustainable Management Criterion (see **Section 14.4.1**). • As stated in a footnote in the MA Plan, "SGMA does not empower GSAs to develop or enforce water quality standards; that authority rests with the State Water Resources Control Board (SWRCB) Division of Drinking Water and the County. Because of the limited purview of GSAs with respect to water quality, and the rightful emphasis on those constituents that may be related to groundwater quantity management activities, the only constituent of concern applicable within the Arvin-Edison Management Area is arsenic in the vicinity of the City of Arvin and ACSD. Furthermore, drinking water quality regulations for public water systems apply at the point of delivery to customers, not in the raw water source, and ACSD blends water from its various well sources." • All monitoring sites will be sampled for the constituents identified in the Groundwater Quality Concerns section (**Section 8.5.1**), as well as other relevant groundwater quality parameters (see **Section 16.1.4**). Collection of additional data during plan implementation will be used to refine SMC definitions, as discussed in **Section 13.4**. • All ACSD wells are sampled regularly in accordance with their SWRCB permit. • The Representative Monitoring Site (RMS) was selected by ACSD, based on the list of considerations described in detail in **Section 16.1.4**. • The topic of groundwater quality SMCs and monitoring networks was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA.
Leadership Counsel	15	The lack of sufficient groundwater quality sustainable management criteria in areas like **Arvin** is likely to lead to critical drinking water impacts, and will be disproportionately felt by disadvantaged communities, who are less able to afford treatment solutions.	• The sustainable management criteria (SMCs) for degraded water quality were developed by AEWSD and ACSD with direct consideration of the drinking water beneficial use (see **Section 14.4**). • The water quality SMCs and monitoring in the MA Plan are in addition to the drinking water standards and monitoring requirements to which ACSD is held under its drinking water permit from the State Water Resources Control Board (SWRCB) Division of Drinking Water (see **Section 14.4**).
Leadership Counsel	15	The GSA has also not specified what actions will be taken if water contamination approaches minimum thresholds, or how minimum thresholds will be triggered. Member agencies such as the **Arvin-Edison WSD** have not specified this in their plans.	• As a public water supplier, ACSD has the responsibility to provide safe drinking water, under regulatory oversight by the SWRCB Division of Drinking Water, which is separate from SGMA. • Under its water system permit from the SWRCB, ACSD provides for water treatment and monitoring of water quality, separate from SGMA. • SGMA does not require that a GSP describe the process that will take place if water quality measurements approach Minimum Thresholds. • **Section 14.4.2** of the MA Plan specifies the Minimum Threshold for groundwater quality as the exceedance of Maximum Contaminant Levels (MCL) for arsenic at the Representative Monitoring Site (i.e., ACSD Well #14). This description of the MT therefore does include a description of "how minimum thresholds will be triggered" (i.e., by an exceedance of the MCL for arsenic over four consecutive bi-annual measurement). • ACSD operates its wells under permit from the SWRCB which has its own monitoring schedule and reporting requirements.
Leadership Counsel	17	The Monitoring Network is Inadequate With Respect to Groundwater Levels and Groundwater Quality	• See comment response below. • See KGA response to this comment for further information.
Leadership Counsel	18	The groundwater quality monitoring network does not adequately capture impacts on drinking water users. In the case of the **Arvin GSP**, the member agency will only monitor for compliance with its minimum threshold and measurable objective for Arsenic once a year in one well, ACSD Well #14, which is one of the wells that provide drinking water to the community of Arvin.	• As described above, ACSD monitors its supply wells for a list of constituents described in and on a schedule set by its drinking water system permit from the SWRCB. The water quality monitoring in this MA Plan is in addition to the monitoring conducted by ACSD under its permit. • The topic of groundwater quality monitoring networks was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA.
Leadership Counsel	18	Second, only measuring for compliance with arsenic measurable objectives and minimum thresholds does not protect against increases in other contaminants that exist in other parts of the management area (boron, nitrates, TDS, 123-TCP, iron and manganese). These contaminants could extend, move or increase due to groundwater management activities and pumping patterns. The Arvin GSP does plan to monitor for these contaminants in seven other wells outside of Arvin, but has not set minimum thresholds and measurable objectives for these wells, and does not have plans to do so.	• Arsenic was chosen as the only constituent for defining SMCs because it is currently the only constituent determined to be related to water management activities (i.e., water levels) (see **Section 13.4.2**). Other constituents are either naturally occurring or regulated pursuant to different programs. Additional data collection and analysis, as described in the MA Plan, will be used to inform the consideration of water quality issues in the future. • The topic of groundwater quality SMCs was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA.
Leadership Counsel	18	Furthermore, Arvin is currently experiencing 123-TCP contamination that threatens the health of Arvin residents, so the GSP must monitor for compliance with 123-TCP standards in particular.	• ACSD has recently installed a treatment system for 1,2,3-TCP in one of its production wells to address this occurrence of contamination (see **Section 17.2.3**). • ACSD has also included in this MA Plan, and is currently implementing, a project to mitigate arsenic and 1,2,3-TCP in its raw water supply through well replacement (see **Section 19.1.2**). • ACSD has never been out of compliance with 1,2,3-TCP as SWRCB set the MCL to take effect January 1, 2018. Wells that contained 1,2,3-TCP were taken offline in January 2018 when the MCL for 1,2,3-TCP was implemented. Arvin CSD is in litigation with Dow Chemical and Shell Oil Co. to collect on damages to the wells that were affected.
Leadership Counsel	19	Third, the well that was chosen, ACSD Well #14, was chosen because it does not have contaminants that are known to exist in wells in the northern part of the management area, which are not currently in use by Arvin CSD, according to our conversation with Arvin-Edison WSD staff at the Kern Subbasin Open House on September 26th, 2019. However, avoiding monitoring contaminated areas defeats the purpose of groundwater quality monitoring under SGMA, which is to measure the concentration and spread of contaminant plumes to ensure that groundwater management activities and pumping do not aggravate existing contamination. The GSA should ensure that the member agency instead monitors for all existing contaminants at minimum throughout the area and especially in areas where contamination is known to exist, and sets minimum thresholds and measurable objectives that apply to all monitoring wells.	• ACSD Well #14 was chosen by ACSD as it is considered representative of wells in the ACSD area that constitute the majority of drinking water beneficial use in the MA Plan area (see **Section 16.1.4**). • AEWSD staff has never, at the 9/26/2019 Kern Subbasin Open house nor at any other time, ever contended that the reason for selection of the ACSD Well #14 was, as the comment states, "because it does not have contaminants that are known to exist in wells in the northern part of the management area." • ACSD chose this well as it is the northern most active well in its water system. This well would serve as an early indicator that would allow detection of any early signs of water quality degradation. Well #14 does contain levels of Arsenic which are below the MCL, but would be a good indicator of groundwater conditions.
Leadership Counsel	20	Current Projects and Management Actions are Inadequate	• See comment response below. • See KGA response to this comment for further information.
Leadership Counsel	20	The GSA has allowed member agencies like the Arvin-Edison WSD to use a "glidepath" approach that increases surface water and groundwater recharge before demand reduction measures are implemented.67	• Supply augmentation projects and demand reduction management actions (as needed) are to be implemented in a balanced approach under the "glide path" laid out in the Arvin-Edison MA Plan (see **Section ES.10**; **Section 9.4.5**; **Section 17.1.4**; and **Table PMA-2**).
Leadership Counsel	20	The Arvin GSP contains two projects for treating water quality in Arvin, but these projects were already under way and fully funded so should not be included in the GSP. The GSP has no overall drinking water protection program to protect residents against dry wells and contaminated drinking water from its policies and groundwater management activities.	• These two projects were identified by ACSD as projects to include in the MA Plan because they aim to address the water quality sustainability indicator and relevant beneficial uses (i.e., drinking water supply).
Leadership Counsel	21	The GSA Must Clearly Commit to a Drinking Water Protection Program for the Kern	• See KGA response to this comment.
Leadership Counsel	22	Recharge In or Near Disadvantaged Communities and Domestic Well Clusters	• See KGA response to this comment.
Leadership Counsel	22	Establish Pumping Buffer Zones That Protect Disadvantaged Communities and Clusters of Domestic Wells	• See KGA response to this comment.
Leadership Counsel	22	Warning Against a Groundwater Market	• See KGA response to this comment.
Leadership Counsel	22	Multi-benefit projects	• See KGA response to this comment.
Leadership Counsel	22	Funding of Projects and Management Actions	• See comment response below. • See KGA response to this comment for further information.
Leadership Counsel	22	Furthermore, any proposed assessments that will pay for projects may not place a disproportionate financial burden on disadvantaged communities. Small disadvantaged communities like Arvin should not be required to pay fees for GSP implementation.	• **Section 17.11** of the MA Plan describes the various funding sources that may be used to pay for the planned P/MAs. • **Section 18.2.2** and **Section 19.2.2** list the funding sources identified by AEWSD and ACSD, respectively, to support general GSP implementation. • The topic of GSP funding was also addressed in AEWSD's email response (dated 11/7/2019; attached below) to questions from LCJA. • ACSD and AEWSD have created a Memorandum of Understanding with regards to SGMA. It shall be noted that ACSD was not asked to contribute financially, which for ACSD stands to be a substantial cost savings. • ACSD does participate financially with the KGA, but the KGA is set up for participating agencies to pay based on acreage which made being a voting member readily accessible for DAC like Arvin and Shafter.
Leadership Counsel	23	The Draft GSP Threatens to Infringe on Water Rights	• See KGA response to this comment.
Leadership Counsel	23	The Draft GSP Conflicts with the Reasonable And Beneficial Use Doctrine	• See KGA response to this comment.
Leadership Counsel	23	The Draft GSP Conflicts with the Public Trust Doctrine	• See KGA response to this comment.

Commentor	Ref #	Comment	Response
Wonderful Orchards/Wonderful Citrus	1	**Quantification of Native Yield** It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource. For example, a district or pumper located adjacent to the foothills does not necessarily have a superior claim to native yield over someone located in the center of the basin just because they are geographically closer to the source of mountain front recharge. Similarly, a district or pumper located in a cone of depression does not necessarily have a superior claim to native yield just because groundwater is flowing toward them. Surface water entering the groundwater via seepage in natural channels, including the Kern River and small streams, may be attributable to the native yield depending upon the circumstances of that seepage. A thorough technical and legal analysis is necessary to determine appropriate sources contributing to the native yield and to quantify these supplies.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that "the "water accounting" approach described in the Coordination Agreement and Appendices thereto does attempt to evaluate the water budget using certain management assumptions (e.g., a uniform "native yield component to all lands within the Basin). However, nothing in this water budget information results in or is intended to be a determination of water rights within the Arvin-Edison Management Area".*** • Implementation of P/MAs, including actions to further refine issues related to water budgets, is described in **Section 18.1.2**. • See KGA response to this comment for further information.
Wonderful Orchards/Wonderful Citrus	2	**Allocation of Native Yield** In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield. Currently, the GSP references native yield in terms of acre-feet per gross acre for water budget purposes. Appendix J of the GSP indicates the subbasin native yield is approximately 0.144 acre-feet per acre. It is our understanding that subsequent to the release of the draft GSP, all MAPs and other GSPs in the basin agreed to utilize the same number for their water budgets. If referencing native yield this way is necessary, the GSP should clarify that it is for initial water budget purposes ONLY, is non-precedent setting, and is not a determination of individual landowner allocations or groundwater rights. Alternatively, in the 2020 plans subbasin native yield could be described as a total volume of water and not associated with a given gross or net area. In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin. The allocation methodology should be consistent with various legal considerations drawn from applicable case law and be generally consistent with groundwater rights, recognizing that GSAs do not have statutory authority to make a final determination of water rights. An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations in addition to acreage owned, to determine a legally defensible allocation. Further information regarding allocation methodology can be found in Groundwater Pumping Allocations Under California's Sustainable Groundwater Management Act – Environmental Defense Fund and New Current Water & Land, July 2018.	• ***Section 18.1.4 which describes Stakeholder Engagement as part of MA Plan implementation, has been modified to include a statement that any actions to establish landowner-level allocations of native yield will be conducted through a robust stakeholder engagement process.*** • See KGA response to this comment for further information. • Also see response to
Wonderful Orchards/Wonderful Citrus	2	**Groundwater Markets** Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	• The MA Plan includes in its portfolio of P/MAs a management action to evaluate and potentially implement a groundwater marketing and trading system (see **Section 17.2.2**). • As described in **Section 18.1.2,** implementation of P/MAs, including the potential establishment of a market-based system, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate. • See KGA response to this comment for further information.
Wonderful Orchards/Wonderful Citrus	2	**Pumping Restrictions** Wonderful understands that there are instances where it may be necessary to restrict pumping in order to achieve basin-wide sustainability. If this becomes a necessity, the GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled).	• Demand reduction Management Actions are included in the MA Plan as one element in a portfolio of P/MAs (see **Section 17**). • The P/MA implementation timetable is based on a phased/incremental "glide path" approach (see **Section 17.1.4**). • P/MA implementation will entail, in many cases, performing studies and/or analysis to refine concepts into actionable projects or policies (see **Section 18.1.2**). ***Section 18.1.2 was modified to clarify that such studies will be based on using the best available data and science.*** • See KGA response to this comment for further information.
Wonderful Orchards/Wonderful Citrus	3	**Groundwater Recharge and Banking** GSAs must develop clear policies and conditions that protect existing investment in groundwater banking and banked inventory, and without interference with existing rules and regulations. GSAs must also find a way to incentivize additional investment, such as on-farm recharge, and allow flexibility for recharged or banked water to be freely transferable (subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results). Where possible, GSPs should also identify management areas that may benefit from additional recharge and banking. We also recommend that GSAs work to develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	• As described in **Section 18.1.2**, implementation of P/MAs, including projects to enhance recharge and projects to manage and/or capture floodwater, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate. • See KGA response to this comment for further information.
Wonderful Orchards/Wonderful Citrus	3	**Measurement and Data Management** Finally, GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	• The comment is noted. • ***Section 8.1 has been added to the MA Plan to describe data sources used in MA Plan development and how this local DMS will be coordinated with the basin-wide DMS.*** • ***Appendix I has been added to the MA Plan to list additional water quality data sources that will be evaluated during MA Plan implementation.*** • The Plan implementation section includes an action to refine the local DMS to comply with (coordinate with) the basin-wide DMS (see **Sections 18.1.1** and **18.1.3**). • See KGA response to this comment for further information.
Farmland Reserves	1	**Allocation of Groundwater Rights.** Though not specifically addressed, we are concerned that the overlying right to extract groundwater will be allocated among all District landowners based on gross acreage. While this is a simple approach to what can be a complex issue, it ignores accepted principles of law intended to more fairly allocate this right among those who have historically used groundwater for irrigation purposes-and made substantial investments based on that use. We wish to at least see identification of this issue in the Chapter and an acknowledgment that it will not be decided now. If the District determines that the issue is broader, then we leave it to the District to address it at the Umbrella GSP level. Any implication that the District has decided to allocate the overlying groundwater rights based simply on gross acreage could invite some to pursue premature legal action to challenge the District's conclusion, which might not be necessary depending on the success of the proposed actions in the Chapter. While this issue certainly affects our interests, we are equally concerned about avoiding unnecessary legal challenges made by others and the instability that would bring to the sub-basin.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that "the "water accounting" approach described in the Coordination Agreement and Appendices thereto does attempt to evaluate the water budget using certain management assumptions (e.g., a uniform "native yield component to all lands within the Basin). However, nothing in this water budget information results in or is intended to be a determination of water rights within the Arvin-Edison Management Area".*** • Implementation of P/MAs, including actions to further refine issues related to water budgets, is described in **Section 18.1.2**. • See KGA response to this comment for further information.

Commentor	Ref #	Comment	Response
Farmland Reserves	2	**Native Yield.** The Chapter identifies a coordinated estimated native yield of 0.15-.0.30 acre feet per acre across the KGA. We understand and acknowledge that some number needed to be identified for Water Budget and planning purposes and support the use of these numbers for such purposes. However, these numbers should not be seen as establishing a precedent or used to establish some legal right. Therefore, a statement emphasizing the above points should be made - the planning purpose nature of these numbers and not establishing legal precedent. Additionally, in coordinating with other members of the KGA under the Umbrella GSP, the District should push for a consistent native yield and related methodology across the sub-basin. We understand that this can be a politically charged process, but we are confident the District can provide support for a consistent approach, which will enable a more stable sub-basin.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that the "native yield" is for planning purposes only and not a determination of actual legal ground water rights.*** • Implementation of P/MAs, including actions to further refine issues related to allocations of groundwater, is described in **Section 18.1.2**. • See KGA response to this comment for further information.
Farmland Reserves	3	**Groundwater Market.** This issue might be premature at this point. However, the Chapter could address the possibility of a market for the exchange or transfer of groundwater credits. If a market system were contemplated, we would encourage such a system to be as flexible as possible (within the requirements of SGMA, the Chapter and the Umbrella GSP) to facilitate the needs of farmers with lands in different areas of the sub-basin and those with the ability to store surface water underground. Again, this might be premature at this time, but a mention of the District's position to support a flexible groundwater market could help move the discussion forward once the Umbrella GSP is submitted to the Department of Water Resources and agencies begin the implementation process.	• The MA Plan includes in its portfolio of P/MAs a management action to evaluate and potentially implement a groundwater marketing and trading system (see Section 17.2.2). • As described in Section 18.1.2, implementation of P/MAs, including the potential establishment of a market-based system, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate. • See KGA response to this comment for further information.
Hancock Financial Services	1	**Allocation of Native Yield** The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area. In the event that allocations of any sort are distilled to a landowner or property level, HFS encourages the GSAs in the basin to initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations that are coordinated across the basin. The allocation methodology should be consistent with various legal considerations drawn from applicable case law and attempt to be consistent with groundwater rights, recognizing that GSAs do not have statutory authority to make a final determination of water rights. An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations, in addition to acreage owned, to determine a legally defensible allocation. Further information regarding allocation methodology can be found in Groundwater Pumping Allocations Under California's Sustainable Groundwater Management Act – EDF and NCWL, dated July, 2018	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that "the "water accounting" approach described in the Coordination Agreement and Appendices thereto does attempt to evaluate the water budget using certain management assumptions (e.g., a uniform "native yield component to all lands within the Basin). However, nothing in this water budget information results in or is intended to be a determination of water rights within the Arvin-Edison Management Area".*** • Implementation of P/MAs, including actions to further refine issues related to water budgets, is described in **Section 18.1.2.** • ***Section 18.1.4 which describes Stakeholder Engagement as part of MA Plan implementation, has been modified to include a statement that any actions to establish landowner-level allocations of native yield will be conducted through a robust stakeholder engagement process.*** • See KGA response to this comment for further information.
Hancock Financial Services	1	**Groundwater Recharge and Banking** GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	• As described in **Section 18.1.2**, implementation of P/MAs, including projects to enhance recharge and projects to manage and/or capture floodwater, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate. • See KGA response to this comment for further information.
Hancock Financial Services	3	**Refinement and Validation of Consumptive Use Calculations Based on ET Measurement** HFS supports use of efficient and accurate systems to determine groundwater use. GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration. These methodologies should be developed in consultation with the vendor providing ET data to ensure it is applicable and useful in creating the best available data set. Additionally, GSAs and/or MAs should establish criteria and procedures to address apparent inaccuracies in the ET calculations. An obvious use of the procedure would be in instances where the grower can demonstrate that applied water, plus precipitation, is less than the calculated ET. In these instances, and subject to any requirements established by the GSA, the grower's use of groundwater should be reduced to the applied water total as the ET calculation should not be greater than applied water.	• The comment is noted. • See KGA response to this comment for further information.
Westchester Group Investment Management	1	**Allocation of Native Yield** The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water and not associated with a given gross or net area. In the event that allocations are to be made at a landowner or property level, WGIM encourages the KGA and other GSAs in the basin to initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations that are coordinated across the basin. The allocation methodology should be consistent with various legal considerations drawn from applicable case law and attempt to be consistent with groundwater rights, recognizing that GSAs and Management Areas (MAs) do not have statutory authority to make a final determination of water rights. An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations, in addition to acreage owned, to determine a legally defensible allocation. Further information regarding allocation methodology can be found in Groundwater Pumping Allocations Under California's Sustainable Groundwater Management Act – EDF and NCWL, dated July, 2018.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that the "the "water accounting" approach described in the Coordination Agreement and Appendices thereto does attempt to evaluate the water budget using certain management assumptions (e.g., a uniform "native yield component to all lands within the Basin). However, nothing in this water budget information results in or is intended to be a determination of water rights within the Arvin-Edison Management Area".*** • Implementation of P/MAs, including actions to further refine issues related to allocations of groundwater, is described in **Section 18.1.2.** • ***Section 18.1.4 which describes Stakeholder Engagement as part of MA Plan implementation, has been modified to include a statement that any actions to establish landowner-level allocations of native yield will be conducted through a robust stakeholder engagement process.*** • See KGA response to this comment for further information.
Westchester Group Investment Management	1	**Pumping Restrictions** We understand that there are instances where it may be necessary to restrict pumping in order to achieve basin-wide sustainability. If this becomes a necessity, the GSAs and MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible without creating undesirable results, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated and consistent across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled).	• Demand reduction Management Actions are included in the MA Plan as one element in a portfolio of P/MAs (see **Section 17**). • The P/MA implementation timetable is based on a phased/incremental "glide path" approach (see **Section 17.1.4**). • P/MA implementation will entail, in many cases, performing studies and/or analysis to refine concepts into actionable projects or policies (see Section 18.1.2). ***Section 18.1.2 was modified to clarify that such studies will be based on using the best available data and science.*** • See KGA response to this comment for further information.
Westchester Group Investment Management	2	**Groundwater Recharge and Banking** GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked water inventory, and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	• As described in **Section 18.1.2**, implementation of P/MAs, including projects to enhance recharge and projects to manage and/or capture floodwater, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate.

