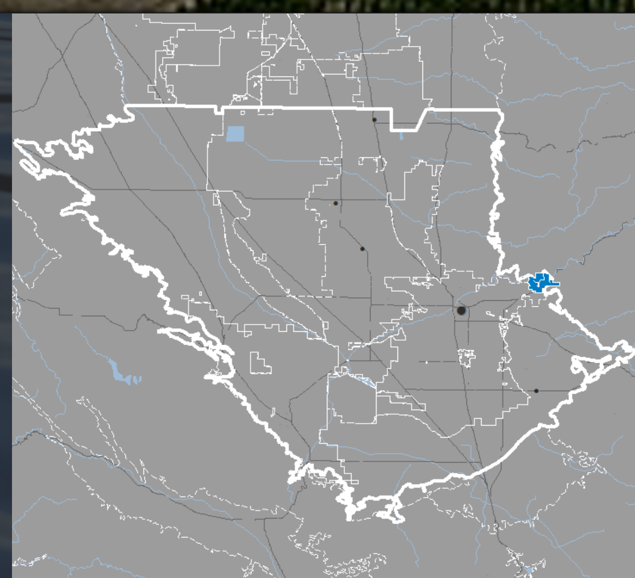
Groundwater Sustainability Plan

Olcese Groundwater Sustainability Agency
Kern County Subbasin

Prepared for

Olcese Groundwater Sustainability Agency

July 2022



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To: Mr. Paul Gosselin, Deputy Director
California Department of Water Resources
Sustainable Groundwater Management Office

From: Jeff Siemens, Olcese GSA

Date: July 27, 2022

Re: Submittal of Amended Olcese Groundwater Sustainability Plan (GSP) for Certain Lands Overlying the Kern County Subbasin

The Olcese Groundwater Sustainability Agency (GSA) is pleased to submit this amended Olcese Groundwater Sustainability Plan (GSP) to the Department of Water Resources (DWR) for continued evaluation pursuant to the Sustainable Groundwater Management Act (SGMA) and implementing regulations (*see* Water Code § 10733.4, 23 Cal. Code Regs. § 355.2). The Olcese GSP is one of six groundwater sustainability plans (GSP) coordinated under the Kern County Subbasin Coordination Agreement (Basin Coordination Agreement) that cover the Kern County Subbasin, Basin Number 5-022.14, DWR Bulletin 118 (Basin), pursuant to Water Code § 10727 (Kern Basin Plan).

This amended Olcese GSP has been prepared to address the deficiencies identified in the "Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin" issued by DWR on January 28, 2022 (Incomplete Determination). With these changes, the Olcese GSA is confident that implementation of the amended Olcese GSP, along with the multiple coordinated GSPs that cover the Kern Subbasin, "are together likely to achieve the sustainability goal for the [Kern] basin." Water Code § 10733.

I. Development of the amended Olcese GSP

Under SGMA's planning deadlines, the Basin was required to be managed under one or more GSPs by January 31, 2020. The several Basin GSAs timely submitted five GSPs (KGA GSP, Kern River GSP, Buena Vista GSP, Olcese GSP, and Henry Miller GSP), coordinated under the Basin Coordination Agreement, to DWR in January 2020.

DWR undertook evaluation of the Kern Basin Plan pursuant to Water Code § 10733.4(d), and on January 28, 2022, issued the Incomplete Determination. DWR found the "[Kern Basin] Plan is incomplete pursuant to Section 355.2(e)(2) of the GSP Regulations," and identified deficiencies for the Basin GSAs to address in advance of resubmission of the Kern Basin Plan for further DWR evaluation by July 27, 2022. Incomplete Determination, p. 1.

The Olcese GSA has undertaken significant technical work, in coordination with the other Basin GSAs, to implement the corrective actions recommended in the Incomplete Determination, as highlighted below and summarized in **Section 1** of the Olcese GSP. The Olcese GSA also continues to participate in ongoing, Basin-wide studies that will inform their annual reporting and first periodic assessment of the GSP anticipated to occur in 2025.