Commentor	Ref #	Comment	Response
Westchester Group Investment Management	2	**Measurement and Data Management** GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	• The comment is noted. • ***Section 8.1 has been added to the MA Plan to describe data sources used in MA Plan development and how this local DMS will be coordinated with the basin-wide DMS.*** • Appendix I has been added to the MA Plan to list additional water quality data sources that will be evaluated during MA Plan implementation. • The Plan implementation section includes an action to refine the local DMS to comply with (coordinate with) the basin-wide DMS (see **Sections 18.1.1** and **18.1.3**). • See KGA response to this comment for further information.
Westchester Group Investment Management	3	**Refinement and Validation of Consumptive Use Calculations Based on ET Measurement** WGIM supports use of efficient and accurate systems to determine groundwater use. GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration. These methodologies should be developed in consultation with the vendor providing ET data to ensure it is applicable and useful in creating the best available data set. Additionally, GSAs and/or MAs should establish criteria and procedures to address apparent inaccuracies in the ET calculations. An obvious use of the procedure would be in instances where the grower can demonstrate that applied water, plus precipitation, is less than the calculated ET. In these instances, and subject to any requirements established by the GSA, the grower's use of groundwater should be reduced to the applied water total as the ET calculation should not be greater than applied water.	• The comment is noted. • See KGA response to this comment for further information.
California Department of Fish and Wildlife	1	The Plan Area narrative does not identify Department-owned lands.	• The Arvin-Edison MA Plan identifies lands owned by the California Department of Fish and Wildlife in **Section 5.1.3** and on **Figure PA-2.** • See KGA response to this comment for further information.
California Department of Fish and Wildlife	2	The GSP identifies an 'environmental' category of beneficial user but does not specify how impacts to environmental beneficial uses and users of groundwater were considered throughout the GSP.	• The process used to assess the potential occurrence of "environmental" uses/users of groundwater in the Management Area is based on depth to groundwater based on available data from wells in the principal aquifer, as described in **Section 8.2, 8.7** and **8.8**. This process was informed by the TNC (2019) guidance for evaluation of GDEs. • See KGA response to this comment for further information.
California Department of Fish and Wildlife	3	The GSP identifies the potential for interconnected surface waters but dismisses further evaluation of interconnectivity and abdicates oversight of shallow groundwater-surface water communication.	• The process used to assess the potential occurrence of interconnected surface water in the Management Area is based on depth to groundwater (similar to the process used for evaluation of GDEs, which was done consistent with TNC (2019) guidance; see below) based on available data from wells in the principal aquifer, as described in **Section 8.2** and **8.7**. • See KGA response to this comment for further information.
California Department of Fish and Wildlife	4	The GDE identification section, pursuant to 23 CCR§ 354.16 (g), identifies ecosystems that may depend on groundwater. A report completed by the California Department of Water Resources (CDWR) (1997) shows that a large area of Kern County has 0 to 10 feet to depth to free water below the surface (see CDWR Figures 2, 3 and 5). Based on the presence of shallow groundwater, the Department supports the further investigation of GDEs and recommends including additional references for a more robust GDE evaluation. The Department recognizes that Natural Communities Commonly Associated with Groundwater (NCCAG) (Klausmeyer et al. 2018) provided by CDWR is a good starting reference for GDEs. There are additional resources available for evaluating GDE locations and habitat types, as well as information for State and Federal listed species. These recommended references include, but not limited to the following tools and other resources: the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) (CDFW 2019A); the CDFW California Natural Diversity Database (CNDDB) (2019B); the California Native Plant Society (CNPS) Manual of California Vegetation (CNPS 2019A); the CNPS California Protected Areas Database (CNPS 2019B); the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (2018); the USFWS online mapping tool for listed species critical habitat (2019); the United States Forest Service CALVEG ecological grouping classification and assessment system (2019); and other publications by Klausmeyer et al. (2019), Rohde et al. (2018), The Nature Conservancy (TNC) (2014, 2019), and Witham et al. (2014).	• The process used to assess the potential occurrence of GDEs in the Management Area is based on depth to groundwater based on available data from wells in the principal aquifer, as described in **Section 8.2** and **8.8**. • ***Section 8.8 was modified to include mention the use of the TNC (2019) guidance and criteria therein.*** • The criteria used to remove NCCAG from the list of potential GDEs is a depth to water greater than 30 feet, which is based on guidance from The Nature Conservancy (2019). • See KGA response to this comment for further information.
California Department of Fish and Wildlife	5	The identification of undesirable results and selection of minimum thresholds are based on an extended 10-year drought period and exclude Sustainable Management Criteria for surface water depletions.	• Because interconnected surface waters are determined to not occur within the MA Plan area, based on depth to groundwater data from the principal aquifer, sustainable management criteria for Depletion of Interconnected Surface Waters are deemed not applicable/necessary. • See KGA response to this comment for further information.
California Department of Fish and Wildlife	"Other"	Implementation of Future Project Actions Related to SGMA: Comments related to: • The CDFW's role as "Trustee Agency for fish and wildlife resources", and • The CDFW's role as a "Responsible Agency under CEQA" that "may need to exercise regulation authority as provided by the Fish and Game Code for implementation of projects related to the GSP that are also subject to CEQA".	• Comments are noted. • Permitting requirements for each P/MA included in the MA Plan are discussed in **Section 17.6** and in **Table PMA 1**. Work efforts related to P/MA implementation, including studies and environmental (CEQA) documentation, are discussed in **Section 18.1.2**. • See KGA response to this comment for further information.
The Nature Conservancy	9	**Notice and Communication** Please describe the other beneficial uses and users of groundwater in the Subbasin identified by the Water Code including: GDEs; managed wetlands; Protected Lands, including preserves, wildlife refuges, conservation areas, recreational areas and other protected lands; and Public Trust Uses, including wildlife, aquatic habitat, fisheries, recreation and navigation. Please identify any environmental uses and users of groundwater in the plan area, and take particular note of the species with protected status.	• The Arvin-Edison MA Plan identifies lands owned by the California Department of Fish and Wildlife in **Section 5.1.3** and on **Figure PA-2**. • See KGA response to this comment for further information.
The Nature Conservancy	10	**Plan Area Setting** Please provide a description of any current and planned instream flow requirements or regulatory requirements for protection of species of concern in the Kern River, Poso Creek and Caliente Creek. If there are no requirements in place or planned, then please state that in the GSP.	• ***Section 7.2.5 of the MA Plan was updated to include a statement that there are no in-stream flow requirements set for any creeks that flow into the Arvin-Edison Management Area, including Caliente Creek.*** • See KGA response to this comment for further information.
The Nature Conservancy	10	**Existing Plans in the Plan Area** We suggest adding a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. Please include a description of any land use or environmental plans relevant to wetlands, aquatic resources and other GDEs and ISWs and their relationship to the GSP. Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands around the Kern Wildlife Refuge, aquatic resources and other GDEs and ISWs. Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.	• **Section 5.3** of the MA Plan includes information about land use plans (i.e., General Plans), including a summary of goals, policies and implementation measures related to land and water use. • See KGA response to this comment for further information.

Commentor	Ref #	Comment	Response
The Nature Conservancy	10	**Existing and Ongoing Water Resource Programs** Please provide a description of resource management plans, monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals, and list them in Table 2-1. Please review and discuss the potential groundwater reliance of critical species in the Subbasin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP. Please include a discussion of any monitoring programs related to GDEs and sensitive habitats.	• See KGA response to this comment for further information.
The Nature Conservancy	11	**Well Permitting Process, Well Construction Policies** Please discuss that future well permitting and well construction must be coordinated with the GSP to assure achievement of the Plan's sustainability goals. Please state how the well permitting process incorporates protection of GDEs and ISWs within the Subbasin. Please include a discussion of the need for well permitting programs to comply with this requirement.	• **Sections 5.3.4** and **5.4** of the MA Plan includes discussion of the Kern County Well Permitting Process. • See KGA response to this comment for further information.
The Nature Conservancy	11	**Hydrogeologic Conceptual Model – Bottom of the Subbasin** Please characterize groundwater well extractions from the deepest wells in relation to defining the basin bottom. If the bottom boundary of the Subbasin has not been clearly defined in certain management areas, please identify this as a data gap and elaborate in the monitoring section how and where additional observations can be made to reconcile this data gap.	• **Section 7.1.3** of the MA Plan describes the definition of the bottom of the basin, which includes consideration of the deepest groundwater wells. • See KGA response to this comment for further information.
The Nature Conservancy	12	**Hydrogeologic Conceptual Model – Principal Aquifers and Aquitards** Please provide additional description of the shallow aquifers within the Subbasin including characteristics of interconnections with surface water and GDEs, vertical groundwater gradients, connections with underlying production aquifers, and the resulting potential interaction of groundwater pumping with ISWs and GDEs. Please state whether localized perched aquifers are present in the Subbasin. Describe any data gaps. The function and significance of the Shallow Aquifers that provide groundwater to ISWs and GDEs should be summarized in Table 2-3. Please describe whether the existence of Aquifer Exemptions has any bearing or implications related to environmental beneficial uses of groundwater.	• **Section 7.1.**4 of the MA Plan mentions the occurrence of the "A"-Clay which may result in localized perched groundwater in some areas. • **Section 7.3.2** of the MA Plan mentions that these perched zones are often poor quality and do not yield significant or economic amounts of water to wells, springs, or surface water systems, and are therefore not considered part of the principal aquifer. • See KGA response to this comment for further information.
The Nature Conservancy	12	**Hydrogeologic Conceptual Model – Data Gaps and Uncertainty** If data are not present to produce the information requested in the comment above, please clearly identify this as a data gap. Please elaborate in the monitoring section how and where additional observations are to be conducted in order to address this data gap.	• See KGA response to this comment for further information.
The Nature Conservancy		**Hydrogeologic Conceptual Model – Cross-Sections** Please include near-surface cross sections or insets that depict the conceptual understanding of shallow groundwater and ISW interactions at different locations, including perched and regional aquifers and GDEs.	• See KGA response to this comment for further information.
The Nature Conservancy	13	**Hydrogeologic Conceptual Model - Elevation and Flow Directions** Please provide any available stratigraphic data, hydrograph data, pumping test data or other information to substantiate these claims. If the data are not available, please identify this as a data gap.	• See KGA response to this comment for further information.
The Nature Conservancy	14	**Interconnected Surface Water Systems** Please provide additional data or analysis to substantiate the nature of the hydrologic relationship between the shallow aquifer and production aquifers and ISWs. If data are not available to verify that such a connection does not exist, acknowledge where ISWs may exist and identify appropriate sustainable management criteria, monitoring networks and management actions for sustainable ISW management or to address data gaps. Data could include groundwater level data from shallow or nested monitoring wells, comparison of stream stages to groundwater levels, modeling information or additional gaging data. Please elaborate how and where additional observations (shallow monitoring wells, stream gauges, and nested / clustered wells) along surface water features can be used to address data gaps in the Monitoring Network section of the GSP to improve identification of ISWs rather than prematurely disregarding them in the GSP.	• The process used to assess the potential occurrence of interconnected surface water in the Management Area is based on depth to groundwater (similar to the process used for evaluation of GDEs, which was done consistent with TNC (2019) guidance; see below) based on available data from wells in the principal aquifer, as described in **Section 8.2** and **8.7**. • See KGA response to this comment for further information.
The Nature Conservancy	14	Groundwater-Dependent Ecosystems Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gaps will be addressed. Please support this statement with specific groundwater level data that indicate a gap in the saturated zone between the production aquifers and shallow groundwater, and define the extent of the NCCAG dataset polygons that are excluded from consideration as GDEs on this basis. Please identify any data gaps related to identifying and mapping GDEs. If there are data gaps, please describe in detail in the monitoring plan how the data gap will be resolved. Please revise the GDE analysis in the GSP by conducting more substantial, data-based evaluation focusing on GDE identification in the GSP, clearly identify which NCCAG polygons are excluded, which polygons are determined to be GDEs and which polygons are uncertain at this time and will be verified as data gaps are address. Confirmation of GDEs should be performed based on depth to groundwater in the shallow zone, and additional information provided as to whether the shallow zone may be affected by groundwater withdrawal from the production aquifers. Please refer to Appendix D of this letter for best practices for using groundwater data to verify a connection to groundwater. Therefore, we recommend using depth to groundwater contour maps derived from subtracting groundwater levels from a DEM, as described above, to identify whether a potential connection to groundwater exists for the wetlands mapped in Attachment H of the GSP. Please refer to Attachments D and E of this letter for best practices for using local groundwater data to 1) verify whether polygons in the NC Dataset are supported by groundwater in an aquifer, and 2) verify whether ecosystem decline or recovery is correlated with groundwater levels.	• The process used to assess the potential occurrence of GDEs in the Management Area is based on depth to groundwater based on available data from wells in the principal aquifer, as described in Section 8.2 and 8.8. • ***Section 8.8 was modified to include mention of the use of TNC (2019) guidance and criteria therein.*** • The criteria used to remove NCCAG from the list of potential GDEs is a depth to water greater than 30 feet, which is based on guidance from The Nature Conservancy (2019). • See KGA response to this comment for further information.

Commentor	Ref #	Comment	Response
		We recommend the inclusion of a discussion regarding the nature and characteristics of GDEs. Please provide information on the historical or current groundwater conditions near the GDEs or the ecological conditions present. We recommend an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized. Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs. Some organisms rely on uplands and wetlands during different stages of their lifecycle.	
The Nature Conservancy	17	**Water Budget** Please provide a breakdown of ET for native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities). Please evaluate the spatial relationship of native vegetation ET to NCCAG polygons to determine the groundwater use by this beneficial user for inclusion in the water budget. Identify any data gaps and outline the actions needed to address them.	• ET information used in the water budget analysis is from the ITRC-METRIC study and includes all lands, including non-irrigated lands. • See KGA response to this comment for further information.
The Nature Conservancy	17	**Sustainability Goal** Please clarify the sustainability goal and expand its description to ensure that all beneficial uses and users of groundwater are identified as being protected from undesirable results, and in particular, include GDEs, ISWs and related critical habitats. Since GDEs and ISWs may be present in the Subbasin (please see comments under Checklist Items 16-20) they should be recognized as beneficial users of groundwater and should be specifically included in the Sustainability Goal. In addition, a statement about any intention to address pre-SGMA impacts should be included. Please include ISWs in the Sustainability Goal until/unless sufficient data is available and provided to verify the status of ISWs. Given that there are potential GDEs in the Subbasin and that they may be affected by water quality, they should be included in the Sustainability Goal and addressed in the Water Quality section.	• The sustainability goal for the MA Plan area is stated in **Section 2** and **Section 12**, and does include mention of beneficial uses including environmental. • See KGA response to this comment for further information.
The Nature Conservancy	18	**Minimum Thresholds and Measurable Objectives** For each of these applicable sustainable management criteria, please include a discussion of GDEs (see comments under checklist items 16-20) and whether the minimum thresholds, measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. Please modify Section 3.2.2 to specifically address impacts from degraded water quality to the plant and wildlife communities within GDEs.	• Because GDEs are determined to not occur within the MA Plan area, based on depth to groundwater data from the principal aquifer, sustainable management criteria for Depletion of Interconnected Surface Waters are deemed not applicable/necessary. • See KGA response to this comment for further information.
The Nature Conservancy	19	**Undesirable Results** Please add "possible adverse impacts to potential GDEs and ISWs" to the list of potential undesirable results. Please review these spatial patterns and, where possible, correlate them with water level trends. Any indications of adverse trends and any data gaps should be identified. For each identifiable GDE unit with supporting hydrological datasets, please include the following: For identifiable GDE units without supporting hydrological datasets please describe data gaps and / or insufficiencies. Compile and synthesize biological data for each GDE unit by: Describe possible effects on potential ISWs, GDEs, land uses, and property interests, including:	• Because GDEs and ISW are determined to not occur within the MA Plan area, based on depth to groundwater data from the principal aquifer, sustainable management criteria for Depletion of Interconnected Surface Waters are deemed not applicable/necessary. • See KGA response to this comment for further information.
The Nature Conservancy	20	**Monitoring Network** Please modify the description of the monitoring network to provide methodologies, data and other information to address the data gaps associated with GDEs and ISWs. This modification should include 1) locating new wells that are appropriately screened to detect changes in groundwater levels in the uppermost water table and the connectivity of GDEs and ISWs with the upper unconfined or shallow zone aquifer; and 2) identifying or installing additional stream gauges in areas where there is potential for ISWs and GDEs. Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs. Please address data gaps along the Kern River and tributary creeks identified earlier in the GSP in this section of the GSP to improve ISW mapping in companion or future GSPs (e.g., through shallow monitoring wells, stream gauges, and nested/clustered wells).	• See KGA response to this comment for further information.
The Nature Conservancy	21	**Projects and Management Actions** For the projects already identified, please consider stating how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue. Please consider additional management actions and projects targeted for protecting ISWs and GDEs. Please describe how the projects and management actions will be evaluated to assess whether adverse impacts to GDEs may occur and/or will be mitigated or prevented.	• Because GDEs and ISW are determined to not occur within the MA Plan area, based on depth to groundwater data from the principal aquifer, P/MAs to benefit and protect GDEs and ISW are deemed not applicable/necessary. • See KGA response to this comment for further information.
Cawelo Water District Received Comments			
Grow View Enterprises	CGSA-1	The draft Chapter proposes several projects to help the District and its Groundwater Sustainability Agency achieve your sustainable groundwater management goals. In terms of the potential annual benefit, one of the significant projects is the purchase of new water supplies. We agree.	Cawelo GSA acknowledges the support for the acquisition of new water supplies.