The governing board for the Olcese GSA approved adoption of the amended Olcese GSP, following a public hearing held on 18 July 2022.

II. <u>Coordinated response to the Incomplete Determination</u>

The Olcese GSA has prepared the amended Olcese GSP to be responsive to the issues identified by DWR in the Incomplete Determination.

Some of the modifications pertain to the Olcese GSA's subscription to recently established Basin-wide goals and standards to improve overall Basin coordination. The Olcese GSA has also modified the sustainable management criteria and management actions established in the Olcese GSP to ensure sustainable groundwater management within the plan area and to contribute to the achievement of the Basin-wide Sustainability Goal.

The Olcese GSA recognizes that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended Olcese GSP. However, as this amended Olcese GSP does not constitute an update to an approved GSP (*see* 23 Cal. Code Regs. § 356.4), but rather a response to the Incomplete Determination intended to secure initial plan approval from DWR, those additional data are not incorporated herein, with minor exceptions as noted. Instead, those data will be included in the upcoming periodic evaluation.

We highlight below the Olcese GSA's specific modifications to the Olcese GSP, based on coordination with the other Basin GSAs. These modifications are also summarized in **Section 1** of the Olcese GSP and described in detail throughout the plan.

<u>Deficiency #1 – The [Basin] GSPs Do Not Establish Undesirable Results that are Consistent for the Entire Subbasin</u>

DWR found that the Kern Basin Plan did not include a Basin-wide definition of undesirable results that consistently described conditions throughout the Basin that would be considered significant and unreasonable. Incomplete Determination, Staff Report, p. 13. It identified three components to this deficiency: (1) failure to explain "the specific effects, occurring throughout the Subbasin, that when significant and unreasonable, would be undesirable results"; (2) inconsistent approaches "to define the management-area-specific undesirable results"; and (3) "incomplete descriptions of the conditions under which an undesirable would occur …." *Id.* at 14-15.

<u>Corrective Action 1.</u> The Olcese GSA coordinated with the other Basin GSAs to revise Appendix 3 of the Basin Coordination Agreement to consistently define undesirable results for the entire Basin. In addition, the Olcese GSA:

- Updated Local Undesirable Results Criteria (i.e., triggers) for each applicable Sustainability Indicator to be consistent with the updated Basin-wide definitions.

- Clearly identified Beneficial Users for each applicable Sustainability Indicator in the Undesirable Results section (see **Section 13**).

<u>Deficiency #2 – The [Basin] 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</u>

DWR expressed general concern regarding the individual GSPs' disparate approaches to developing minimum thresholds for chronic groundwater lowering and, in some cases, identified specific deficiencies in the approaches used for individual management areas. Incomplete Determination, Staff Report, pp. 18-19. DWR also found that the GSPs had not adequately described "the relationship between minimum thresholds for a given sustainability indicator (in this case, chronic lowering of groundwater levels) and the other sustainability indicators, degradation of water quality in particular." *Id.* at 19.

<u>Corrective Action 2.</u> The DWR determination letter did not recommend any corrective actions at this time related to the Olcese GSP definition of groundwater level minimum thresholds, and therefore no changes to the groundwater level minimum thresholds were made.

<u>Deficiency #3 – The [Basin] Plan's Land Subsidence Sustainable Management Criteria Do Not Satisfy the Requirements of SGMA and the GSP Regulations</u>

DWR found that the Kern Basin Plan did not establish a Basin-wide approach to developing sustainable management criteria for land subsidence that satisfied the requirements of SGMA and the GSP Regulations, despite "evidence of subsidence occurring throughout the Subbasin." Incomplete Determination, Staff Report, p. 38. The corrective action recommended by DWR stated the following, in part:

> The Subbasin GSAs should coordinate and collectively satisfy the requirements of SGMA and the GSP Regulations to develop the sustainable management criteria for land subsidence. The GSPs should document the conditions for undesirable results for which the GSAs are trying to avoid, supported by their understanding of land uses and critical infrastructure in the Subbasin and the amount of subsidence that would substantially interfere with those uses. The revised Plan, and component GSPs and management areas, 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. *Id.* at 38-39.