Commentor	Ref #	Comment	Response
Grow View Enterprises	CGSA-2	Grow View Enterprises recently sent the District a request made on behalf of certain of our affiliated landowners to connect, at their expense, to the District's existing water distribution system to allow for the delivery of surface water to the lands identified in that request. Those lands are currently served exclusively with groundwater. If excess District surface water is available, such a connection would allow these landowners to purchase District water and provide an additional funding source for the District's purchase of new water supplies. At the same time, a connection would allow the landowners to pursue private acquisitions of water supplies for conveyance into the District. Both possibilities would benefit the sustainability efforts of the District by lessening reliance on groundwater and bolstering the identified project to purchase new water supplies. Accordingly, a comment we have on the draft Chapter is that the Chapter should reflect a willingness by the District to allow landowners in the District's non-service area to connect to the District's water distribution system and become part of the District's service area. While individual situations will differ, any unique terms and conditions can be established for each. The Chapter should show the District's willingness to expand its service area as part of the project to allow for an increased delivery of the new water supply purchases the District proposes as a groundwater sustainability project.	As noted in the comment letter, potential connection to the Water District's water distribution system is a Cawelo Water District (CWD) matter. The Cawelo GSA supports landowners' efforts to bring into the GSA or CWD area additional imported water supplies to help meet demand. CWD has a history of allowing its landowners to connect their private systems to the CWD water distribution system and coordinating delivery of landowner owned water per CWD policies and oversite.
Wonderful Orchards/Citrus	CGSA-3	**Quantification of Native Yield**[1] It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource. For example, a district or pumper located adjacent to the foothills does not necessarily have a superior claim to native yield over someone located in the center of the basin just because they are geographically closer to the source of mountain front recharge. Similarly, a district or pumper located in a cone of depression does not necessarily have a superior claim to native yield just because groundwater is flowing toward them. Surface water entering the groundwater via seepage in natural channels, including the Kern River and small streams, may be attributable to the native yield depending upon the circumstances of that seepage. A thorough technical and legal analysis is necessary to determine appropriate sources contributing to the native yield and to quantify these supplies. [1] Native yield as defined in Section 4.2.1 of Appendix J to the GSP.	Cawelo GSA agrees the Native Yield quantification needs to be properly addressed. Currently, for purposes of developing this initial Cawelo GSP/Management Area Plan, the best available data was used to determine an initial Native Yield value for the Cawelo GSA area which is presented in Section 4.7.2. Cawelo GSA acknowledges the Native Yield value needs to be refined with additional studies and/or research and endeavors to update the Native Yield quantification as new data becomes available and coordination within the Kern County Subbasin continues.
Wonderful Orchards/Citrus	CGSA-4	**Allocation of Native Yield** In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield. Currently, the GSP references native yield in terms of acre-feet per gross acre for water budget purposes. Appendix J of the GSP indicates the subbasin native yield is approximately 0.144 acre-feet per acre. It is our understanding that subsequent to the release of the draft GSP, all MAPs and other GSPs in the basin agreed to utilize the same number for their water budgets. If referencing native yield this way is necessary, the GSP should clarify that it is for initial water budget purposes ONLY, is non-precedent setting, and is not a determination of individual landowner allocations or groundwater rights. Alternatively, in the 2020 plans subbasin native yield could be described as a total volume of water and not associated with a given gross or net area. In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin. The allocation methodology should be consistent with various legal considerations drawn from applicable case law and be generally consistent with groundwater rights, recognizing that GSAs do not have statutory authority to make a final determination of water rights. An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations in addition to acreage owned, to determine a legally defensible allocation. Further information regarding allocation methodology can be found in Groundwater Pumping Allocations Under California's Sustainable Groundwater Management Act – Environmental Defense Fund and New Current Water & Land, July 2018.	The initial Native Yield volume has been updated per Section 4.7.2. At this time, the total volume for the Cawelo GSA has been estimated using best available data and further described by averaging that volume over the acreage within the Cawelo GSA area. This is not an allocation of Native Yield and is merely a method to communicate the average Native Yield in the Cawelo GSA area. For initial plan purposes, the Cawelo GSA, and in coordination with the KGA and other GSAs, has agreed to use an initial estimate of 0.15 AF per acre which is roughly equivalent to the Cawelo GSA initial calculations. The Cawelo GSA and other management areas within the Kern County Subbasin need to better understand the science supporting the Native Yield and the legal concerns surrounding potential allocation of Native Yield. Cawelo GSA will continue to gather additional information to better inform the Native Yield values and potential allocation of Native Yield. Cawelo GSA will participate in regional coordinated efforts for Native Yield work.
Wonderful Orchards/Citrus	CGSA-5	**Groundwater Markets** Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	It is necessary to gather additional data to better understand groundwater dynamics and how groundwater levels, established Minimum Thresholds and Measurable Objectives, or groundwater users in general may be impacted by a potential groundwater transfer market.
Wonderful Orchards/Citrus	CGSA-6	**Pumping Restrictions** Wonderful understands that there are instances where it may be necessary to restrict pumping in order to achieve basin-wide sustainability. If this becomes a necessity, the GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled).	Cawelo GSA will consistently endeavor to coordinate with other management areas in the Kern County Subbasin on SGMA matters and as they relate to the GSPs. For this initial Plan, there are no proposed management actions to limit pumping in the Cawelo GSA area. Management actions include acquiring additional water supplies and if necessary reduce demand.
Wonderful Orchards/Citrus	CGSA-7	**Groundwater Recharge and Banking** GSAs must develop clear policies and conditions that protect existing investment in groundwater banking and banked inventory, and without interference with existing rules and regulations. GSAs must also find a way to incentivize additional investment, such as on-farm recharge, and allow flexibility for recharged or banked water to be freely transferrable (subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results). Where possible, GSPs should also identify management areas that may benefit from additional recharge and banking. We also recommend that GSAs work to develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	The Cawelo GSA has deferred potential groundwater recharge and banking to the CWD. The CWD is currently developing a landowner recharge/banking program.

Commentor	Ref #	Comment	Response
Wonderful Orchards/Citrus	CGSA-8	**Measurement and Data Management** Finally, GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	The Cawelo GSA anticipates participating in a coordinated Subbasin effort to develop a DMS that is appropriate for the management areas of the Subbasin.
Farmland Reserve	CGSA-9	1. Allocation of Groundwater Rights. Though not specifically addressed, we are concerned that the overlying right to extract groundwater will be allocated among all District landowners based on gross acreage. While this is a simple approach to what can be a complex issue , it ignores accepted principles of law intended to more fairly allocate this right among those who have historically used groundwater for irrigation purposes-and made substantial investments based on that use. We wish to at least see identification of this issue in the Chapter and an acknowledgment that it will not be decided now. If the District determines that the issue is broader, then we leave it to the District to address it at the Umbrella GSP level. Any implication that the District has decided to allocate the overlying groundwater rights based simply on gross acreage could invite some to pursue premature legal action to challenge the District's conclusion, which might not be necessary depending on the success of the proposed actions in the Chapter. While this issue certainly affects our interests, we are equally concerned about avoiding unnecessary legal challenges made by others and the instability that would bring to the sub-basin.	At this time, the total Native Yield volume for the Cawelo GSA has been estimated and further described by averaging that volume over the acreage within the Cawelo GSA area. This is not an allocation of Native Yield and is merely a method to communicate the average Native Yield in the Cawelo GSA area. For initial plan purposes, the Cawelo GSA, and in coordination with the KGA and other GSAs, has agreed to use an initial estimate of 0.15 AF per acre which is roughly equivalent to the Cawelo GSA initial calculations. The Cawelo GSA and other management areas within the Kern County Subbasin need to better understand the science supporting the Native Yield and the legal concerns surrounding potential allocation of Native Yield before an allocation can be issued. Cawelo GSA will continue to gather additional information to better inform the Native Yield values and potential allocation of Native Yield. Cawelo GSA will participate in regional coordinated efforts for Native Yield work.
Farmland Reserve	CGSA-10	2. Native Yield. The Chapter identifies a coordinated estimated native yield of 0.15-0.30 acre feet per acre across the KGA. We understand and acknowledge that some number needed to be identified for Water Budget and planning purposes and support the use of these numbers for such purposes. However, these numbers should not be seen as establishing a precedent or used to establish some legal right. Therefore, a statement emphasizing the above points should be made - the planning purpose nature of these numbers and not establishing legal precedent. Additionally, in coordinating with other members of the KGA under the Umbrella GSP, the District should push for a consistent native yield and related methodology across the sub-basin. We understand that this can be a politically charged process, but we are confident the District can provide support for a consistent approach, which will enable a more stable sub-basin.	See the above response
Farmland Reserve	CGSA-11	3. Groundwater Market. This issue might be premature at this point. However, the Chapter could address the possibility of a market for the exchange or transfer of groundwater credits. If a market system were contemplated, we would encourage such a system to be as flexible as possible (within the requirements of SGMA, the Chapter and the Umbrella GSP) to facilitate the needs of farmers with lands in different areas of the sub-basin and those with the ability to store surface water underground. Again, this might be premature at this time, but a mention of the District's position to support a flexible groundwater market could help move the discussion forward once the Umbrella GSP is submitted to the Department of Water Resources and agencies begin the implementation process	It is necessary to gather additional data to better understand groundwater dynamics and how groundwater levels, established Minimum Thresholds and Measurable Objectives, or groundwater users in general may be impacted by a potential groundwater transfer market. The Cawelo GSA Board of Directors have publicly stated they believe flexibility is key to the success of SGMA and the GSPs, and that it is necessary for the future of farming.
Eastside Water Management Authority Received Comments			
Kern County Water Agency – Pioneer Project Received Comments			
No Comments Received			
Kern Tulare Water District Received Comments			
Wonderful Orchards		Refer to KGA Summary of Comments	Refer to KGA Response
Kern Water Bank Received Comments			
Hancock Farmland Services	HFS-2	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	The KWBA concurs with the comment that existing banking projects need to continue operating as they have. Water banking projects in the Kern County subbasin are critical to reaching the sustainability goals of SGMA. The projects store available surplus surface water during wet years for later recovery in dry years, thereby reducing the reliance on native groundwater by others in the subbasin. The projects operate under agreements with other basin stakeholders – developed during the CEQA process – that provide for project monitoring and mitigation measures which reduce any potential impacts to less than significant. Moreover, the projects, by their nature, do not contribute to any of the six undesirable results listed in SGMA.
Westchester	WGIM-4	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	See above comment.
Wonderful Orchards	WO-6	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	See above comment.
North Kern Water Storage District & Shafter-Wasco Irrigation District Received Comments			
Farmland Reserve		"Though not specifically addressed, we are concerned that overlying right to extract groundwater will be allocated among all District landowners based on gross acreage...it ignores accepted principles of law intended to more fairly allocate this right among those who have historically used groundwater for irrigation purposes -- and made substantial investments based on that use."	We have discussed adding language to the Water Budget section of the plan to address the fact that there is currently no in-district allocation of water to the landowners. The language in the Projects & Mgmt Actions section, dealing with in-district allocation as a mgmt action has been revised to address this, as well.
Farmland Reserve		"These numbers should not be seen as establishing a precedent or used to establish some legal right. Therefore, a statement emphasizing the above points should be made."	The discussion on native yield in the Water Budget section of the plan addresses this.
Farmland Reserve		"The Chapter could address the possibility of a market for the exchange or transfer of groundwater credits."	At this time, such a discussion is premature. There is no framework within the districts or the basin at large to allow for the exchange or transfer of groundwater credits. We cannot reasonably address this in the plans for 2020 submittal.

Commentor	Ref #	Comment	Response
Hancock Farmland Services		"The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area."	The discussion on native yield in the Water Budget section of the plan addresses this already. Further emphasis on the "planning budget" role of the Native Yield estimate has been added to the final draft of the plan.
Hancock Farmland Services		"GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.)."	At this time, the framework to offer such incentives does not exist and would require the districts' boards to develop & adopt policy to put it in place. In the time required to prepare the 2020 submittal of the plan, we cannot develop the structure and policy required to implement this. However, this is discussed in the Projects & Mgmt Actions section of the plan and will be considered for implementation after the 2020 plan submittal, when the districts have an opportunity to develop the policy and framework necessary for such programs.
Hancock Farmland Services		"GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration. These methodologies should be developed in consultation with the vendor providing ET data to ensure it is applicable and useful in creating the best available data set. Additionally, GSAs and/or MAs should establish criteria and procedures to address apparent inaccuracies in the ET calculations. An obvious use of the procedure would be in instances where the grower can demonstrate that applied water, plus precipitation, is less than the calculated ET. In these instances, and subject to any requirements established by the GSA, the grower's use of groundwater should be reduced to the applied water total as the ET calculation should not be greater than applied water."	This is already included in the Projects and Management Actions section and is part of the larger action of refining data for the calculation of Water Budget components in future plan updates.
Wonderful Orchards		"The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource."	The districts have identifed as a management action the coordinated effort to further refine water budget components in the Kern County Subbasin Model. The Model and water budget components will continue to be refined in coordination with the KGA and other GSAs in the basin.
Wonderful Orchards		"In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield. Currently, the GSP references native yield in terms of acre-feet per gross acre for water budget purposes. Appendix J of the GSP indicates the subbasin native yield is approximately 0.144 acre-feet per acre. It is our understanding that subsequent to the release of the draft GSP, all MAPs and other GSPs in the basin agreed to utilize the same number for their water budgets. If referencing native yield this way is necessary, the GSP should clarify that it is for initial water budget purposes ONLY, is non-precedent setting, and is not a determination of individual landowner allocations or groundwater rights. Alternatively, in the 2020 plans subbasin native yield could be described as a total volume of water and not associated with a given gross or net area."	The discussion on native yield in the Water Budget section of the plan addresses this already. Further emphasis on the "planning budget" role of the Native Yield estimate has been added to the final draft of the plan. In terms of native yield allocation to the parcel/landowner level, there is no framework currently in place to do so. The development the policies and framework necessary to implement such an allocation cannot be completed in time for the 2020 plan submittal.
Wonderful Orchards		"Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next."	At this time, such a discussion is premature. There is no framework within the districts or the basin at large to allow for the exchange or transfer of groundwater credits. We cannot reasonably address this in the plans for 2020 submittal.
Wonderful Orchards		"Wonderful understands that there are instances where it may be necessary to restrict pumping in order to achieve basin-wide sustainability. If this becomes a necessity, the GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled)."	As described in the Management Actions subsection of the Management Area Plan, policies for instituting pumping restrictions have not been developed for the 2020 plan submittal. This has been identifed as a potential management action, should the districts or the basin in general determine that it cannot maintain its path to sustainability through the projects and other management actions to be implemented.
Wonderful Orchards		"GSAs must develop clear policies and conditions that protect existing investment in groundwater banking and banked inventory, and without interference with existing rules and regulations. GSAs must also find a way to incentivize additional investment, such as on-farm recharge, and allow flexibility for recharged or banked water to be freely transferrable (subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results). Where possible, GSPs should also identify management areas that may benefit from additional recharge and banking. We also recommend that GSAs work to develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.)."	At this time, the framework to offer such incentives does not exist and would require the districts' boards to develop & adopt policy to put it in place. In the time required to prepare the 2020 submittal of the plan, we cannot develop the structure and policy required to implement this. However, this is discussed in the Projects & Mgmt Actions section of the plan and will be considered for implementation after the 2020 plan submittal, when the districts have an opportunity to develop the policy and framework necessary for such programs.
Wonderful Orchards		"GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	A coordinated DMS is already being developed. However, that effort is currently focused at the district/MA level due to the precision of the data being used. Parcel-level allocation is not at this time being done in the subbasin. It is premature to consider a basin-wide water market, as the data available does not allow for that level of allocation to be done. For consideration in the 2020 plan submittal, we do not have adequate time or resources for the development of such a framework.
Pacific Ag Management		Landowner would like to see RRID's ability to access future water supplies such as flood or highflow water from the Kern River made available to the District or additional waters that may become available. Landowner requests consideration of RRID's right to an ongoing, guaranteed share of such water as it is made available to the District.	This is already addressed in the RRID-specific projects in Section 5.4 of this plan. These projects are conceptual in nature, but they will be further defined as the district implements SGMA.
Pacific Ag Management		In regard to the produced water available to the District, Landowner requests that RRID be granted increased access to this water to be delivered in the form of pumping credits	This is already addressed in the RRID-specific projects in Section 5.4 of this plan. These projects are conceptual in nature, but they will be further defined as the district implements SGMA.
Pacific Ag Management		Landowner requests that the District consider using its positive water budget balance (Inflows less Outflows) for the purpose of offsetting any RRID water budget deficit.	The water budget for RRID has been revised based on the addition of the projects into the projected baseline water budget for years 2030 and 2070.
Pacific Ag Management		Landowner understands that recharge opportunities are an integral part of sustaining agricultural operations as the RRID area transitions to urban development. Recharge provides positive hydrological benefits as well as additional pumping opportunities for landowners. Landowner supports the enlargement, creation, and maintenance of recharge facilities within RRID, along with use of the RRID canal system as a recharge area and supplement to RRID water supplies.	This is already addressed in the RRID-specific projects in Section 5.4 of this plan. These projects are conceptual in nature, but they will be further defined as the district implements SGMA.
Pacific Ag Management		Conveyance capacity is critical in order to effectively and strategically manage the movement of water supplies, both at the agency and at the landowner level. Landowner supports the proposed Calloway Canal improvements. Additionally, Landowner requests that RRID be given greater access to pipeline capacity when surplus water exists and that RRID canals be enhanced and expanded to the benefit of RRID landowners.	Continued maintenance of existing conveyance to RRID is already included as part of the RRID-specific projects discussed in Section 5.4 of this plan.
Pacific Ag Management		As an RRID stakeholder, Landowner is appreciative of North Kern Water Storage District's and Kern Groundwater Authority's support of agricultural land owners and their commitment to the effective management of RRID's water supplies and agricultural lands. The City of Bakersfield and the Kern River Groundwater Sustainability are critical strategic partners for RRID. Landowner is confident that a partnership between the agencies and respective landowners will ensure the continued viability of agricultural operations in RRID and a successful transition to urban development.	Per the terms of the Coordination Agreement between KGA and the other Kern GSAs, and NKWSD and SWID's membership in KGA, the Districts already coordinate with KRGSA. Coordination between the Districts and KRGSA will continue through the SGMA implementation process and beyond.

Commentor	Ref #	Comment	Response
Westchester Group Investment Mgmt		The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water and not associated with a given gross or net area. In the event that allocations are to be made at a landowner or property level, WGIM encourages the KGA and other GSAs in the basin to initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations that are coordinated across the basin.	The discussion on native yield in the Water Budget section of the plan addresses this already. More language can be added to emphasize the "planning budget" role of the Native Yield estimate.
Westchester Group Investment Mgmt		GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked water inventory, and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	At this time, the framework to offer such incentives does not exist and would require the districts' boards to develop & adopt policy to put it in place. In the time required to prepare the 2020 submittal of the plan, we cannot develop the structure and policy required to implement this. However, this is discussed in the Projects & Mgmt Actions section of the plan and will be considered for implementation after the 2020 plan submittal.
Westchester Group Investment Mgmt		GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	A coordinated DMS is already being developed. However, that effort is currently focused at the district/MA level due to the precision of the data being used. Parcel-level allocation is not at this time being done in the subbasin. It is premature to consider a basin-wide water market, as the data available does not allow for that level of allocation to be done. For consideration in the 2020 plan submittal, we do not have adequate time or resources for the development of such a framework.
Westchester Group Investment Mgmt		"WGIM supports use of efficient and accurate systems to determine groundwater use. GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration. These methodologies should be developed in consultation with the vendor providing ET data to ensure it is applicable and useful in creating the best available data set. Additionally, GSAs and/or MAs should establish criteria and procedures to address apparent inaccuracies in the ET calculations. An obvious use of the procedure would be in instances where the grower can demonstrate that applied water, plus precipitation, is less than the calculated ET. In these instances, and subject to any requirements established by the GSA, the grower's use of groundwater should be reduced to the applied water total as the ET calculation should not be greater than applied water."	This is already included in the Projects and Management Actions section and is part of the larger action of refining data for the calculation of Water Budget components in future plan updates.
BDII Investments		"Landowners would like RRID to be able to purchase produced water resources conveyed and/or banked in NKWSD facilities. These volumes appear to be available sources of water in the GSP that could become an integral source of water for acres (sic) within RRID. Landowners would like RRID to improve future water supplies by purchasing flood water or high-flow water from the Kern River when it is available and before that water is offered to areas outside the managed areas within the GSP. Landowners would also like to see RRID purchase surplus water from NKWSD when available to help mitigate the deficit in RRID before these surplus supplies are sold outside the GSP management area. Landowners believe that RRID should continue to improve conveyance and turnout facilities that could be used to supply lands with excess Kern River flow when its available."	This is already addressed in the RRID-specific projects in Section 5.4 of this plan. These projects are conceptual in nature, but they will be further defined as the district implements SGMA.
BDII Investments		"Landowners would encourage RRID to participate in groundwater banking and the use of recharge facilities in NKWSD for the benefit of RRID. This will allow RRID to develop a more stable long-term supply and pump groundwater in years when there is little or no access to excess Kern River water. Landowners would encourage RRID to explore potential banking and development of recharge facilities within the RRID service area."	This is already addressed in the RRID-specific projects in Section 5.4 of this plan. These projects are conceptual in nature, but they will be further defined as the district implements SGMA.
City of Shafter		"The City's specific comments, concerns, and suggestions have been made to ensure that the description of the City's water system and demond are accurate."	These items were addressed through discussions with the cities and accounted for in the Water Budget: Urban Demand sections of the plan.
City of Shafter		"The City's specific comments, concerns, and suggestions have been made to ensure that [...] the City's beneficial uses are recognized and protected and that the plan does not inadvertently include language that could be misinterpreted to adversely affect the City's water rights or ability to utilize those rights to the benefit of public health and safety."	As described in the plan, SGMA does not alter existing water rights. With input from the cities (through their MOU with the Districts), this comment has been further addressed in the final draft of the plan.
City of Shafter		"Two critical pieces that the plan should ultimately address are minimum thresholds and measurable objectives set for specific water quality constituents to ensure that water quality does not degrade beyond current conditions."	As discussed in the existing conditions portion of the Basin Setting and the discussions in Section 3 which pertain to water quality, the Sustainable Management Criteria for groundwater levels are being used as a proxy for water quality at this time, in addition to continued monitoring of the constituents of concern coincidental with the monitoring of groundwater levels and cooperation and compliance with existing water quality programs.
Leadership Council		"The Draft GSP is incomplete and must include additional information for the public to evaluate the GSP. The Draft GSP omits critical data regarding the consideration of drinking water impacts on disadvantaged communities and protected groups, sustainable management criteria that consider all beneficial users, and projects and management actions that address significant and unreasonable impacts to beneficial users."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with the statement, as the information that Leadership Council claims is missing from the GSP is actually included in the management area plans, as appropriate to each respective management area.
Leadership Council		"The KGA is responsible for the disproportionate and disparate impacts that its policies and activities will have on disadvantaged communities belonging to protected groups."	This comment is directed to the KGA GSP and will be addressed by KGA. While the KGA is the GSA entity submitting the plan on behalf of its members, the JPA forming the KGA is such that each member is responsible for the implementation of SGMA within their respective plan areas. The KGA GSP and its management area plans were developed in consideration of all beneficial uses of water and the beneficial users of the groundwater in the subbasin.
Leadership Council		"The Coordination Agreement does not "explain how the plans, implemented together, satisfy the requirements of the Act."	This comment is directed to the KGA GSP and will be addressed by KGA.
Leadership Council		"The GSP was not crafted in a way that adequately considered the input of disadvantaged communities, either at the GSA level or the member agency level."	This comment is directed to the KGA GSP and will be addressed by KGA, pertaining to the KGA level engagement. With respect to the member level engagement, SGMA leaves the manner and frequency of public outreach and engagement to the discretion of the GSA. As described in the introduction of the management area plan, both NKWSD and SWID hold monthly publicly-noticed meetings which serve as an opportunity for members of the public to provide feedback to the districts regarding the plan's development and implementation. Furthermore, the districts were active participants in the KGA-level outreach activities as well as hosts of their own workshops, which were publicly-noticed, and coordination with the cities of Shafter and Wasco and with Oildale Mutual Water Co on the development of the plan.
Leadership Council		"The Kern Subbasin Undesirable Results do not comply with existing law."	The definitions for undesirable results were developed in coordination with the other GSAs and take into consideration "significant and unreasonable" impacts to the groundwater which affect all beneficial users. Such beneficial uses include agriculture, domestic, and municipal & industrial.
Leadership Council		"It is not clear what the impacts from reaching this undesirable result will be on beneficial users, and instead seems to be an arbitrary determination of what is "significant and unreasonable."	The impact analysis performed by the GSAs in the subbasin contributed to the development of the undesirable results for declining groundwater level.
Leadership Council		"Like the proposed definition of undesirable results for groundwater levels, the proposed definition of undesirable results for degraded water quality are 'when the minimum threshold for when the minimum threshold for groundwater levels are exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the Subbasin (as measured by each management area)."	The comment letter cites an incorrect definition. The definition for the undesirable result for water quality is "when the minimum threshold for a groundwater quality constituent of concern is exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the designated monitoring points within the Subbasin."
Leadership Council		"The GSP's minimum thresholds and measurable objectives were not established in a way that considered the interests of beneficial users including domestic well owners and disadvantaged communities."	The KGA GSP outlines the methods used by its members to establish the Sustainable Management Criteria (SMCs) within their respective plan areas. For the NKWSD-SWID management plan area, projected groundwater levels based on recent historical hydrology were used to analyze the impact to known agricultural, domestic, and municipal wells. While impacts were identified at the minimum thresholds in some management areas, these impacts were determined to not meet the definition of "significant and unreasonable".
Leadership Council		"As in the case of groundwater levels, it is clear that the GSA has not considered the potential impact on drinking water users, in particular disadvantaged communities who are less able to afford solutions to treat contaminated drinking water."	As with the groundwater level SMCs, the KGA GSP outlines the methods used by its members to establish the Sustainable Management Criteria (SMCs) within their respective plan areas. Based on the analysis in the Basin Setting subsection on existing water quality conditions, it was determined appropriate to use groundwater levels as a proxy for water quality, in addition to water quality and water level measurement at the representative monitoring sites will be coincidental.
Leadership Council		"GSAs must monitor impacts to groundwater for drinking water beneficial users,54 including disadvantaged communities on domestic wells, and must avoid disparate impacts on protected groups pursuant to state law. The GSA's monitoring network does not comply with SGMA regulations, and fails to capture drinking water impacts to disadvantaged communities and domestic wells[...] To ensure the monitoring network adequately captures impacts to all beneficial users, the GSA must ensure the following: Ensure the proposed monitoring network contains representative monitoring wells in or near all disadvantaged communities and clusters of domestic wells in the GSA area; Ensure that monitoring wells and representative monitoring wells in or near disadvantaged communities and clusters of domestic wells are able to measure the groundwater levels at the depth at which the drinking water wells are screened; Explicitly describe any future representative monitoring wells and identify the proposed locations. When assessing the monitoring network data gaps, the GSP must prioritize installing new monitoring wells in locations where disadvantaged communities, small water systems, and domestic well users reside."	The coordinated basin-wide monitoring network was developed using the DWR BMP on SGMA Monitoring Networks, which discusses recommended well density and what constitutes a "SGMA compliant" representative monitoring site. It also allows for (and encourages) GSAs to use existing monitoring programs already in place for collecting data on the Sustainability Indicators identified in a basin's plan. Domestic wells are typically shallow or in the first occurence of groundwater and are, therefore, not representative of the groundwater conditions of the basin as a whole. Further, there are existing programs with which domestic wells and community wells must comply. These have been identified in the Basin Setting and Monitoring Network sections in the discussions of existing programs. In areas of the basin where the well density does not meet the standards used in the plan, proposed well locations have been identified. Per discussion and comments from the cities of Shafter and Wasco, three additional wells have been added to the monitoring network within the NKWSD-SWID management area.