<u>Corrective Action 3</u>. The Olcese GSA participated in Basin-wide efforts to address Deficiency #3. They also undertook significant technical work to review and update the sustainable management criteria for land subsidence within the Olcese GSA Area in a manner that relies on best available data and is consistent with the Basin-wide approach. These efforts are reflected in the following modifications to the Olcese GSP:

- Revised the description of subsidence in the Groundwater Conditions (GWC) section to clarify the existence of critical infrastructure in the Olcese GSA Area (see **Section 8.5**).

- Added **Figure GWC-5** showing the major infrastructure within the Basin as identified by the Basin GSAs. As shown on **Figure GWC-5**, no Regional Critical Infrastructure is located within the Olcese GSA Area.
- Added a new **Appendix F** containing information on ground surface elevations at surveyed benchmarks within the Olcese GSA Area, showing negligible inelastic subsidence over the period 2000 through 2017.
- Updated **Figure GWC-4** that shows the Olcese GSA Area relative to the Interferometric Synthetic Aperture Radar (InSAR) data that represents total vertical ground surface displacement; the updated figure covers the period June 2015 to April 2022. As shown on **Figure GWC-4**, both historical and recent subsidence data indicate there has been negligible inelastic subsidence within the Olcese GSA Area.
- Defined sustainable management criteria for Land Subsidence based on consideration of beneficial uses/users and the basin-wide coordinated definitions of Undesirable Results (see **Sections 13.5, 14.5**, and **15.5**).
- Defined a monitoring network for land subsidence (see **Table MN-1** and **Figure MN-1**).

<u>**Additional Revisions**</u>

The Olcese GSA made additional revisions to the Olcese GSP to improve consistency and clarity, including the following:

- Revised the Sustainability Goal consistent with the Basin-wide revision thereto.
- Described the drilling of a new well by the Anne Sippi Clinic to serve as a back-up to the Canyon View Well.
- Added description of progress towards the implementation of the planned Projects and Management Actions.
- Added **Table SMC-1** to summarize current conditions with respect to established sustainable management criteria and to demonstrate that continued proactive sustainable management of groundwater is occurring in the Olcese GSA Area.

In addition to the above specific revisions to portions of the Olcese GSP, the Olcese GSA has participated in the coordinated efforts by all Kern Subbasin GSAs, to address the DWR's overarching comment regarding its perception of fragmented approaches taken by the various GSPs. These efforts have resulted in updates to the Kern County Subbasin Coordination Agreement (see **Appendix J**).

III. <u>Conclusion</u>

SGMA requires that the Basin be sustainably managed by 2040. The Olcese GSP has been developed to achieve this sustainability goal for the Basin in compliance with SGMA and the GSP Regulations, and the Olcese GSA is committed to moving forward with implementation of the plan, in coordination with other Basin GSAs, to demonstrate measurable progress toward that goal.

Groundwater Sustainability Plan

Olcese Groundwater Sustainability Agency

Kern County Subbasin

Prepared by:

EKI Environment & Water, Inc.

for:

Olcese Water District

July 2022

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List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
AWMP	Agricultural Water Management Plan
BMP	Best Management Practice
C2VSim	California Central Valley Groundwater-Surface Water Simulation Model
CASGEM	California Statewide Groundwater Elevation Monitoring
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
CIMIS	California Irrigation Management Information System
COCs	constituents of concern
CWC	California Water Code
DAC	Disadvantaged Community
DEW	Drier with Extreme Warming
DOGGR	Division of Oil, Gas and Geothermal Resources
DWR	Department of Water Resources
DTSC	Department of Toxic Substances Control
EC	electrical conductance
EKI	EKI Environment & Water, Inc.
ET	evapotranspiration
ETo	reference evapotranspiration
ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sea level
ft/day	feet per day
ft/ft	feet per foot
ft/yr	feet/year
ft2/day	feet squared per day
GAMA	Groundwater Ambient Monitoring and Assessment
GDEs	groundwater dependent ecosystems
GIS	Geographic Information System
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	hydrogeologic conceptual model
in	inches
in/hr	inches per hour
in/mo	inches per month
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Integrated Regional Water Management Plan

ITRC	Irrigation Training & Research Center
JPL	Jet Propulsion Laboratory
KGA	Kern Groundwater Authority
km	kilometer
MCL	Maximum Contaminant Level
METRIC	Mapping EvapoTranspiration at high Resolution with Internalized Calibration
mg/L	milligrams per liter
NASA	National Aeronautics and Space Administration
NCCAG	Natural Communities Commonly Associated with Groundwater
ND	not detect
NRCS	Natural Resources Conservation Service
PLSS	Public Land Survey System
SCEP	Stakeholder Communication and Engagement Plan
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SSURGO	Soil Survey Geographic Database
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TNC	The Nature Conservancy
ug	micrograms
ug/L	micrograms per liter
UIC	Underground Injection Control
umhos/cm	microsiemens per centimeter
uS/cm	microSiemens per centimeter
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WMW	Wetter with Moderate Warming
WY	Water Year

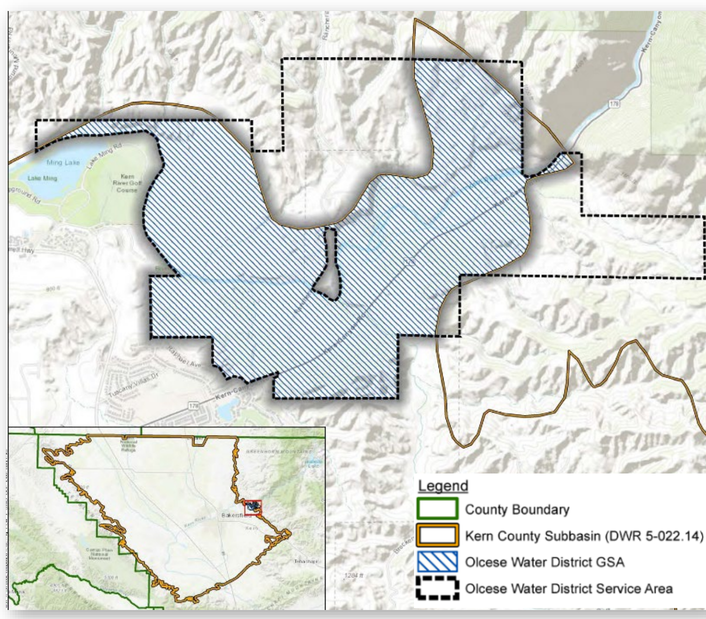
EXECUTIVE SUMMARY

☑ 23 CCR § 354.4(a)

ES.1. Introduction

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) whose primary purpose is to achieve and/or maintain sustainability within the state's high and medium priority groundwater basins. Key tenets of SGMA are the concept of local control, use of best available data and science, and active engagement and consideration of all beneficial uses and users of groundwater. As such, SGMA empowers certain local agencies to Groundwater Sustainability Agencies whose purpose is to manage basins sustainably through the development and implementation of Groundwater Sustainability Plans (GSPs). Under SGMA, GSPs are required to contain certain elements, the most significant of which include: a Sustainability Goal; a description of the GSP "Plan Area"; a description of the Basin Setting, including the hydrogeologic conceptual model, historical and current groundwater conditions, and a water budget; locally-defined sustainability criteria; monitoring networks and protocols for tracking the sustainability indicators; and a description of projects and/or management actions that will be implemented to achieve or maintain sustainability.