Commentor	Ref #	Comment	Response
Leadership Council		The groundwater quality monitoring network does not adequately capture impacts on drinking water users.[…] First, measuring for Arsenic (as in Arvin-Edison WSD) only once a year does not provide the member agency or the GSA with frequent enough information to respond to severe drinking water contamination in a reasonable amount of time. If the member agency's management actions, projects, or decisions to let groundwater decline increase drinking water contamination for families in the management area, the member agency could go a whole year without detecting these impacts. […] Second, only measuring for compliance with arsenic measurable objectives and minimum thresholds does not protect against increases in other contaminants that exist in other parts of the management area (boron, nitrates, TDS, 123-TCP, iron and manganese). These contaminants could extend, move or increase due to groundwater management activities and pumping patterns. […] However, avoiding monitoring contaminated areas defeats the purpose of groundwater quality monitoring under SGMA, which is to measure the concentration and spread of contaminant plumes to ensure that groundwater management activities and pumping do not aggravate existing contamination.	The monitoring of water quality for the basin will include the use of data from existing programs (e.g. Title 22, ILRP, CV-SALTS) and sampling coincidental with groundwater level measurements at the representative monitoring sites. As such, the water quality data collected through SGMA will be more frequent than once a year. The constituents of concern to be tested in the water quality sampling at representative monitoring sites vary between the management areas. Therefore, the constituents analyzed will differ according to the management area plan. The selection of representative monitoring sites discouraged the use of wells with existing MCL exceedances because of the nature of the definition of undesirable results for degradation of groundwater quality. The occurence of an increase in concentration for constituents of concern in a representative monitoring site will, by virtue of it being a representative site, will be indicative of the migration of existing contamination.
Leadership Council		The projects and management actions set forth in the Draft GSP do not demonstrate a path towards achieving sustainability goals in the plan, and do not adequately account for the needs of disadvantaged communities pertaining to protected groups under state law. The GSA has allowed member agencies like the Arvin-Edison WSD to use a "glidepath" approach that increases surface water and groundwater recharge before demand reduction measures are implemented. This places the majority of the plan's success on surface water resources, which are variable and may not be able to be procured. The GSA should instead ensure that member agencies implement demand reduction strategies from the beginning so that groundwater levels do not plummet. A critical problem with the structure of the GSA is that member agencies cannot share the cost or responsibility for critical GSA-wide projects. Many more financially powerful agricultural and water banking member agencies could and should be part of a strategy to protect drinking water resources in the GSA area, especially given that they use much larger quantities of groundwater and their continued pumping will likely lead to dry wells and groundwater contamination issues for the most vulnerable homes in the GSA area.	The KGA and its members have the authority under SGMA to prioritize projects and management actions, as they see fit, to demonstrate that the basin can reach sustainability by 2040. The prioritization of projects to increase imported supply for use by districts' customers or for water banking projects protects groundwater for beneficial use in the basin by facilitiating in-lieu banking (where surface water is used whenever it is available, replacing groundwater pumping) or by maintaining groundwater levels through replenishment with banking projects. These projects do not run contrary to the mandate to protect groundwater quality. In fact, with groundwater levels as a proxy Sustainability Indicator for water quality, these projects achieve both the maintenance of groundwater levels and water quality. The agricultural and water banking agencies in the basin, as the customers paying for water deliveries and funding projects via land assessments in their respective districts, can and should be a beneficiary of the projects which they are funding.
Leadership Council		"The KGA GSA should implement or incentivize recharge basins or other recharge activities throughout the subbasin wherever DACs and clusters of domestic wells exist. The GSA should encourage these kinds of recharge projects with health co-benefits over on-farm recharge, which is likely lead to accelerate groundwater contamination."	It is at the discretion of the KGA's member agencies to identify projects to fund, as well as opportunities to collaborate with DACs. SWID, since its founding, has used its imported supplies to maintain groundwater levels and water quality to the benefit of the beneficial users within the district, including the cities of Shafter and Wasco and domestic well users. NKWSD has also operated in the same manner since its founding as a water storage district. Future projects and management actions which deal specifically with the DACs and domestic wells may be considered for subsequent updates to the GSP and management area plans.
Leadership Council		"For areas vulnerable to declining water levels and loss of production capacity, the KGA GSA should adopt management actions that establish geographical protection areas (buffer zones) by establishing bans, pumping limitations or community-specific management areas around disadvantaged communities and domestic well clusters."	The development of these buffer zones would be predicated on the development of a shallow-zone specific monitoring network and SMCs. As discussed in the response to the Monitoring Network comments, these shallow zones are not representative of groundwater conditions throughout the basin. Furthermore, the framework necessary to implement pumping restrictions or bans does not exist within the KGA or its members. Such policy would not be developed or implemented in time for the 2020 submittal.
Leadership Council		"We also strongly recommend against a groundwater market in the KGA GSA area. The GSP includes potential groundwater market and trading programs. Groundwater markets raise concerns from the perspective of domestic well users and disadvantaged communities."	At this time, the framework to establish a groundwater market in the basin does not exist. The policies and framework that would need to be developed by the KGA and its members is too complex to be completed in time for consideration in the 2020 submittal. Additionally, any groundwater market developed by the KGA or its members would have to comply with SGMA (i.e. prevent localized impacts to the Sustainability Indicators in its implementation).
Leadership Council		"The GSAs should implement and incentivize multi-benefit projects such as wetlands restoration or stormwater drainage ponds that would eliminate flooding and increase groundwater recharge in disadvantaged communities."	It is at the discretion of the KGA's member agencies to identify projects to fund. Future projects and management actions which provide benefits beyond SGMA may be considered for subsequent updates to the GSP and management area plans.
Leadership Council		"Although there are multiple short-term funding sources to leverage for SGMA-related projects, the GSA's and member agencies' operating budgets must be a reliable source of funding over the long-term of GSP implementation, and the GSA and member agencies cannot rely on grant funding for long-term projects and programs that benefit disadvantaged communities. The GSA and member agencies must be responsible for addressing the drinking water issues caused by their policy decisions and activities."	It is entirely appropriate that the KGA's members, when working in collaboration with DACs on a project to benefit groundwater quantity and quality in the basin, seek funding for such projects through state and federal grant funding programs. Grant funding, where the districts are eligible, is applied for to defray the cost of projects (which often far exceed the award amount). The remaining costs of projects and management actions are to be funded with the districts' operating budgets or through special assessments.
Leadership Council		"the Draft GSP allows continued overdraft above the safe yield of the basin, such that drinking water wells (especially domestic wells) will continue to go dry, infringing on the rights of overlying users of groundwater. The GSP must be revised to protect the rights of residents of disadvantaged communities and/or low-income households who hold water rights to groundwater."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with the statement, as the KGA GSP and its included management area plans have demonstrated, the combination of projects, management actions, and established SMCs will bring the basin into balance with its groundwater management by 2040.
Leadership Council		"The reasonable and beneficial use doctrine applies here given the negative impacts of the Draft GSP on groundwater supply and quality, which are likely to unreasonably interfere with the use of groundwater for drinking water and other domestic uses. As the Draft GSP authorizes waste and unreasonable use, it conflicts with the reasonable and beneficial use doctrine and the California Constitution."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with Leadership Council's statement regarding the plan's authorization of "waste and unreasonable use". The beneficial uses of water in the basin include other uses beyond domestic consumption. As such, it is entirely appropriate and in the authority of the GSAs that impacts to groundwater be analyzed in consideration of all beneficial uses identified in the plan.
Leadership Council		"The "public trust" doctrine has recently been applied to groundwater where there is a hydrological connection between the groundwater and a navigable surface water body. In Environmental Law Foundation , the court held that the public trust doctrine applies to "the extraction of groundwater that adversely impacts a navigable waterway" and that the government has an affirmative duty to take the public trust into account in the planning and allocation of water resources. The court also specifically held that SGMA does not supplant the requirements of the common law public trust doctrine. In contrast to these requirements, the Draft GSP does not consider impacts on public trust resources, or attempt to avoid insofar as feasible harm to the public's interest in those resources."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with Leadership Council's position in that the Basin Setting of the KGA GSP and its management area plans have adequately demonstrated that there are no interconnected surface waters in the basin and that this is the existing condition of the basin.
Rosedale-Rio Bravo Water Storage District Received Comments			
Wonderful Orchards	WO-1	It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource.	See KGA WO-1 Response
Wonderful Orchards	WO-2	In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield.	See KGA WO-2 Response
Wonderful Orchards	WO-3	In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin.	See KGA WO-1 Response
Wonderful Orchards	WO-4	Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	See KGA WO-1 Response
Wonderful Orchards	WO-5	GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity	See KGA WO-1 Response
Wonderful Orchards	WO-6	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	See KGA WO-1 Response
Wonderful Orchards	WO-7	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater.	See KGA WO-1 Response
Semitropic Water Storage District Received Comments			
Central Valley Joint Venture	CV1	We hope future proposed allocations and management actions in Semitropic weigh the value of wetlands as beneficial users of groundwater and support their continued existence.	Agree that managed wetlands have value, and there is nothing in the GSP to the contrary. Will weigh the value and reasonable water needs of managed wetlands in relation to other beneficial uses of groundwater in preparing future water budgets.

Commentor	Ref #	Comment	Response
California Waterfowl	CW1	The ET water budgets in the GSP are inadequate for continued operation of the managed wetlands. Without an affordable replacement water supply , the water budgets would lead to the complete eradication of managed wetlands in the Semitropic Water Storage District in 20 years.	Agree that managed wetlands have value, and there is nothing in the GSP to the contrary. Will weigh the value and reasonable water needs of managed wetlands in relation to other beneficial uses of groundwater in preparing future water budgets.
California Waterfowl	CW2	... recommends that ET allocations for managed wetlands be set on par with agricultural and other users atr 4.2 acre-feet for five years or until a sufficient data on ET rates for managed wetlands becomes available.	Acknowledge the data gap with respect to ET of managed wetlands. Will be including a MA for the continued refinement of ET on managed wetlands. Will adjust the initial water budget for managed wetlands to 4.2 acre-feet with the approriate ramp-down over the implementation period
California Waterfowl	CW3	Unless a surface water supply can be found to make up the difference between the proposed groundwater budget for managed wetlands, the water budget should be increased to a minimum of 4.2 acre-feet per acre. The cost of surface water should not exceed the cost of pumping groundwater ...	Will adjust the initial water budget for managed wetlands to 4.2 acre-feet with the appropriate ramp-down over the implementation period.
California Waterfowl	CW4	How can a surface water supply be provided? ... allow flood flows in the Tulare Lake Basin to be used on managed wetlands. ... provide access to State Water Project supplies to augment groundwater pumping.	Will consider joint projects for development of Poso Creek flood flows. Will consider access to SWP conveyance capacity for supplemental water supplies, including but not limited to water transfers. These will be included and considered in the development of individual projects and management actions.
California Waterfowl	CW5	The total number of acres in managed wetlands ...is very small in comparison to the number of acres in trees and other crops. An increase in the water budget will have a small effect on the groundwater available to agriculture.	All lands will be treated equally with respect to access to native yield and proportionate participation in District programs.
Rancho Visalia	RV1	**The Et Estimates Are Seriously Flawed** The first and most obvious conclusion from the above is that the Et estimates for Rancho Visalia are nowhere near accurate, both as to its undeveloped land and its flooded wetland ponds. This may be because the methodology used to determine the Et works well for agricultural land but does not work for natural, undeveloped land, wetlands or ponds. This is not surprising given that ag land loses water through the much higher Et rates associated with growing and exporting crops whereas duck clubs are composed of only natural, undeveloped land or flooded ponds/wetlands.	ET for undeveloped land is assumed to equal precipitation and therefore there is no net demand for undeveloped properties. Acknowledge the data gap with respect to ET of managed wetlands and duck clubs. Will be including a MA for the continued refinement of ET on managed wetlands. ET is a measurement of consumptive use, not applied water.
Rancho Visalia	RV2	**Restricted Water Budgets for Duck Clubs Will Cause Significant and Irreversible Environmental Harm** Imposing duck club water budgets of 1.5 af/ac/yr, as is proposed for the year 2020 in the draft Groundwater Sustainability Plan, will severely impede those clubs' ability to maintain year -round or even seasonal wetlands. Allowing the clubs to only extract .5 af/ac/yr, or worse, just the .15 af/ac/yr Native Yield, when the proposed GSP is fully implemented in 2040, will all but eliminate those wetlands, even for clubs such as Rancho Visalia which only floods about one sixth of its Special GPSC land.	We acknowledge the values of managed wetlands and duck clubs, but are required under SGMA to sustainabily manage the Subbasin without altering the water rights of landowners. Accordingly, all lands are being treated equally with initial allocation of available native yield in the Subbasin.
Rancho Visalia	RV3	**Any Over-Extraction by Duck Clubs Would Be Insignificant** ....duck club wetlands make up just 2 percent of the 140,000 acres of irrigated land and 1.3 percent of the total acreage within the SWSD. If duck clubs were allowed to extract the 3.5 af/ac/yr necessary to adequately flood their 2,800 acres of ponds, this would total just 9,800 af/yr. This is just .08 percent of the 123,900 af/yr reduction in groundwater pumping required under SGMA. In short, allowing the clubs to extract sufficient water to maintain their wetlands would have no measurable impact on the groundwater levels yet would avoid most of the environmental harm.	It is the expectation that a finite native yield will be developed for the entire Subbasin and that will be allocated among all lands equally. Providing some lands with higher native yields will require a reduction in the native yield allocated to other lands. Moreover, SGMA defines groundwater sustainablity in terms of the avoidance of six (6) defined undesirable results. Allocations of native yield are merely one tool (among many) to achieve sustainability within statutorily-mandated timeframes.
Rancho Visalia	RV4	**The finalized GSP Should Allow Duck Clubs to Extract Sufficient Groundwater to Sustain Year-round Wetlands on a Perpetual Basis.** **...** allowing duck clubs to extract sufficient water to adequately maintain their ponds would cause virtually no measurable groundwater reduction yet would avoid most of the environmental damage. For these reasons, the example duck club Water Budget should be modified so as to allow clubs to extract 3.5 af/ac/yr for their wetlands.	See Response to Comment RV2. The GSP is predicated on tracking consumptive use (ET), not applied water.
Larry Frey	LF1	Objection to the proposed District plan to not allow a farmer to carry-over from year to year, or a number of years, on a one-to-one basis without a fee the Incremental Pumping allowance portion of his yearly water right.	Comment to be considered through the development process of the Landowner Budgets Management Action.
Fresno Irrigation District	FID1	The project ("Tulare Lake") is fundamentally flawed, as Semitropic has not established that it has the right to export Kings River water to Kern County as the project requires.	The ultimate yield of the Tulare Lake Project will be determined pursuant to the water right proceeding now being conducted by the State Water Resources Control Board. Any water supply developed through the implementation of any of the projects identified in Table 5-1 will reduce the District's obligation to retire properties as identified in the third management action.
Kings River Water Association	KR1	The project ("Tulare Lake") is fundamentally flawed, as Semitropic has not established that I has the right to export Kings River water to Kern County as the project requires.	The ultimate yield of the Tulare Lake Project will be determined pursuant to the water right proceeding now being conducted by the State Water Resources Control Board. Any water supply developed through the implementation of any of the projects identified in Table 5-1 will reduce the District's obligation to retire properties as identified in the third management action.
North Kings Groundwater Sustainability Agency	NK1	The project ("Tulare Lake") is fundamentally flawed, as Semitropic has not established that I has the right to export Kings River water to Kern County as the project requires.	The ultimate yield of the Tulare Lake Project will be determined pursuant to the water right proceeding now being conducted by the State Water Resources Control Board. Any water supply developed through the implementation of any of the projects identified in Table 5-1 will reduce the District's obligation to retire properties as identified in the third management action.
Hancock Farmland Services	HF1	The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area.	Agree that references to native yield are for initial water budget purposes only, are not precedent-setting, and are not a determination of the water rights of individual landowners or other water users.
Hancock Farmland Services	HF2	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Agree that existing groundwater banking projects and banking inventory should be protected in accordance with contractual requirements and that incentives for additional recharge and banking projects should be developed.
Hancock Farmland Services	HF3	GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration.	Agree, Landowner information is important for validating the Et Measurements.
Westchester	W1	The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water, for example xxx,xxx acre-feet and not associated with a given gross or net area.	Agree that references to native yield are for initial water budget purposes only, are not precedent-setting, and are not a determination of the water rights of individual landowners or other water users.

Commentor	Ref #	Comment	Response
Westchester	W2	… GSAs and MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible without creating undesirable results, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity.	To the extent pumping restrictions are adopted in the future, they will be implemented in accordance with SGMA (including but not limited to the requirement that water rights not be altered) and best available science.
Westchester	W3	As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated and consistent across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled).	To the extent pumping restrictions are adopted in the future, they will be implemented in accordance with SGMA (including but not limited to the requirement that water rights not be altered) and best available science.
Westchester	W4	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Same as Hancock HF2
Westchester	W5	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater.	Agree, this is contemplated as an item for coordination relative to all GSA's within the basin
Westchester	W6	GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration.	Same as Hancock HF3
Wonderful Orchards	WO1	It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource.	The KGA has identified the "Study of Native Yield for the Kern Subbasin" as a management action that will include all GSAs in the Subbasin. This Management Action will work to develop a common and agreed to native yield value for the entire Subbasin and appropriate methodology for allocation of the native yield, in accordance with SGMA.
Wonderful Orchards	WO2	In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield. Currently, the GSP references native yield in terms of acre-feet per gross acre for water budget purposes. .... If referencing native yield this way is necessary, the GSP should clarify that it is for initial water budget purposes ONLY, is non-precedent setting, and is not a determination of individual landowner allocations or groundwater rights	Clarification regarding planning level water budget and native yield analysis can be added to the GSP. Agree that references to native yield are for initial water budget purposes only, are not precedent-setting, and are not a determination of the water rights of individual landowners or other water users.
Wonderful Orchards	WO3	Alternatively, in the 2020 plans subbasin native yield could be described as a total volume of water and not associated with a given gross acreage.	Agree with respect to GSA or Management Area; however, utilization of native yield at the landowner level requires an allocation. The initial policy direction is to allocate native yield equally to all acres within the Subbasin.
Wonderful Orchards	WO4	In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin.	Opportunities for stakeholder input will be provided during the planning and implementation of the Landowner Water Budget Management Action in early 2020.
Wonderful Orchards	WO5	An equal-per-gross acre approach to allocations is not likely to be consistent with established water rights doctrine, which must recognize many equitable considerations in addition to acreage owned, to determine a legally defensible allocation.	To the extent pumping restrictions are adopted in the future, they will be implemented in accordance with SGMA (including but not limited to the requirement that water rights not be altered) and best available science. The comment is unclear regarding what is meant by "equitable considerations."
Wonderful Orchards	WO6	Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	Water markets will be considered as potential future management actions.
Wonderful Orchards	WO7	GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. ... As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled)	Same as Westchester W2 Agreed - is reflected in the development of the IPA and gradual reduction of IPA to 0 by 2040 With regard to ramp-down schedules, not all lands are equal with respect to surface water supplies; therefore the sustainable yield for each property will vary across the Subbasin and accordingly the ramp-down schedules will vary.
Wonderful Orchards	WO8	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Same as Hancock HF2 Agree and will continue to consider through implementation of projects and management action.
Wonderful Orchards	WO9	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions.	Same as Westchester W5 1) Agree - however the level of detail (district vs landowner) many vary and will need to be discussed further. 2) Market interface will be considered as markets develop. Should not be limited to just groundwater.
Wonderful Orchards	WO10	GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	Agree - all data needs to be verifiable and defensible at the District and landowner level.
Major Dhillon	MD1	The SGMA draft report(hereinafter as "Report") completely favors the farmers who are getting State water or contracting for surface water. They have access to surface and as well as to the well water, whereas land owners who have no access to surface water are at big disadvantage especially with the new allocation that Semitropic is using	See Section 5.2.3 for clarification. Additonal clarification to be provided in additional information developed through implementation of the Landowner Water Budget Management Action in early 2020.

Commentor	Ref #	Comment	Response
Major Dhillon	MD2	The Semitropic water Storage District(hereinafter as "District") did not give any opportunity to land owners if they wish to participate in a program called "Developed land" where a landowner can also pay the water assessment of $137 + per acre. We the land owners who were not provided the opportunity to participate in the Developed land definition MUST BE PROVIDED AN OPPORTUNITY TO PARTICIPATE IF THEY WISH	Disagree - See Prop 218 for New Lands Surcharge
Major Dhillon	MD3	The District has given no consideration to properties which are enrolled in Williamson Act.	Under California law, lands enrolled in the Williamson Act are not exempt from the requirements of SGMA.
Maricopa Orchards	MO1	**Section 2.7.2** 1) Can properties not currently in the in-lieu program enroll? 2) What if growers pay for infrastructure to be part of the program? 3) I don't understand the terminology in the section labeled "Construct additional irrigation distribution systems". What does absorptive capacity and related priorities mean? 4) Water in storage by banking partners may help the groundwater levels generally but any of it can be called upon so should this be recognized? 5) How will the landowner pumping agreement be affected by SGMA? 6) Where is the surface water storage capacity located? 7) On Third Party Banking, how will SGMA affect the in-lieu banking program?	1) yes 2) will be considered 3) one on one discussion for clarification 4) Banked water is not water supply of the District, with the exception of the 10% leave behind. 5) no impact to a landowners Groundwater Pumping Agreement is expected relative to recovery of banked water via the agreement on behalf of the district for bankers. There could be an impact with respect to a landowners ability to wheel water due to compliance with the SGMA Sustainability Indicators 6) Temp storage at Goose Lake under agreement with Goose Lake Holding Co. and surcharge spresding facilities at Scofield. 7) Do not foresee an impact relatative to an existing bankers first priority recharge rights.
Maricopa Orchards	MO2	**Section 3.3.1.1** Does this mean that upper zone pumping is unlimited for now and will just be monitored? How does this effect the Agua Via/WAP projects? There needs to be clear contract language re the assumption of risk for the service providers.	No - This is a data gap. MT and MO for the upper aquifer will be developed in the future
Maricopa Orchards	MO3	**Section 3.3.2 and 3.3.3** Seem not to address the issues for MOs/MTs -for example, doesn't SWSD need to monitor subsidence and, if below a specified level, then would require a management action?	The KGA and the District have identified the understanding of subsidence as a data gap and have committed to maintaing existing monitoring sites and establishing additonal sites to better understand the specific causes of subsidence in the subbasin. With this information we will establish MO & MT in the District.
Maricopa Orchards	MO4	**General, Water Budget** Allow Growers to determine their order of use. However, with the knowledge that you cannot roll over native yield. Allow Growers to decide if they want to manage their allocation year to year or if they want to opt into the average - How can SWSD guarantee the then current average SWP? Isn't that taking water from the basin to incrementally benefit SWP contract holders? What if contract holders want to bank their surplus water on their own account (either through the SWRU or via the new recharge program?) (Section 5.2.3.2) When will landowners be expected to start using the water budget? 2020 or 2021?	Good input - will consider when developing Landowner Water Budgets
Maricopa Orchards	MO5	**General** The GSP punts to a later 5-year update in many instances. This could be a red flag for DWR. Banking partners should be able to use or sell their banked water in SWSD to growers who have deficits without having to recover from SWSD wells. Query whether there should be a discount to the recovery charge per AF?	Noted
Maricopa Orchards	MO6	**General, Subsidence at the Aqueduct** Additional monitoring should be completed due to subsidence may not be directly linked to Semitropic.	Agree
Maricopa Orchards	MO7	**General, Expiration of Credits on Recharge** Semitropic should not have expiration dates or increasing leave behind factors on water stored via recharge or credit carryover. It will encourage pumping in an effort not to lose stored water.	Good input - will consider when developing Landowner Water Budgets
Maricopa Orchards	MO8	**5.2.3.2, Incremental Pumping Allowance** 1) We are pleased with this glide path approach. This gives growers the opportunity to plan and reach sustainability by 2040. 2) What if the IPA results in undesirable results? 3)Doesn't a larger IPA for non-contract growers reward those that have been benefitting from the overdraft?	1) Comment noted. 2) If IPA results in undesirable results it will require adaptive management. 3) Potentially in the short term, but IPA is reduced to zero by 2040.
Maricopa Orchards	MO9	**Chapter 5** 1) Potentially add ASR as a project that growers/district can use as a tool for recharge. 2) Why is brackish water desalination limited to only 1,800 AF? 3) For Poso Creek MAR, would SWSD allow growers to take flood water and recharge in their own facilities? 4) For SWRU, what type of storage is referenced? 5) Will the pilot program for private recharge continue?	1) Considered as enhanced recharged 2) place holder for proposed project 3) Potentially 4) Primarily in-leu groundwater storage 5) likely yes
Maricopa Orchards	MO10	**Table 5-1** Various spelling errors.	Noted
Maricopa Orchards	MO11	**General, Landowner Classifications** Let landowners that have parcels that are paying a portion of the GPSC to opt in to pay the entirety.	Not at this time
Maricopa Orchards	MO12	**General, Water Markets** Allow basin-wide market and do coordination agreement with neighboring districts (regional).	Will be considered in the future as water market develop within and between districts in the Subbasin. Consideration will need to be given to location of groundwater extractions to avoid concentration of withdrawal and the potential for undesirable results
Maricopa Orchards	MO13	**Kings River Water/ State Water Project** 1) Has any assumption been made regarding there being less Kings River flood water? 2) Has any assumption been made regarding there being less SWP due to projections of long-term allocations being lowered given climate change and expected biological opinion limitations?	1) Planning level estimate. Project yield would reduce obligation to retire lands within the District (MA 3) 2) Currently using DWR provided delivery estimates for 2030 and 2070
Audobon	A1	The proposed consumptive use allocation for duck clubs will result in severe near-term and long-term declines in wetlands in the Semitropic GSA.	Currently, not enough data to make this determination. Additional analysis on consumptive use (ET) and fate of pumped groundwater is required.
Audobon	A2	The evapotranspiration (ET) of flooded wetlands and native uplands is currently poorly understood by Semitropic GSA and should be identified as a data gap. The Incremental Pumping Allowance for wetlands should be set to give an initial ET allocation of 4.2 acre-feet per acre, on par with other irrigated lands, while the ET data gap is addressed in the first five years of the GSP implementation.	Will Modify initial IPA for wetlands to allow up to 4.2AF/Ac of consumptive use Address ET data gap in ongoing ET refinement efforts as an MA
Audobon	A3	Recharge from imported surface water to Kern National Wildlife Refuge should be reflected in proposed water budgets for managed habitat. State and federal lands should be allocated native supply and Semitropic GSA should work with federal and state agencies to develop an appropriate trading system to support habitat *(accounting for recharge from Refuge water supplies)*	Clarification / refinements to the Landowner Water Budget Management Action will be considered as part of the process of approving the same for implementation.
Audobon	A4	P. i: Executive Summary, paragraph 2. The beneficial users of water in the Tulare Lake Region are described as "agricultural; municipal and domestic; industrial; and environmental." In the proceeding sentence the environmental users are not included as being supported by groundwater. However groundwater in this region supports managed wetlands that are important migratory bird habitat, provide recreational opportunities, and contribute to the economic viability of local communities.	Agree to change the identified sentence to include managed wetlands
Audobon	A5	P 4. 1.4.1 Plan Area Setting. It is unclear if the "146,000 acres of irrigated lands" includes managed habitat and wetlands. Please clarify if managed wetlands, i.e. 'duck clubs', are included as irrigated lands	Comment noted - numbers ajusted in text
Audobon	A6	Additionally, clarification on how riparian versus native vegetation was classified is absent and would be helpful to understand why the "native vegetation" directly surrounding the Kern River Channel is not "riparian vegetation	Will provide clarification based on sources. I believe this data came from DWR and its their classification system.
Audobon	A7	In Figure 1-2 approximately 1/3 of the area is identified as riparian and native vegetation. This should be noted in the description of land use in this section because of its significance.	Change made to the text to say "Land use within SWSD consists mainly of agricultural production and environmental land uses, as shown in Figure 1-2."

Commentor	Ref #	Comment	Response
Audobon	A8	1-3 does not show any of the native and riparian vegetation areas from Figure 1-2, many of which are known to be GDEs, as identified by the DWR's Natural Communities Commonly Associated with Groundwater dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) and the Nature Conservancy's GDE Pulse tool (https://gde.codefornature.org/#/home).	Figures have been update to properly reflect areas of the District that are groundwter dependent. No requirement to overlay habitats on that map.
Audobon	A9	P 8. L. Impacts on Groundwater Dependent Ecosystems. Within SWSD there are significant and important habitat areas supported by supplemental water and these managed wetlands heavily rely on pumped groundwater or applied surface water.	Our statement currently is: "There is the potential for Groundwater Dependent Ecosystems (GDE) in the western portion of the District and along Poso Creek. However, the presence of GDE's has not been verified. Section 2.3 of this GSP provides an overview of the available information regarding GDEs in the District. " GDEs are not the same as managed wetlands.
Audobon	A10	P 9. 1.5.2 Beneficial Uses and Users. DWR Bulletin 118 identifies beneficial uses and users that include the environment. Under the list for "Users of groundwater", "landowners" should include managed habitat and duck clubs, especially since "duck clubs" are identified under section 5.2.3.1 as a unique "Landowner Class" and an example water budget was created for duck clubs in see Figure 5.3.	The change has been made to the text: As required by Section 354.10(a) of the GSP emergency regulations, beneficial use and users in the District's portion of the Subbasin have been identified. The beneficial uses of groundwater in the Plan Area, consistent with the uses identified in DWR Bulletin 118, are: • Agricultural • Municipal and Industrial • Domestic • Environmental Users of groundwater have been identified as landowners, agricultural operations (including farms, dairies, and food processors), rural residents, managed wetlands and unincorporated
Audobon	A11	P 45. 2.2.7.2 Direct Recharge. It should be noted that percolation not only occurs from "applied water that passes below the crop roots zones, and unlined canals," but may also occur on managed wetlands within the SWSD service area. Managing wetlands to be multiple benefit may provide an opportunity to increase acreage of managed recharge in this region. Direct recharge on managed wetlands should be treated consistent with direct recharge on irrigated agricultural lands.	Noted change was made to the text.
Audobon	A12	P 46. 2.2.9 Sources and Point Delivery for Imported Water Supplies. It should be noted that the Kern National Wildlife Refuge receives water from the State Water Project through agreements with the Bureau of Reclamation, the State, and via conveyance agreements with Buena Vista Water Storage District. As pointed out in 2.2.8 Surface Water Bodies, the Kern National Wildlife Refuge relies on these deliveries of surface water, though these water supplies are becoming less reliable. These surface deliveries have benefited the SWSD management area by providing the use of surface water in-lieu of local groundwater resources, and creating a source for groundwater recharge from the delivered surface water.	Acknowledge that this supply was not accounted for, but neither was the demand or conveyance losses for delivery of Refuge water.
Audobon	A13	P 58. Table 2-4. Land Uses Within SWSD. Duck clubs and overall managed habitat should be a separate land use in this table. It is not clear where the acres for Kern National Wildlife Refuge or the various private duck clubs are represented in this table. This land use, managed habitat, has an applied water demand similar to agriculture and should be included in current and projected water budgets.	Table was removed from text. Numbers inconsistent with other figures
Audobon	A14	P 77. 2.3.7 Interconnected Surface Water Systems. In this section it states that "In order to sustain the managed wetlands in the study area, imported surface water is needed," suggesting that these habitats rely solely on surface water. This is correct for some managed wetlands, such as those found at Kern National Wildlife Refuge. Most private wetlands, operated as duck hunting clubs, pump groundwater to support managed habitat and may access surface water at times. Furthermore, in the proceeding section, 2.3.8 Potential Groundwater Dependent Ecosystems, it describes areas with GDEs being associated with "managed wetlands and riparian areas" that are supported by a "combination of groundwater and imported surface water." These two sections contradict one another and consistency is needed.	Text as been changed as follows: Interconnected surface water systems are surface waters that are hydraulically connected by a continuous saturated zone to an underlying aquifer (DWR, 2016). There are no known natural interconnected surface water systems in the study area. ~~The majority of surface water bodies in the study area, such as Jerry Slough, Kern River Channel, receive managed surface water deliveries. In order to sustain the managed wetlands in the Semitropic area, imported surface water or pumped groundwater is used. For example, the Kern National Wildlife Refuge (KNWR) is now sustained by imported surface water wheeled from the California Aqueduct and conveyed by the Goose Lake Canal (USFS, 2005) or from groundwater pumping at the site. Any interconnected surface water systems in the Semitropic area are sustained by managed water deliveries of either Kern River water, imported surface water or local groundwater pumping.~~ The Poso Creek channel is the only channel that experiences natural recharge from the surrounding highlands. However, Poso Creek is ephemeral and only flows during limited wet periods.
Audobon	A15	P 82. Land Use Data. Though Kern National Wildlife Refuge relies solely on surface water, most managed wetlands in SWSD depend solely on groundwater. Some private wetlands do purchase surface water in select years. This distinction should be highlighted in this section.	The section reads as follows. Yellow highlight is suggested addition Land use data surrounding NCCAG vegetation and wetlands indicate actively managed wetlands as well as agricultural land. The agricultural lands may employ groundwater pumping in dry years; however, it is unknown if pumping occurs in the upper zone. In general, the actively managed wetlands are reliant on a combination of surface water imports and ~~are therefore not dependent solely on~~ pumped groundwater. For example, the KNWR (Figures 2-48 and 2-49), is sustained by surface water imports.
Audobon	A16	P 82-83. 2.3.8.6 Shallow Groundwater and Land Use Discussion (third paragraph). The identification of sources that contribute to shallow groundwater should be identified. This information will be important to understanding how to maintain critical habitat areas and should be prioritized for monitoring efforts.	We state that "It is unknown if or from which aquifer zone groundwater pumping occurs for adjacent agricultural land."
Audobon	A17	P 93-94. 2.6 Management Areas within SWSD. Duck clubs and the Kern National Wildlife Refuge actively apply water to meet consumptive use needs so therefore should not be considered "undeveloped." These lands should be recognized as developed lands within their respective management areas.	Change to: "Management area 3 includes managed wetlands (private duck clubs), the Kern National Wildlife Refuge, undeveloped native lands." Not sure I see a reason to change the statement.
Audobon	A18	P 97. Increased Direct Recharge Capability. Managed wetlands, including Kern National Wildlife Refuge and duck clubs, can potentially provide a unique opportunity for in-lieu recharge while providing waterbird habitat. It is recommended that this be further evaluated for increasing recharge capacity within the service area.	Noted for future consideration
Audobon	A19	P 98. Implemented Third-Party Water Banking. The imported water for the Kern National Wildlife Refuge could be treated similarly to other lands in this section - as a source of continuous surface delivery in-lieu of groundwater use, and a source of recharge with delivery of the surface water through Goose Lake canal.	The refuge is not currently a third party banker. Not appropriate
Audobon	A20	P 154. Table 4-1. Potential Impacts of Overdraft with Corresponding Monitoring. There should be a unique row for managed habitats, as they will have the same impacts as "Irrigated Agriculture." Managed habitats pump groundwater (and when available rely on SWSD surface water) to meet irrigation and habitat needs.	Table 4-1 - In the User Group identification add: Irrigated Agriculture (including managed habitats)
Audobon	A21	P 156. 4.2.2.6 Consumptive Use. We understand that the District is not confident in the consumptive use estimates for managed habitat areas and would like to work together to improve this data set.	Noted - will include a management action for refinement of ET on managed wetlands
Audobon	A22	P 157. 4.3.3 Rationale for Design (paragraph after bullet points). To improve the understanding of how groundwater pumping can impact managed habitat, monitoring well locations may be available within duck clubs or state and federally managed habitats.	Will consider in future updates to monitoring network. No response in document suggested.
Audobon	A23	P 180. Table 5.1. Rows 4 & 7. As specific projects become further developed, managed habitat areas may offer ideal opportunities for recharge or temporary storage of water during high flow events. Projects that utilize habitat lands may lessen negative impacts to cultivated lands from flooding or intentional recharge. We recommend that the GSA investigate opportunities that can allow habitat areas to function both for habitat and to provide recharge or temporary storage. Additionally, knowing that water for recharge likely comes in large quantities over short timeframes, the existing configurations of managed habitat areas can make for useful retention areas, without risking the flooding on irrigated crops such as trees and vines. Expanding priorities that have added benefit, such as habitat and wildlife value, can also lead to non-target benefits (e.g. water filtration or recreation opportunities) and be accomplished through simple actions. This may open the door to additional funding sources that otherwise would not have been available if these benefits were not part of a project. Audubon is interested in helping the GSA investigate these potential opportunities to develop multi-benefit projects.	This concept is captured in the Tulare Lake project and the Poso Creek MAR project. Comment will be considered as projects are developed. No change to text or table as suggested.

Commentor	Ref #	Comment	Response
Audobon	A24	P 185. 5.2.1 Existing Projects and Management Actions (second bullet point). How will managed habitat lands fit into this program and fee structure given the uncertainties of managed habitat consumptive use? (See above comment related to consumptive use). Clarification here is recommended.	To be determined. We are awaiting additional data from Audubon re consumptive use.
Audobon	A25	P 186-187. 5.2.2 Future Projects and Management Actions (bullet #6 and 8). For the management action that "will be developed in a manner which allows for the creation of a 'market' for the transfer of water among District landowners," will this be limited to transfer of Native Yield, or will it also include Incremental Pumping Allowances? Also, please clarify which water supplies this market is intended for. Additionally, what does the management action "equal access to participate proportionate to investment" mean? Managed habitats are a significant benefit to the public resource, are managed to provide critical habitat to migratory birds and other wildlife, and create recreational and economic benefits (i.e. hunting and wildlife viewing) to the community. Please clarify what is the "access" level that may vary by investment?	Water markets will be considered as future management actions.
Audobon	A26	P 189. Incremental Pumping Allowance (IPA). This section states, "The IPA will be established by the District and set such that on average no individual landowner will be short of a water supply at the initiation of the SGMA implementation period." The current estimate of Incremental Pumping Allowance for "duck clubs" is likely insufficient and will make duck clubs "short" at the initiation of the SGMA implementation period. This needs to be addressed to ensure that the duck clubs can continue to provide critical habitat to migratory birds and other wildlife during the transition period of GSP implementation.	Changing IPA to Temprorary Consumptive Use Allowance (TCA)
Audobon	A27	P 192. Special GPSC (Duck Clubs). Details and clarification of how consumptive use amounts were determined for managed habitat is needed. Has the District obtained any data from duck club operators regarding water use per acre? The Incremental Pumping Allowance should be increased to meet the consumptive use needs, similar to the standard GPSC designated lands. Furthermore, for Kern National Wildlife Refuge, the 'banked supplies' should recognize the seepage losses in the Goose Lake Canal that occur from the imported surface water, that is not imported by the SWSD. This is an independent source of surface water imported by the U.S. Bureau of Reclamation and conveyed per agreements with Buena Vista Water Storage District to lands that include a significant portion of Kern National Wildlife Refuge lands within the District. Audubon is interested in working with SWSD to improve information on habitat consumptive use in the management area.	Currently under review.
Dept of Fish and Wildlife	DFW1	The Department recommends continued data collection to reduce uncertainty around shallow groundwater, and concurrently, around the presence of GDEs. Until such time as a GOE can be verified through field work or increased resolution of groundwater mapping reliant on hydrologically robust baselines, the Department recommends including all potential GDEs in the MAP as beneficial users of groundwater	Will include a management action for identification and assesement of GDE and managed habitat water uses and needs. We do identify this as a data gap.
Dept of Fish and Wildlife	DFW2	i. Revise the sustainable management criteria and accompanying narrative by accounting for undesirable results for environmental beneficial users of groundwater. Clarify how species and habitat groundwater needs were considered in the identification of sustainable management criteria. ii. Revise sustainable management criteria to reflect a 'Critically Overdrafted' subbasin designation by seeking to improve current groundwater conditions rather than allowing for continued aquifer depletions over the next two decades.	i) no distinction on landowner use of water ii) NO - Sustainable management critieria developed using concensus position as to what constitutes a significant and undesireable result or worse case scenario (not best case)
Dept of Fish and Wildlife	DFW3	The Department recommends that the GSP clarify locations of existing shallow groundwater monitoring wells used to create the shallow groundwater elevation contour map provided within the MAP (Figure 2-27). Additionally, the figure should show overlap potential GDEs with shallow monitoring well locations to vet vegetation groundwater reliance. This figure and associated information would clarify monitoring data gaps and serve as an assessment tool when verifying GDEs.	The District has added a management action to evaluate the presense of GDEs, in order to determine the appropriate level of monitoring required.
Dept of Fish and Wildlife	DFW4	Many of the Duck Clubs in the MAP area are currently supported by the Department'sCalifornia Waterfowl Habitat Program to ensure the adequate maintenance of habitat critical to wetland-dependent species. Implementation of pumping allowances identified in Figure 5-3 would eliminate all wildlife value associated with these wetlands. To continue to share in the support of this valuable public benefit, the Department recommends that the Semitropic Water Storage District Groundwater Sustainability Agency create additional pumping allowances and/or supplemental water supply opportunities for lands that support wetland habitat. The Department also requests confirmation that all Department-owned lands within Semitropic Water Storage District jurisdiction (see Comment #1) will be granted an equitable native groundwater yield allocation under new Landowner Water Budget management actions (starting page 187).	Semitropic will support the Department in securing additional diversions from the Delta for environmental benefits in Semitropic, with no impacts to Semtropic's SWP allocations. All allocations of native groundwater yield will be undertaken in accordance with SGMA, including but not limited to the requirement that water rights not be altered.
Bob Bostick Duck Club	BB1	I support Rancho Visalia's proposal to allow private wetland owners in the Special GPSC to extract 3.5 ac/ft/yr for the acres of land paying the Special GPSC. This would amount to approximately 10,000 ac/ft for the all of the private wetlands in the district and only 0.08 percent of the targeted reduction in groundwater pumping required by SGMA.	The Special GPSC lands have been give a TCA of 4.2 ac-ft per acre.
Bob Bostick Duck Club	BB2	In cooperation with NGOs like CWA and DU, WCB, CA DFW, US Fish and Wildlife, and TBWA develop a written plan and agree to execute the plan to connect all private wetlands to the Pintail Slough water delivery system.	Noted - will be considerd in development of future projects and management actions
Bob Bostick Duck Club	BB3	Agree to support efforts by the private wetland owners to obtain Environmental water to be used only by the wetlands.	Noted - will be considerd in development of future projects and management actions
Clean Water Action	CWA1	Disadvantaged communities are present in the District but are not identified. An ongoing study "Tulare Kern Funding Area Disadvantaged Community Involvement Program" is mentioned but not referenced, nor is there a description of what information is being developed and how it would be used in this plan, particularly since the information won't be available until after the plan is prepared. Instead the plan should use the DWR DAC mapping tool at https://gis.water.ca.gov/app/dacs/ , and identify the program listed above as a refinement of that information that can be used to improve implementation	Noted
Clean Water Action	CWA2	The CA MCLs are cited, however the OEHHA PHG for hexavalent chromium should be used since a standard is unavailable. No other criteria from the RWQCB Plan or Transportation Plan appear to be used.	Noted
Clean Water Action	CWA3	The beneficial uses, including environmental, are listed but no specific groups are mentioned. Kern National Wildlife Refuge (NWR) and Duck Clubs (i.e. private managed wetlands) are identified later in the document, but should be specifically listed as beneficial users of groundwater as Kern NWR uses groundwater for domestic purposes and Duck Clubs use groundwater to provision habitat. There is no mention of involvement in the GSP development by Kern NWR or the Duck Clubs, which is especially important given that this GSP contains one of the largest extents of these environmental beneficial users of all the critical basin GSPs. The Community Portal on the District Website was listed in the GSP as a means of engaging in the development of the GSP, but a more thorough description should be given of actions to engage environmental beneficial users.	Representative from the Kern NWR and private Duck Clubs were notified of all outreach and stakeholder opportunities. Representatives were present at public workshops held by the District and a GSA Board meetings. Comments were received and responded.
Clean Water Action	CWA4	The types and locations of environmental uses, species and habitats supported, and the designated beneficial environmental uses and users of surface waters that may be affected by groundwater extraction in the Subbasin should be specified. The GSP should explicitly identify any environmental uses and users of groundwater in the plan area, and take particular note of the species with protected status. The following are resources that can be used: ● Natural Communities Commonly Associated with Groundwater dataset (NC Dataset): https://gis.water.ca.gov/app/NCDatasetViewer/ ● The list of freshwater species located in the Kern County Subbasin can be found here: https://groundwaterresourcehub.org/sgma-tools/environmental-surface-water-beneficiaries/ ● The California Department of Fish and Wildlife's California Natural Diversity Database (CNDDB): https://www.wildlife.ca.gov/Data/CNDDB ● Land Use Datasets on the Department of Water Resources' SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer	Noted - will consider in proposed management action to evaluate the presense of GDEs

Commentor	Ref #	Comment	Response
Clean Water Action	CWA5	The GSP does not include a copy of the SCEP. An SCEP should be included in the GSP as an appendix or attachment.	The District has engaged in stakeholder engagement through out the development of the GSP, as documented in the GSP.
Clean Water Action	CWA6	The GSP should clearly identify how DAC beneficial users were engaged in the GSP planning process, by providing detailed information on the number of meetings held, general levels of attendance, what feedback was provided by community members, etc.	GSP identifies all public meetings. District will include attendance sheets from all meeting in Plan updates.
Clean Water Action	CWA7	The draft GSP states that stakeholders' input was considered during decision making processes, however, it does not describe how the input was incorporated. The GSP should provide detailed description about stakeholder input and responses and how are those were addressed by the decisions.	Noted - comments from all stakeholders where considered during the development process.
Clean Water Action	CWA8	Detailed information regarding the location and depths of domestic wells is currently lacking in the GSP. Domestic well location and construction information are essential for evaluating impacts of proposed MOs/MTs on domestic wells. The GSP should provide the locations and depths of all domestic and public supply wells in the GSA area using the best available information, and present this information on maps along with the proposed SGMA-compliance monitoring network so that the public can evaluate how well the monitoring network addresses these key beneficial users. If no better source is available, DWR has made well construction records available through its Well Completion Report Map application website: https://www.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37	Noted - will consider adding additonal detail on well impact analysis.
Clean Water Action	CWA9	The GSP should provide a more thorough assessment of GDEs, per the discussion provided in Question 2a above. The GSP should provide depth to groundwater contour maps and note the following best practices for doing so: ● Are the wells used for interpolating depth to groundwater sufficiently close (<5km) to NC Dataset polygons to reflect local conditions relevant to ecosystems? ● Are the wells used for interpolating depth to groundwater screened within the surficial unconfined aquifer and capable of measuring the true water table? ● Is depth to groundwater contoured using groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape? This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide much more accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found. Depth to groundwater contours developed from depth to groundwater measurements at wells assumes that the land surface is constant, which is a poor assumption to make. It is better to assume that water surface elevations are constant in between wells, and then calculate depth to groundwater using a DEM of the land surface to contour depth to groundwater.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA10	The GSP should also provide maps of the representative monitoring network overlaid with location of DACs, GDEs, and any other sensitive beneficial users. Such maps will allow the reader to evaluate the adequacy of the network to monitor conditions near these beneficial users, and whether or not the GSP is compliant with 23 CCR § 354.34.(b)(2)	Noted
Clean Water Action	CWA11	The GSP should include a discussion regarding the nature and characteristics of the identified GDEs and potential GDEs, and should provide information on the current and historical groundwater conditions near the GDEs and corresponding GDE ecological conditions. The GSP should include an ecological inventory for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value.	Information is provided in the GSP
Clean Water Action	CWA12	The GSP should identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat have been identified in or near any of theGDEs. Note that some organisms rely on uplands and wetlands during different stages of their lifecycle. Resources for this include the list of freshwater species located in the Subbasin that can be found at https://groundwaterresourcehub.org/sgma-tools/environmental-surface-water-beneficiaries/ , the Critical Species Lookbook, and CDFW's CNDDB database.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA13	The GSP should provide data or analysis to document the statement of the absence of interconnected surface water systems within the GSA area. The GSP should also identify data gaps (e.g., lack of shallow or nested/clustered monitoring wells or stream gauges) and either reconcile them or provide a plan to address them as needed to improve identification of ISWs prior to disregarding them in the GSP.	Groundwater elevation data is presented in the GSP
Clean Water Action	CWA14	The GSP uses a superficial manner of addressing water budgets. Water supplies for the current water budget are presented and the water demand is compared as a total. The available water supply from the State Water Project (SWP) is based on DWR's 2017 Delivery Capacity Report. The quantities related to the SWP are adjusted for 2030.	Noted
Clean Water Action	CWA15	The water demand based on land uses and cropping was not adjusted for 2030. The GSP deferred to the analysis in the KGA Umbrella GSP for 2070 and no summary is provided.	
Clean Water Action	CWA16	The GSP should provide a breakdown of ET for all land-cover types, including managed wetlands, and native and riparian vegetation (such as wetlands, riparian vegetation, phreatophytes and other communities). The GSP should identify any data gaps and outline the actions needed to address them and the schedule for their implementation.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA17	The GSP should design management areas and the associated monitoring network to adequately assess and protect against impacts to all beneficial users, including DACs. It is recommended that the GSP discuss what, if any, differential impacts would be anticipated as a result of the separate management of these areas.	Noted
Clean Water Action	CWA18	The GSP should describe the well network to provide methodologies, data and other information to support the investigation and monitoring of the shallow zone, GDEs and ISWs. This modification should include 1) locating new wells that are appropriately screened to detect connectivity of GDEs and ISWs with the shallow zone, particularly in the northwest management area, and 2) identifying or installing stream gages, if possible, in areas where there is potential for ISWs and GDEs. Please expand on the discussion of how the new well and stream data will be used to improve ISW mapping and inform an adequate analysis, and how the data will be used to verify possible GDEs. The GSP should address data gaps (shallow monitoring wells, stream gages, and nested/clustered wells) to improve ISW mapping in future GSPs.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA19	Based on the presented information, domestic well uses are considered under URs and for the development of water level MOs and MTs, but DAC members are not explicitly considered. More detail and specifics regarding DAC members, including those that rely on smaller community drinking water systems, not only domestic wells, is necessary to demonstrate that these beneficial users were adequately considered.	The District has engaged in stakeholder engagement through out the development of the GSP, as documented in the GSP.
Clean Water Action	CWA20	The information about impacts on domestic wells presented in Appendix D is presented as an average depth. The draft GSP should include more detailed information about the potential impacts on sensitive drinking water users, such as 1) where the likely impacted wells are located, 2) what communities are most affected (including DACs), 3) an estimate of the size of the population that relies on these domestic wells, or 4) if the creation of a new or expanded community water system could address some or all of the population affected by the loss of domestic wells.	Noted
Clean Water Action	CWA21	Undesirable results are not clearly identified in the plan. Instead an "undesirable results watch area" is created when 51% of identified representative monitoring sites exceed minimum threshold criteria and when multiple such watch areas are identified. However, there is no discussion of how many watch areas would trigger undesirable results, or whether those watch areas would be for the same sustainable management criteria or a mix. This seems to be contrary to the DWR definition of a minimum threshold in CCR § 351(t), which identifies a minimum threshold as "a numeric value for each sustainability indicator used to define undesirable results."	See section 3.2.2 of District GSP and KGA GSP
Clean Water Action	CWA22	The GSP states (page 158): "A minimum threshold for degraded water quality has not been set because historical data used to evaluate groundwater conditions does not indicate lowered water levels, at least at levels observed to date, resulting in degraded water quality. Regardless, groundwater sampling will continue: monitoring sites and parameters were strategically selected to inform on future degradation." The GSP should present a clear and detailed plan for evaluating and monitoring water quality parameters. Specifically, any plan to recharge groundwater must include groundwater quality monitoring, as recharge even with high quality water can mobilize contaminants.	Noted
Clean Water Action	CWA23	The GSP should include GDEs when developing MOs and MTs and whether the MOs and interim milestones will help achieve the sustainability goal as it pertains to environmental beneficial users. The water quality MOs does not consider the water quality needs of GDEs. The GSP should include impacts from degraded water quality on the plant and wildlife communities within GDEs. The GSP should include all potential MOs and MTs impacts on ISWs and GDEs in the analysis.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA24	The GSP should also discuss any potential undesirable results from degradation of water quality that may impact GDEs and freshwater species in the area.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.

Commentor	Ref #	Comment	Response
Clean Water Action	CWA25	For each potential GDE unit with supporting hydrological datasets, the GSP should include: ● Plot and provide hydrological datasets for each GDE. ● Define the baseline period in the hydrologic data. ● Classify GDE units as having high, moderate, or low susceptibility to changes in groundwater. ● Explore cause-and-effect relationships between groundwater changes and GDEs.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA26	The GSP should include 1) an assessment of the nature of potential undesirable results to ISWs and GDEs; 2) recognition of the existence of potential ISWs and GDEs, unless adequate data can be provided to dismiss them, 3) a statement that the aquifers will be managed such that there will be no depletion of ISWs that results in a significant and unreasonable impact to GDEs; and 4) recognition of any data gaps and specific steps to verify the presence or absence of ISWs and GDEs with monitoring wells screened at the appropriate depths.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA27	We recommend that the sustainability goal explicitly include drinking water and nature because they are important beneficial uses of groundwater.	Noted
Clean Water Action	CWA28	The likely benefits and impacts to DAC members by the proposed projects and management actions are not clearly identified in the GSP. A discussion should be added for each project or management action to clearly identify the benefits to DAC drinking water users and potential impacts to the water supply. For all potential impacts, the project/management action should include a clear plan to monitor for, prevent, and/or mitigate against such impacts.	Noted
Clean Water Action	CWA29	For the projects already identified, describe and assess how ISWs and GDEs will benefit or be protected, or what other environmental benefits will accrue. If ISWs will not be adequately protected by those listed, include and describe additional management actions and projects targeted for protecting ISWs.	Noted - District is proposing a management action to evaluate the presense of GDEs and appropropriate monitoring requirements, if needed.
Clean Water Action	CWA30	For projects that construct recharge ponds, the GSP should consider identifying if there is habitat value incorporated into the design and how the recharge ponds can be managed as multiple-benefit projects to benefit environmental users. The GSP should include environmental benefits and multiple benefits as criteria for assessing project priorities. For examples of case studies on how to incorporate environmental benefits into groundwater projects, visit TNC's website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/	Noted
Pat MarchBanks	PM1	In conclusion, I encourage the District to Amend the draft SGMA policy. I request that you be more sensitive and considerate of the future water needs and embrace the value of these important wetlands that are within the District and take proper action to insure their survival.	Noted. Adjusts have been make to the water budget for duck clubs and is reflected in the revised GSP.
Valley Water	VW1	Long-term and sustainable management of California's groundwater basins is important, and Valley Water will encourage the Semitropic GSA's to make efforts towards curbing historic overdraft and other undesirable groundwater impacts in its portion of Kern County. In this regard, Valley Water also recognizes that groundwater bank 'leave behind' (i.e., 10-percent of all stored water provided to Semitropic for their use in local groundwater management), provided by Valley Water and the other banking partners, has proven a positive contribution to local groundwater levels. It is important to Valley Water that existing Semitropic Bank terms and conditions are protected as groundwater managers move forward with the requirements of SGMA. Valley Water will continue to monitor GSP development throughout the DWR review process, and will continue to work with Semitropic regarding annual banking operations. Additionally, as the Semitropic GSA moves forward with SGMA requirements and finalizing the GSP document, Valley Water would appreciate insight or notice from Semitropic on how contemplated actions could directly or indirectly impact the Semitropic Bank	Noted
Shafter-Wasco Irrigation District 7th Standard Annexation Management Area Plan Received Comments			
Rosedale – Rio Bravo Water Storage District (RRBWSD)		Our initial review of the Shafter Wasco & Annex GSP's did not find any statement or commitment to address the respective deficits using a proportional glide path. With that in mind, could you please identify what glide path your respective management areas will be implementing? Specifically, what level of projects and/or demand reduction strategies will be implemented to address any deficit within each of the five (5) year milestones identified within the DWR Guidance Document?	A response was provided to RRBWSD to clarify the location of the requested information in the Annex Area MA Plan (Executive Summary, Section 16, and Table PMA-2).
North of the River Municipal Water District (NORMWD)		We note that throughout the 7th Std Annex Plan, it references the waste water from the NORSD WWTP. In an effort to be concise and frame the comments below, we will not list every section or table that references the waste water; however, we request that you consider our comments directed at every such reference within the 7th Std Annex Plan upon your review of this letter and the plan itself and edit your plan to reflect that NORMWD is the owner of such groundwater and such waste water is being currently utilized via contracts for limited agricultural uses.	The information presented in the SWID Annex Area Management Area (MA) Plan is required by the Sustainable Groundwater Management Act (SGMA) and does not represent any groundwater allocation or determination of water rights or claims. The water budget information presented in Section 8 contains both a physical accounting of water flows in and out of the Management Area consistent with 23 CCR § 354.18 of the GSP regulations and current Waste Discharge Requirements, and a checkbook methodology consistent with the approach developed by the Kern Groundwater Authority GSA in coordination with other basin GSAs. While water rights are not addressed in the MA Plan, we welcome further discussion of water rights from any Basin landowner as part of SGMA implementation.
Southern San Joaquin Municipal Utility District Received Comments			
Farmland Reserve		"Though not specifically addressed, we are concerned that overlying right to extract groundwater will be allocated among all District landowners based on gross acreage…it ignores accepted principles of law intended to more fairly allocate this right among those who have historically used groundwater for irrigation purposes -- and made substantial investments based on that use."	We have discussed adding language to the Water Budget section of the plan to address the fact that there is currently no in-district allocation of water to the landowners. The language in the Projects & Mgmt Actions section, dealing with in-district allocation as a mgmt action has been revised to address this, as well.
Farmland Reserve		"These numbers should not be seen as establishing a precedent or used to establish some legal right. Therefore, a statement emphasizing the above points should be made."	The discussion on native yield in the Water Budget section of the plan addresses this.
Farmland Reserve		"The Chapter could address the possibility of a market for the exchange or transfer of groundwater credits."	At this time, such a discussion is premature. There is no framework within the districts or the basin at large to allow for the exchange or transfer of groundwater credits. We cannot reasonably address this in the plans for 2020 submittal.
Wonderful Orchards		"The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource."	The districts have identifed as a management action the coordinated effort to further refine water budget components in the Kern County Subbasin Model. The Model and water budget components will continue to be refined in coordination with the KGA and other GSAs in the basin.
Wonderful Orchards		"In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield. Currently, the GSP references native yield in terms of acre-feet per gross acre for water budget purposes. Appendix J of the GSP indicates the subbasin native yield is approximately 0.144 acre-feet per acre. It is our understanding that subsequent to the release of the draft GSP, all MAPs and other GSPs in the basin agreed to utilize the same number for their water budgets. If referencing native yield this way is necessary, the GSP should clarify that it is for initial water budget purposes ONLY, is non-precedent setting, and is not a determination of individual landowner allocations or groundwater rights. Alternatively, in the 2020 plans subbasin native yield could be described as a total volume of water and not associated with a given gross or net area."	The discussion on native yield in the Water Budget section of the plan addresses this already. Further emphasis on the "planning budget" role of the Native Yield estimate has been added to the final draft of the plan. In terms of native yield allocation to the parcel/landowner level, there is no framework currently in place to do so. The development the policies and framework necessary to implement such an allocation cannot be completed in time for the 2020 plan submittal.
Wonderful Orchards		"Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next."	At this time, such a discussion is premature. There is no framework within the districts or the basin at large to allow for the exchange or transfer of groundwater credits. We cannot reasonably address this in the plans for 2020 submittal.
Wonderful Orchards		"Wonderful understands that there are instances where it may be necessary to restrict pumping in order to achieve basin-wide sustainability. If this becomes a necessity, the GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity. As with native yield allocations, initial pumping allowances and ramp down schedules should be coordinated across the entire basin so that similarly situated pumpers in the basin are treated equitably regardless of their respective MA (some MAPs include a ramp down schedule for groundwater-only lands and others do not; this is a significant difference and should be reconciled)."	As described in the Management Actions subsection of the Management Area Plan, policies for instituting pumping restrictions have not been developed for the 2020 plan submittal. This has been identifed as a potential management action, should the districts or the basin in general find that it cannot maintain it path to sustainability through the projects and other management actions to be implemented.

Commentor	Ref #	Comment	Response
Wonderful Orchards		"GSAs must develop clear policies and conditions that protect existing investment in groundwater banking and banked inventory, and without interference with existing rules and regulations. GSAs must also find a way to incentivize additional investment, such as on-farm recharge, and allow flexibility for recharged or banked water to be freely transferrable (subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results). Where possible, GSPs should also identify management areas that may benefit from additional recharge and banking. We also recommend that GSAs work to develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.)."	At this time, the framework to offer such incentives does not exist and would require the districts' boards to develop & adopt policy to put it in place. In the time required to prepare the 2020 submittal of the plan, we cannot develop the structure and policy required to implement this. However, this is discussed in the Projects & Mgmt Actions section of the plan and will be considered for implementation after the 2020 plan submittal, when the districts have an opportunity to develop the policy and framework necessary for such programs.
Wonderful Orchards		"GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	A coordinated DMS is already being developed. However, that effort is currently focused at the district/MA level due to the precision of the data being used. Parcel-level allocation is not at this time being done in the subbasin. It is premature to consider a basin-wide water market, as the data available does not allow for that level of allocation to be done. For consideration in the 2020 plan submittal, we do not have adequate time or resources for the development of such a framework.
Westchester Group Investment Mgmt		The GSP references native yield in terms of acre-feet per gross acre for water budget purposes. If referencing it this way is necessary, the GSP should clarify that these calculations are for initial water budget purposes ONLY, are non-precedent setting, and not a determination of individual landowner allocations or groundwater rights. Alternatively, native yield could be described only as a total volume of water and not associated with a given gross or net area. In the event that allocations are to be made at a landowner or property level, WGIM encourages the KGA and other GSAs in the basin to initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations that are coordinated across the basin.	The discussion on native yield in the Water Budget section of the plan addresses this already. More language can be added to emphasize the "planning budget" role of the Native Yield estimate.
Westchester Group Investment Mgmt		GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked water inventory, and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	At this time, the framework to offer such incentives does not exist and would require the districts' boards to develop & adopt policy to put it in place. In the time required to prepare the 2020 submittal of the plan, we cannot develop the structure and policy required to implement this. However, this is discussed in the Projects & Mgmt Actions section of the plan and will be considered for implementation after the 2020 plan submittal.
Westchester Group Investment Mgmt		GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater. The DMS should also include, or be capable of interfacing with, a groundwater market platform that allows for individual users to conduct transactions. Markets will be most effective if there is confidence in the accuracy of the measurements taken, consistency in the data sources relied upon, and flexibility to allow for transactions across the basin. For instance, GSAs using remote sensing to calculate crop evapotranspiration ("ET") as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower provided information to be included into the ET calculation and calibration. Additionally, GSAs should establish criteria and procedures to address any apparent inaccuracies in the ET calculations (e.g., if calculated ET is greater than applied water and precipitation).	A coordinated DMS is already being developed. However, that effort is currently focused at the district/MA level due to the precision of the data being used. Parcel-level allocation is not at this time being done in the subbasin. It is premature to consider a basin-wide water market, as the data available does not allow for that level of allocation to be done. For consideration in the 2020 plan submittal, we do not have adequate time or resources for the development of such a framework.
Westchester Group Investment Mgmt		"WGIM supports use of efficient and accurate systems to determine groundwater use. GSAs using remote sensing to calculate crop ET as a measurement of consumptive use of groundwater should develop methodologies and quality assurance elements to allow for grower-provided information to be included into the ET calculation and calibration. These methodologies should be developed in consultation with the vendor providing ET data to ensure it is applicable and useful in creating the best available data set. Additionally, GSAs and/or MAs should establish criteria and procedures to address apparent inaccuracies in the ET calculations. An obvious use of the procedure would be in instances where the grower can demonstrate that applied water, plus precipitation, is less than the calculated ET. In these instances, and subject to any requirements established by the GSA, the grower's use of groundwater should be reduced to the applied water total as the ET calculation should not be greater than applied water."	This is already included in the Projects and Management Actions section and is part of the larger action of refining data for the calculation of Water Budget components in future plan updates.
Leadership Council		"The Draft GSP is incomplete and must include additional information for the public to evaluate the GSP. The Draft GSP omits critical data regarding the consideration of drinking water impacts on disadvantaged communities and protected groups, sustainable management criteria that consider all beneficial users, and projects and management actions that address significant and unreasonable impacts to beneficial users."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with the statement, as the information that Leadership Council claims is missing from the GSP is actually included in the management area plans, as appropriate to each respective management area.
Leadership Council		"The KGA is responsible for the disproportionate and disparate impacts that its policies and activities will have on disadvantaged communities belonging to protected groups."	This comment is directed to the KGA GSP and will be addressed by KGA. While the KGA is the GSA entity submitting the plan on behalf of its members, the JPA forming the KGA is such that each member is responsible for the implementation of SGMA within their respective plan areas. The KGA GSP and its management area plans were developed in consideration of all beneficial uses of water and the beneficial users of the groundwater in the subbasin.
Leadership Council		"The Coordination Agreement does not "explain how the plans, implemented together, satisfy the requirements of the Act."	This comment is directed to the KGA GSP and will be addressed by KGA.
Leadership Council		"The GSP was not crafted in a way that adequately considered the input of disadvantaged communities, either at the GSA level or the member agency level."	This comment is directed to the KGA GSP and will be addressed by KGA, pertaining to the KGA level engagement. With respect to the member level engagement, SGMA leaves the manner and frequency of public outreach and engagement to the discretion of the GSA. As described in the introduction of the management area plan, SSJMUD holds monthly publicly-noticed meetings which serve as an opportunity for members of the public to provide feedback to the districts regarding the plan's development and implementation. Furthermore, the districts were active participants in the KGA-level outreach activities as well as hosts of their own workshops, which were publicly-noticed, and coordination with the cities of Delano and McFarland on the development of the plan.
Leadership Council		"The Kern Subbasin Undesirable Results do not comply with existing law."	The definitions for undesirable results were developed in coordination with the other GSAs and take into consideration "significant and unreasonable" impacts to the groundwater which affect all beneficial users. Such beneficial uses include agriculture, domestic, and municipal & industrial.
Leadership Council		"It is not clear what the impacts from reaching this undesirable result will be on beneficial users, and instead seems to be an arbitrary determination of what is "significant and unreasonable."	The impact analysis performed by the GSAs in the subbasin contributed to the development of the undesirable results for declining groundwater level.
Leadership Council		"Like the proposed definition of undesirable results for groundwater levels, the proposed definition of undesirable results for degraded water quality are 'when the minimum threshold for when the minimum threshold for groundwater levels are exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the Subbasin (as measured by each management area)."	The comment letter cites an incorrect definition. The definition for the undesirable result for water quality is "when the minimum threshold for a groundwater quality constituent of concern is exceeded in at least three (3) adjacent management areas that represent at least 15% of the Subbasin or greater than 30% of the designated monitoring points within the Subbasin."
Leadership Council		"The GSP's minimum thresholds and measurable objectives were not established in a way that considered the interests of beneficial users including domestic well owners and disadvantaged communities."	The KGA GSP outlines the methods used by its members to establish the Sustainable Management Criteria (SMCs) within their respective plan areas. For the SSJMUD management plan area, projected groundwater levels based on recent historical hydrology were used to analyze the impact to known agricultural, domestic, and municipal wells. While impacts were identified at the minimum thresholds in some management areas, these impacts were determined to not meet the definition of "significant and unreasonable".
Leadership Council		"As in the case of groundwater levels, it is clear that the GSA has not considered the potential impact on drinking water users, in particular disadvantaged communities who are less able to afford solutions to treat contaminated drinking water."	As with the groundwater level SMCs, the KGA GSP outlines the methods used by its members to establish the Sustainable Management Criteria (SMCs) within their respective plan areas. Based on the analysis in the Basin Setting subsection on existing water quality conditions, it was deemed appropriate to use groundwater levels as a proxy for water quality, in addition to water quality and water level measurement at the representative monitoring sites.
Leadership Council		"GSAs must monitor impacts to groundwater for drinking water beneficial users,54 including disadvantaged communities on domestic wells, and must avoid disparate impacts on protected groups pursuant to state law. The GSA's monitoring network does not comply with SGMA regulations, and fails to capture drinking water impacts to disadvantaged communities and domestic wells[…] To ensure the monitoring network adequately captures impacts to all beneficial users, the GSA must ensure the following: Ensure the proposed monitoring network contains representative monitoring wells in or near all disadvantaged communities and clusters of domestic wells in the GSA area; Ensure that monitoring wells and representative monitoring wells in or near disadvantaged communities and clusters of domestic wells are able to measure the groundwater levels at the depth at which the drinking water wells are screened; Explicitly describe any future representative monitoring wells and identify the proposed locations. When assessing the monitoring network data gaps, the GSP must prioritize installing new monitoring wells in locations where disadvantaged communities, small water systems, and domestic well users reside."	The coordinated basin-wide monitoring network was developed using the DWR BMP on SGMA Monitoring Networks, which discusses recommended well density and what constitutes a "SGMA compliant" representative monitoring site. It also allows for (and encourages) GSAs to use existing monitoring programs already in place for collecting data on the Sustainability Indicators identified in a basin's plan. Domestic wells are typically shallow or in the first occurence of groundwater and are, therefore, not representative of the groundwater conditions of the basin as a whole. Further, there are existing programs with which domestic wells and community wells must comply. These have been identified in the Basin Setting and Monitoring Network sections in the discussions of existing programs. In areas of the basin where the well density does not meet the standards used in the plan, proposed well locations have been identified. Per discussion and comments from the cities of Delano and McFarland, four additional wells have been added to the monitoring network within the SSJMUD management area.

Commentor	Ref #	Comment	Response
Leadership Council		The groundwater quality monitoring network does not adequately capture impacts on drinking water users.[…] First, measuring for Arsenic (as in Arvin-Edison WSD) only once a year does not provide the member agency or the GSA with frequent enough information to respond to severe drinking water contamination in a reasonable amount of time. If the member agency's management actions, projects, or decisions to let groundwater decline increase drinking water contamination for families in the management area, the member agency could go a whole year without detecting these impacts. […] Second, only measuring for compliance with arsenic measurable objectives and minimum thresholds does not protect against increases in other contaminants that exist in other parts of the management area (boron, nitrates, TDS, 123-TCP, iron and manganese). These contaminants could extend, move or increase due to groundwater management activities and pumping patterns. […] However, avoiding monitoring contaminated areas defeats the purpose of groundwater quality monitoring under SGMA, which is to measure the concentration and spread of contaminant plumes to ensure that groundwater management activities and pumping do not aggravate existing contamination.	The monitoring of water quality for the basin will include the use of data from existing programs (e.g. Title 22, ILRP, CV-SALTS) and sampling coincidental with groundwater level measurements at the representative monitoring sites. As such, the water quality data collected through SGMA will be more frequent than once a year. The constituents of concern to be tested in the water quality sampling at representative monitoring sites vary between the management areas. Therefore, the constituents analyzed will differ according to the management area plan. The selection of representative monitoring sites discouraged the use of wells with existing MCL exceedances because of the nature of the definition of undesirable results for degradation of groundwater quality. The occurence of an increase in concentration for constituents of concern in a representative monitoring site will, by virtue of it being a representative site, will be indicative of the migration of existing contamination.
Leadership Council		The projects and management actions set forth in the Draft GSP do not demonstrate a path towards achieving sustainability goals in the plan, and do not adequately account for the needs of disadvantaged communities pertaining to protected groups under state law. The GSA has allowed member agencies like the Arvin-Edison WSD to use a "glidepath" approach that increases surface water and groundwater recharge before demand reduction measures are implemented. This places the majority of the plan's success on surface water resources, which are variable and may not be able to be procured. The GSA should instead ensure that member agencies implement demand reduction strategies from the beginning so that groundwater levels do not plummet. A critical problem with the structure of the GSA is that member agencies cannot share the cost or responsibility for critical GSA-wide projects. Many more financially powerful agricultural and water banking member agencies could and should be part of a strategy to protect drinking water resources in the GSA area, especially given that they use much larger quantities of groundwater and their continued pumping will likely lead to dry wells and groundwater contamination issues for the most vulnerable homes in the GSA area.	The KGA and its members have the authority under SGMA to prioritize projects and management actions, as they see fit, to demonstrate that the basin can reach sustainability by 2040. The prioritization of projects to increase imported supply for use by districts' customers or for water banking projects protects groundwater for beneficial use in the basin by facilitiating in-lieu banking (where surface water is used whenever it is available, replacing groundwater pumping) or by maintaining groundwater levels through replenishment with banking projects. These projects do not run contrary to the mandate to protect groundwater quality. In fact, with groundwater levels as a proxy Sustainability Indicator for water quality, these projects achieve both the maintenance of groundwater levels and water quality. The agricultural and water banking agencies in the basin, as the customers paying for water deliveries and funding projects via land assessments in their respective districts, can and should be a beneficiary of the projects which they are funding.
Leadership Council		"The KGA GSA should implement or incentivize recharge basins or other recharge activities throughout the subbasin wherever DACs and clusters of domestic wells exist. The GSA should encourage these kinds of recharge projects with health co-benefits over on-farm recharge, which is likely lead to accelerate groundwater contamination."	It is at the discretion of the KGA's member agencies to identify projects to fund, as well as opportunities to collaborate with DACs. SSJMUD is already collaborating with the City of Delano to develop in-district recharge facilities which will be made available to the city when there is capacity available. Conversely, Delano will allow the district to utilize an existing stormwater catch basin as a spreading basin, when it is not in use to manage storm flows. Future projects and management actions which deal specifically with the DACs and domestic wells may be considered for subsequent updates to the GSP and management area plans.
Leadership Council		"For areas vulnerable to declining water levels and loss of production capacity, the KGA GSA should adopt management actions that establish geographical protection areas (buffer zones) by establishing bans, pumping limitations or community-specific management areas around disadvantaged communities and domestic well clusters."	The development of these buffer zones would be predicated on the development of a shallow-zone specific monitoring network and SMCs. As discussed in the response to the Monitoring Network comments, these shallow zones are not representative of groundwater conditions throughout the basin. Furthermore, the framework necessary to implement pumping restrictions or bans does not exist within the KGA or its members. Such policy would not be developed or implemented in time for the 2020 submittal.
Leadership Council		"We also strongly recommend against a groundwater market in the KGA GSA area. The GSP includes potential groundwater market and trading programs. Groundwater markets raise concerns from the perspective of domestic well users and disadvantaged communities."	At this time, the framework to establish a groundwater market in the basin does not exist. The policies and framework that would need to be developed by the KGA and its members is too complex to be completed in time for consideration in the 2020 submittal. Additionally, any groundwater market developed by the KGA or its members would have to comply with SGMA (i.e. prevent localized impacts to the Sustainability Indicators in its implementation).
Leadership Council		"The GSAs should implement and incentivize multi-benefit projects such as wetlands restoration or stormwater drainage ponds that would eliminate flooding and increase groundwater recharge in disadvantaged communities."	It is at the discretion of the KGA's member agencies to identify projects to fund. Future projects and management actions which provide benefits beyond SGMA may be considered for subsequent updates to the GSP and management area plans.
Leadership Council		"Although there are multiple short-term funding sources to leverage for SGMA-related projects, the GSA's and member agencies' operating budgets must be a reliable source of funding over the long-term of GSP implementation, and the GSA and member agencies cannot rely on grant funding for long-term projects and programs that benefit disadvantaged communities. The GSA and member agencies must be responsible for addressing the drinking water issues caused by their policy decisions and activities."	It is entirely appropriate that the KGA's members, when working in collaboration with DACs on a project to benefit groundwater quantity and quality in the basin, seek funding for such projects through state and federal grant funding programs. Grant funding, where the districts are eligible, is applied for to defray the cost of projects (which often far exceed the award amount). The remaining costs of projects and management actions are to be funded with the districts' operating budgets or through special assessments.
Leadership Council		"the Draft GSP allows continued overdraft above the safe yield of the basin, such that drinking water wells (especially domestic wells) will continue to go dry, infringing on the rights of overlying users of groundwater. The GSP must be revised to protect the rights of residents of disadvantaged communities and/or low-income households who hold water rights to groundwater."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with the statement, as the KGA GSP and its included management area plans have demonstrated, the combination of projects, management actions, and established SMCs will bring the basin into balance with its groundwater management by 2040.
Leadership Council		"The reasonable and beneficial use doctrine applies here given the negative impacts of the Draft GSP on groundwater supply and quality, which are likely to unreasonably interfere with the use of groundwater for drinking water and other domestic uses. As the Draft GSP authorizes waste and unreasonable use, it conflicts with the reasonable and beneficial use doctrine and the California Constitution."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with Leadership Council's statement regarding the plan's authorization of "waste and unreasonable use". The beneficial uses of water in the basin include other uses beyond domestic consumption. As such, it is entirely appropriate and in the authority of the GSAs that impacts to groundwater be analyzed in consideration of all beneficial uses identified in the plan.
Leadership Council		"The "public trust" doctrine has recently been applied to groundwater where there is a hydrological connection between the groundwater and a navigable surface water body. In Environmental Law Foundation , the court held that the public trust doctrine applies to "the extraction of groundwater that adversely impacts a navigable waterway" and that the government has an affirmative duty to take the public trust into account in the planning and allocation of water resources. The court also specifically held that SGMA does not supplant the requirements of the common law public trust doctrine. In contrast to these requirements, the Draft GSP does not consider impacts on public trust resources, or attempt to avoid insofar as feasible harm to the public's interest in those resources."	This comment is directed to the KGA GSP and will be addressed by KGA. We respectfully disagree with Leadership Council's position in that the Basin Setting of the KGA GSP and its management area plans have adequately demonstrated that there are no interconnected surface waters in the basin and that this is the existing condition of the basin.
Tejon-Castac Water District Received Comments			
No Comments Received			
West Kern Water District Received Comments			
Chevron	Letter-1	Include discussion of aquifer lower boundary as above top of the oil/exempt water-bearing zones below oil	Suggested text added to section
Chevron	Letter-2	Provide additional support for removing industrial/non-domestic GW wells in Western Management as "de mimimis extractors" (ES-1.4, Figures 1-13 - 1-15)	Added text to 5-year update to re-evaluate wells in the western management area to review potential uses that may not be de-minimus.
Chevron	Letter-3	In the Western Management Area, how will we evaluate subsidence and undesirable results?	Added text to 5-year update to re-evaluate potential for water use to affect sustainability indicators in the area
Chevron	Comment-1	Same as comment "Letter-2"	Added text to 5-year update to re-evaluate wells in the western management area to review potential uses that may not be de-minimus.
Chevron	Comment-2	Language change: The GSA area includes the WKWD boundary and adjacent oilfield properties owned by corporate and independent operators "*as well as Stateland and privately owned parcels*"	Suggested text added to section
Chevron	Comment-3	Per WC Section 10721(e), "De minimus extractor" defined as "a person who extracts, for domestic purposes, two acre-feet or less per year."	Added text to refine description without relying on 'de minimis'.
Chevron	Comment-4	An aquifer may not be suitable for beneficial use if: a) is not currently serving as a source of drinking water, b) it has commercially producible minerals or hydrocarbons, or c) it is not expected to supply a public water system and d) is either economically or technologically infeasible for treatment or recovery now or in the future for domestic, agricultural, or industrial use. The purpose of this plan is not to exempt aquifers, nor is it to define the maximum depth or water quality concentration at which groundwater is economically recoverable or treatable now or in the future. However, by applying the criteria of 40 CFR §144.3 and 40 CFR §146.4, active oil and gas aquifers and exempted aquifers are not a part of the groundwater basin for beneficial use. The following whichever is shallowest, are the lateral and vertical boundaries of the groundwater Subbasin: a) depth to producible minerals or hydrocarbons or primacy productive limits, b) depth to exempted aquifers, c) depth that makes recovery of water for domestic, commercial, or industrial purposes no longer economically or technologically feasible, or d) the depth at which groundwater cannot now or in the future serve as a source of drinking water. For example, water bearing zones below the depth to producible hydrocarbons are not within the groundwater basin; likewise, water bearing zones below an exempted aquifer are not within the groundwater basin	Suggested text added to section
Chevron	Comment-5	Language change: Separate GW quality and production "There is little or no groundwater production in the Western Management Area, so water quality in that area is not discussed in this section."	GSA's can only manage groundwater quality through groundwater pumping management. If there is no significant groundwater pumping in a region, the GSA cannot effectively manage groundwater quality in that area.

Commentor	Ref #	Comment	Response
Chevron	Comment-6a	1. Consider moving Section 4.9 to this section. 2. Consistent with DWR Water Budget BMP, consider adding language to discuss how this is monitored and how you reach the conclusion it is not impacting GW quality. 3. Please provide reference for "one of the world's largest" or delete it.	Copied content from 4.9 to this section. Removed reference to largeness. Added consideration of coordination with oil producers on an approach to enhance water quality monitoring and reporting of oil produced water to ensure no degradation of groundwater quality due to oil pumping occurs under SGMA.
Chevron	Comment-6b	How have we reached the conclusion that oil production has not impacted groundwater quality?	
Chevron	Comment-6c	Cite "world's largest petroluem producing areas"	
Chevron	Comment-7	Language change: change "produced water ponds" to "percolation ponds"	changed
Chevron	Comment-8	Addition of 4 paragraphs written by Chevron (see comments on pg 120 of draft)	Added majority of text recommended
Chevron	Comment-9	Include a bibliography for cited references	Present in Section 3.9 and at the end of each section
Chevron	Comment-10	change title to "Treated Produced Water"	changed
Chevron	Comment-11	Change "Water produced water" to "treated produced water"	changed
Chevron	Comment-12	Change "evaporation ponds" to "percolation ponds"	changed
Chevron	Comment-13	Consider deleting sentence or providing data to support it: "This water is supplemented by water purchased from WKWD, which indicates that very little water is disposed of, since purchasing fresh water is more expensive than recycling water."	removed
Chevron	Comment-14	Replace last sentence with "Oilfield produced water is sourced from beneath the bottom of the basin."	changed
Chevron	Comment-15	To subsidence bullet point, add "and critical infrastructure."	changed
Chevron	Comment-16	Consider deleting "Most extensometers are located too far from the GSA area to provide useful insight into subsidence trends."	changed
Chevron	Comment-17	Add "critical" before "infrastructure"	changed
Chevron	Comment-18	Replace "large pipelines" with "large-scale linear infrastructure"	changed
TNC	General - 0	Use TNC's online tools and resources and TNC's checklist to better include nature in the GSP (see specifics below)	NCCAG Dataset was used to identify potential locations of GDEs
TNC	General - 1	Actively engage with environmental stakeholders	Outreach is addressed in KGA's Umbrella GSP
TNC	General - 2	For GDEs, utilize: NC Dataset on DWR website, GDE Pulse, and CNDDB	added text stating these uses are not known to exist in the plan area
TNC	General - 3	Potential effects on environmental beneficial users: Use Attachment C for list of freshwater species in Kern County Subbasin	Identification of endangered species is not a requirement under GSP regulations
TNC	General - 4a	ISWs and GDEs are not adequately identified	corrected 2.10.2 to ephemeral, added that there are no known flow requirements
TNC	General - 4b	connectivity of ISWs and GDEs with the Shallow Zone and Upper Unconfined Aquifer was not adequately characterized	There are no GDEs in management areas with non-deminimis pumping (North, South, and Lake Management Areas).
TNC	General - 4c	the plans to address GDE/ISW data gaps in the Subbasin characterization and monitoring networks need to be expanded	There are no GDEs in management areas with non-deminimis pumping (North, South, and Lake Management Areas).
TNC	General - 4d	set sustainable management criteria for all identified and potential GDEs/ISWs	There are no GDEs in management areas with non-deminimis pumping (North, South, and Lake Management Areas).
TNC	Checklist - 1	Describe any environmental beneficial uses and users of groundwater (i.e. GDEs, managed wetlands, fisheries, recreation, etc.) and species with protected status	Beneficial uses are addressed in KGA's Umbrella GSP
TNC	Checklist - 2	Describe current/planned habitat and flow requirements for streams in WKWD (or state if there are none)	Identification of endangered species is not a requirement under GSP regulations, added text about no flow requirements on WKWD GSA area's ephemeral streams
TNC	Checklist - 3	provide a description of monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs in the GSP plan area that could be affected by groundwater withdrawals	There are no GDEs in management areas with non-deminimis pumping (North, South, and Lake Management Areas).
TNC	Checklist - 4	review and discuss the potential groundwater reliance of critical species in the Subbasin. Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.	Identification of endangered species is not a requirement under GSP regulations, added text about no flow requirements on WKWD GSA area's ephemeral streams
TNC	Checklist - 5	Please include a discussion of monitoring programs related to GDEs and sensitive or protected habitats.	There are no GDEs in management areas with non-deminimis pumping (North, South, and Lake Management Areas).
TNC	Checklist - 6	Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, aquatic resources riparian vegetation, and other potential GDEs and ISWs, if applicable.	the General Plan does not have policies regarding the protection of wetlands, aquatic resources riparian vegetation, and other potential GDEs and ISWs,
TNC	Checklist - 7	Please identify all relevant HCPs and NCCPs within the WKWD GSP area, and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.	no HCPs or NCCPs are known to cover the managed management areas (North, South, Lake) of the WKWD GSP
TNC	Checklist - 8	discuss that future well permitting and well construction must be coordinated with the GSP to assure achievement of the sustainability goals, how the process incorporates protection of GDEs, and how well permitting programs must consider the potential impacts of GW extractor on public trust resources	Well permitting is performed by Kern County, not the WKWD GSA
TNC	Checklist - 9	Define the bottom of the boundary from deepest extraction wells. If data unavailable, describe this in data gaps.	Bottom of basin was updated to match KGA's Umbrella GSP
TNC	Checklist - 10	Show cross sections (that could show shallow/perched GW) - (Same as Umbrella comment on Section 2.2.1.6)	Cross Sections for the Kern County Subbasin are included in the KGA's Umbrella GSP
TNC	Checklist - 11	Describe shallow aquifers including interconnections with surface water, vertical GW gradients, and interactions with GDEs and state presence of perched aquifers (or identify as data gap if unavailable)	Section 2.8 contains aquifer information
TNC	Checklist - 12	Support statement of lack of springs with data, or identify as data gap	Figure 2-5 shows locations of springs
TNC	Checklist - 13	Potentially add gaps listed in comments above	None present
TNC	Checklist - 14	Provide more supporting data on why no ISWs are present (including Buena Vista Aquatic Recreational Area and ponds in north central)	Buena Vista Aquatic Recreational Area is not in the WKWD GSA Area. The ponds in the North and South Management areas are managed recharge ponds that are not naturally occuring - effects of pumping in these areas and recharge from the recharge ponds is explained in the water budgets section.
TNC	Checklist - 15	further describe the conceptual understanding of shallow groundwater and stream interactions with the aquifer system at different locations, including perched and unconfined aquifers and GDEs	The only non-managed surface water in the GSA are ephemeral streams, which are not managed, and are in the Western Management Area, which does not have pumping.
TNC	Checklist - 16	elaborate on the relationship between surface water in the BVARA and adjacent shallow and deeper groundwater levels. Since this is identified as a data gap, please describe how and where additional observations (shallow monitoring wells, nested / clustered wells, etc.) along surface water features can be used to reconcile this data gap	the BVARA is outside WKWD GSA, and therefore is not managable by the WKWD GSA. Identifying monitoring in the Lake Management area is identified as a part of implementation
TNC	Checklist - 17	Use GW contours (including seasonal and interannual fluctuations) to verify whether a connection between GDEs and GW exist	Groundwater Contours are provided in the KGA's Umbrella GSP
TNC	Checklist - 18	Expand GDE analysis of using GW data (using their attachments D and E) to verify is ecosystem decline/recovery is correlated with GWLs	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)
TNC	Checklist - 19	Provide more data-driven analysis of GDE identification, or identify in data gaps and resolve inconsistency in Umbrella GSP on pg 92	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)
TNC	Checklist - 20	Decribe nature and characteristics of GDEs including: GW conditions near GDEs, ecological inventory and ranking, and nearby endangered freshwater species	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)
TNC	Checklist - 21	Disaggregate ET of native and riparian vegetation further, or identify as data gap	ET is discussed in the KGA's Umbrella GSP
TNC	Checklist - 22	We recommend an ecological inventory (see Appendix III, Worksheet 2 of the GDE Guidance) for all potential GDEs that includes vegetation or habitat types and rank the GDEs as having a high, moderate or low value. Explain how each rank was characterized. Please identify whether any endangered or threatened freshwater species of animals and plants, or areas with critical habitat were found in or near any of the GDEs. Some organisms rely on uplands and wetlands during different stages of their lifecycle.	GSP Regulations do not require these activities.
TNC	Checklist - 23	Please expand the sustainability goal to describe that all beneficial users and GW users will be protected from undesirable results, including GDEs	Sustainability Goal and undesirable results are a coordinated statement that was developed by the KGA, and cannot be changed at this level
TNC	Checklist - 24	Include a statement about any intention to address pre-SGMA impacts	2015 is used as a key function of the identification of minimum thresholds. This is described in Section 7
TNC	Checklist - 25	Address how water quality would affect GDEs	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)
TNC	Checklist - 26	For each sustainable management criteria, discuss whether minimum threshold/measureable objectives/interim milestones addresses the environment's sustainability goal	Sustainability Goal and undesirable results are a coordinated statement that was developed by the KGA, and cannot be changed at this level
TNC	Checklist - 27	List GDEs as one of the beneficial users of GW and add “possible adverse impacts to potential GDEs and ISWs” to the list of potential undesirable results	Sustainability Goal and undesirable results are a coordinated statement that was developed by the KGA, and cannot be changed at this level
TNC	Checklist - 28	Correlate trends/spatial patterns of GDEs with GWL trends. Note adverse trends and/or data gaps. (Specific details of trends listed in Appendix B pf 17)	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)
TNC	Checklist - 29	Monitoring networks should include proposing (i) new wells to be located in the Western Management Area to be properly screened to analyze GDEs and (ii) stream gages in areas where there is potential for GDEs/ISWs	The western management area does not have significant pumping, and is not managed beyond monitoring for new groundwater use. Will consider monitoring should groundwater use increase in the 5 year update.
TNC	Checklist - 30	Modify monitoring network to include water quality impacts on GDEs	Water quality is monitored by proxy, this covers GDEs (which are not present in the 3 managed management areas)
TNC	Checklist - 31	Resolve inconsisency stating "all streams are ephemeral" vs both "ephemeral and perennnial streams"	corrected 2.10.2 to ephemeral, added that there are no known flow requirements
TNC	Checklist - 32	For proposed projects, state how ISWs/GDEs could benefit or list additional management actions to protect GDEs/ISWs and how adverse impacts will be evaluated and mitigated	NCCAG Dataset showed that there were no potential GDE's in the 3 managed management areas (North, South, Lake)

Commentor	Ref #	Comment	Response
Westside District Water Authority Received Comments			
Wonderful Orchards	WO-1	It is imperative that the final GSP properly address the quantification of native yield. The GSPs, management areas, and other planning units in the subbasin should utilize coordinated methods of determining supply sources for native yield, quantifying the native yield, and accounting for it in individual MAPs' water budgets. Unless there are specific hydrogeologic conditions that differentiate certain portions of the basin from the basin at-large (such as a fault line or barrier to groundwater flow), native yield should be considered a basin-wide resource.	Comment noted. Please see Section 2.7-Water Budget of the WDWA Chapter GSP
Wonderful Orchards	WO-2	In addition to a clear definition of native yield, the final GSP must also include a thorough description of how to calculate the allocation of native yield.	Comment noted. Please see Section 2.7-Water Budget of the WDWA Chapter GSP
Wonderful Orchards	WO-3	In addition, GSAs should initiate a stakeholder-driven process to develop a methodology for establishing landowner-level allocations of native yield that are coordinated across the subbasin.	Comment noted. The WDWA will participate in KGA discussions related to all Subbasin issues.
Wonderful Orchards	WO-4	Markets are essential in facilitating the highest and best use of a limited resource and in giving landowners the most flexibility to minimize the economic impacts of pumping restrictions. To enable a market that works for all landowners in the subbasin, it is imperative that all pumpers know exactly how much marketable water they have available for use or transfer. Unless it is deemed necessary to prevent undesirable results, markets should not place geographic or jurisdictional limitations on transfers within a subbasin and should allow for carry-over of allocations from one year to the next.	Comment noted. The WDWA will participate in KGA discussions related to all Subbasin issues.
Wonderful Orchards	WO-5	GSAs or MAs should implement pumping restrictions when supported by the best available data and appropriate analytical tools. Furthermore, if possible, pumping should be ramped down gradually over the implementation period to avoid a sudden disruption in economic activity	Comment noted. The WDWA will participate in KGA discussions related to all Subbasin issues.
Wonderful Orchards	WO-6	GSAs and MAs must develop clear and understandable policies and conditions that protect existing groundwater banking and banked inventory and allow them to continue operating as they have been under their existing rules and regulations without interference. They must also incentivize additional investment, such as on-farm recharge by providing pumping credits and allow flexibility for recharged or banked water to be freely transferrable subject to the rights and conditions of use associated with the source water and the avoidance of undesirable results. They should develop incentives for public or private investment to expand recharge and banking capacity, as these facilities help to achieve multiple benefits (e.g., habitat, water quality, drinking water, etc.).	Comment noted. The WDWA will participate in KGA discussions related to all Subbasin issues.
Wonderful Orchards	WO-7	GSAs should develop a coordinated basin-wide data management system ("DMS") that is capable of tracking groundwater and surface water use at the landowner, field, or parcel level, and a coordinated methodology for measuring landowner-level use of groundwater.	Comment noted. The WDWA will participate in KGA discussions related to all Subbasin issues. Please also see Setion 6.0- GSP Reporting and Periodic Evaluations of the WDWA Chapter GSP
Department of Fish and Wildlife	DWF-4	The Plan Area narrative does not identify Department-owned lands. … The Department also owns the Buttonwillow, *Lokern*, and Bakersfield Cactus Ecological Reserves, which are also located within the GSP area.	The WDWA has included text and a figure describing DWF lands (Lokern Ecological Resreve) witihn its management area.
Wheeler Ridge-Maricopa Water Storage District Received Comments			
Chevron	1	An aquifer may not be suitable for beneficial use if: a) is not currently serving as a source of drinking water, b) it has commercially producible minerals or hydrocarbons, or c) it is not expected to supply a public water system and d) is either economically or technologically infeasible for treatment or recovery now or in the future for domestic, agricultural, or industrial use. The purpose of this plan is not to exempt aquifers, nor is it to define the maximum depth or water quality concentration at which groundwater is economically recoverable or treatable now or in the future. However, by applying the criteria of 40 CFR §144.3 and 40 CFR §146.4, active oil and gas aquifers and exempted aquifers are not a part of the groundwater basin for beneficial use. As described above, the following, whichever is shallowest, are the lateral and vertical boundaries of the groundwater Subbasin: a) depth to producible minerals or hydrocarbons or primacy productive limits, b) depth to exempted aquifers, c) depth that makes recovery of water for domestic, commercial, or industrial purposes no longer economically or technologically feasible, or d) the depth at which groundwater cannot now or in the future serve as a source of drinking water. For example, water bearing zones below the depth to producible hydrocarbons are not within the groundwater basin; likewise, water bearing zones below an exempted aquifer are not within the groundwater basin.	Section 7.1.3 was modified to clarify that in areas where pools in oil fields in the MA Plan area are at shallower depths than the base of fresh water, the bottom of the basin is defined as the shallower depth of fresh water from the DOGGR oil field data.
Farmland Reserve	1	**Allocation of Groundwater Rights.** Though not specifically addressed, we are concerned that the overlying right to extract groundwater will be allocated among all District landowners based on gross acreage. While this is a simple approach to what can be a complex issue, it ignores accepted principles of law intended to more fairly allocate this right among those who have historically used groundwater for irrigation purposes-and made substantial investments based on that use. We wish to at least see identification of this issue in the Chapter and an acknowledgment that it will not be decided now. If the District determines that the issue is broader, then we leave it to the District to address it at the Umbrella GSP level. Any implication that the District has decided to allocate the overlying groundwater rights based simply on gross acreage could invite some to pursue premature legal action to challenge the District's conclusion, which might not be necessary depending on the success of the proposed actions in the Chapter. While this issue certainly affects our interests, we are equally concerned about avoiding unnecessary legal challenges made by others and the instability that would bring to the sub-basin.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see Section 9.1.3). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that the "native yield" is for planning purposes only and not a determination of actual legal ground water rights.*** • Implementation of P/MAs, including actions to further refine issues related to allocations of groundwater, is described in Section 18.2. • See KGA response to this comment for further information.
Farmland Reserve	2	**Native Yield.** The Chapter identifies a coordinated estimated native yield of 0.15-.0.30 acre feet per acre across the KGA. We understand and acknowledge that some number needed to be identified for Water Budget and planning purposes and support the use of these numbers for such purposes. However, these numbers should not be seen as establishing a precedent or used to establish some legal right. Therefore, a statement emphasizing the above points should be made - the planning purpose nature of these numbers and not establishing legal precedent. Additionally, in coordinating with other members of the KGA under the Umbrella GSP, the District should push for a consistent native yield and related methodology across the sub-basin. We understand that this can be a politically charged process, but we are confident the District can provide support for a consistent approach, which will enable a more stable sub-basin.	• "Native yield", as defined in the Coordinated Water Budget, is applied to all lands in the basin uniformly (see **Section 9.1.3**). • ***Section 9.1.3 was added to clarify the intended purpose of the water budget, and includes a statement that the "native yield" is for planning purposes only and not a determination of actual legal ground water rights.*** • Implementation of P/MAs, including actions to further refine issues related to allocations of groundwater, is described in **Section 18.2**. • See KGA response to this comment for further information.
Farmland Reserve	3	**Groundwater Market.** This issue might be premature at this point. However, the Chapter could address the possibility of a market for the exchange or transfer of groundwater credits. If a market system were contemplated, we would encourage such a system to be as flexible as possible (within the requirements of SGMA, the Chapter and the Umbrella GSP) to facilitate the needs of farmers with lands in different areas of the sub-basin and those with the ability to store surface water underground. Again, this might be premature at this time, but a mention of the District's position to support a flexible groundwater market could help move the discussion forward once the Umbrella GSP is submitted to the Department of Water Resources and agencies begin the implementation process.	• The MA Plan includes in its portfolio of P/MAs a management action to evaluate and potentially implement a groundwater marketing and trading system (see **Section 17.2.2**). • As described in **Section 18.2**, implementation of P/MAs, including the potential establishment of a market-based system, will include performance of any appropriate further studies and analysis, including engineering, economic/financial, and/or legal, as appropriate. • See KGA response to this comment for further information.