SGMA also requires a significant element of stakeholder outreach to ensure that all beneficial uses and users of groundwater are given the opportunity to provide input into the GSP development and implementation process.



Olcese Groundwater Sustainability Agency Area

This GSP has been prepared by the Olcese GSA which is the GSA for the portion of the Kern County Subbasin of the San Joaquin Valley Groundwater Basin (Department of Water Resources [DWR] Basin No. 5-022.14, referred to herein as the "Kern Subbasin" or "Basin") that underlies the Olcese Water District ("OWD" or "District"). The area that is covered by this GSP is referred to herein as the "Olcese Groundwater Sustainability Agency Area" or "Olcese GSA Area" and is located in the eastern portion of the Kern Subbasin. The Kern Subbasin is one of 21 basins and subbasins identified by the DWR as being critically overdrafted, a designation that triggers an accelerated timetable for GSP development by 2020 and achievement of sustainability by 2040.

As of June 2022, a total of 14 GSAs, including the Olcese GSA, have been formed within the Kern Subbasin and a total of six GSPs have been prepared by these various GSAs. This Olcese GSP has been developed in coordination with the other GSPs for the Kern Subbasin to meet SGMA regulatory requirements[1] while reflecting the unique hydrogeologic conditions within the Olcese GSA Area and preserving local control over water resources. Pursuant to the SGMA GSP submittal deadline, the Olcese GSP was originally submitted to DWR in January 2020; this amended Olcese GSP is in response to DWR's 28 January 2022 letter entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*. Together, the Kern Subbasin GSPs provide a path to maintain the long-term sustainability of locally managed groundwater resources now and into the future.

ES.2. Sustainability Goal

The Basin-wide Sustainability Goal adopted by all Basin GSAs, is as follows:

> "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 and beyond
> - 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 uses for municipal and domestic drinking water supply wells"

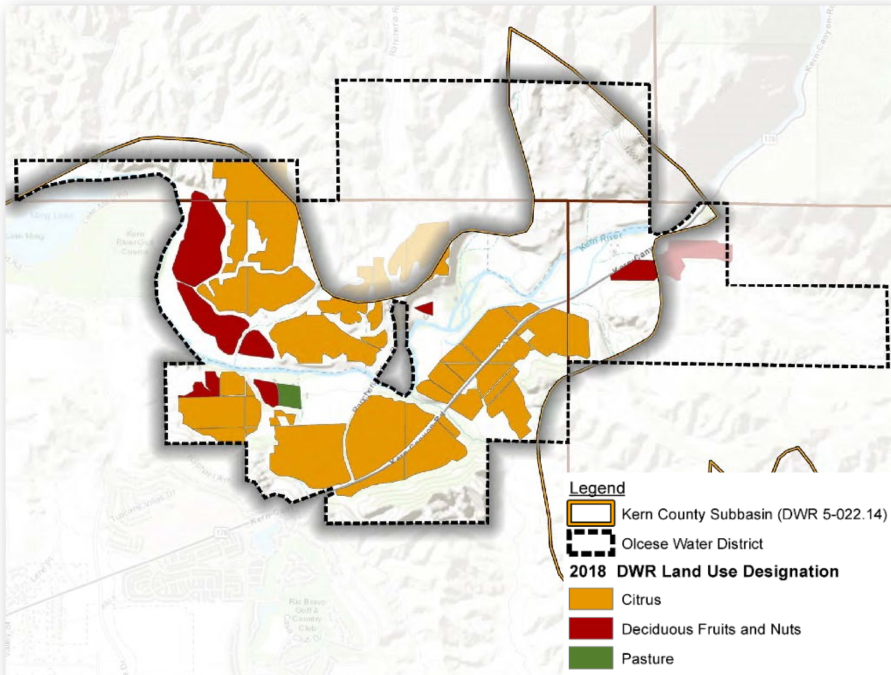
The Olcese GSA has developed a local sustainability goal for the Olcese GSA Area which is consistent with and in addition to the above Basin-wide sustainability goal being adopted by all GSAs in the Kern Subbasin. The Olcese GSA's local sustainability goal is as follows:

> "to maintain an economically-viable groundwater resource that supports the current and future beneficial uses of groundwater by utilizing the area's groundwater resources within the local sustainable yield. Long-term groundwater sustainability will be evaluated and maintained in compliance with locally-defined sustainability criteria, including through active monitoring and the conjunctive use of groundwater and Kern River surface water supplies."

[1] Regulations for GSP development are contained within Title 23 of the California Code of Regulations (CCR) Division 2 Chapter 1.5 Subchapter 2.

ES.3. Plan Area

The Olcese GSA Area covers approximately 3,206 acres in the eastern portion of the Kern Subbasin. Located at the southern end of the state's Central Valley, the Kern Subbasin is the largest groundwater basin in the state and is bordered on the north by the Tulare Lake Subbasin, the Tule Subbasin, and the Kettleman Plain Subbasin and on the south by the White Wolf Subbasin. The Olcese GSA Area is bounded on the north and east sides by either the OWD boundary or the Kern Subbasin extent. The Kern Gorge Fault bounds the Olcese GSA Area (and the Kern Subbasin) on a small portion of the northeast side. To the south and west, the Olcese GSA Area boundary coincides with the District's administrative boundary.



2018 Land Use (same in 2022)

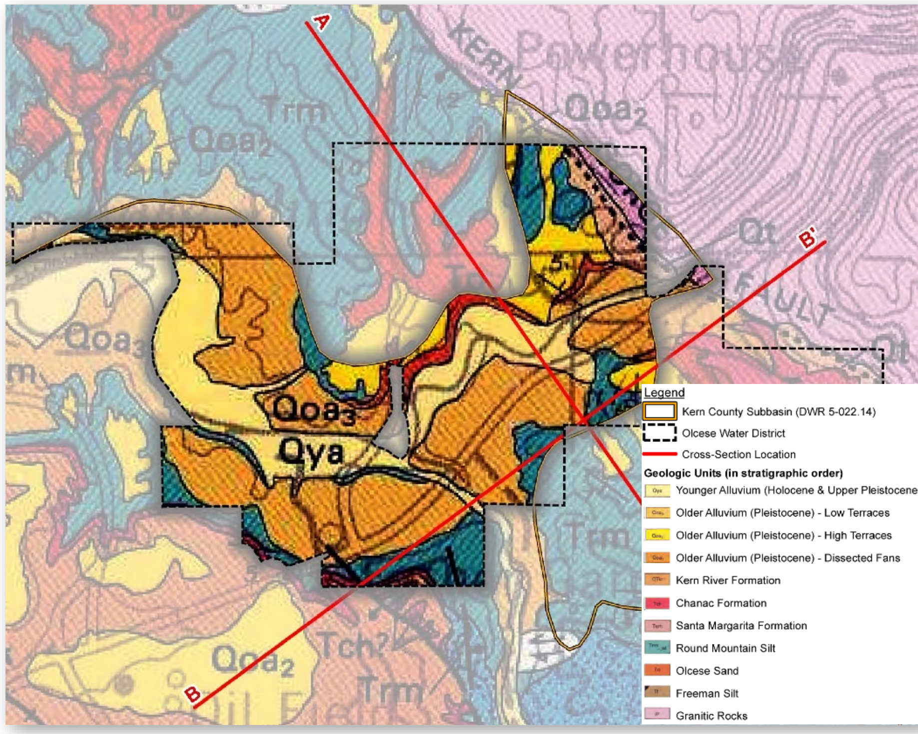
Approximately 1,200 acres within the Olcese GSA Area are irrigated and used for agricultural purposes. In 2022 approximately 83% of this area was planted in citrus, 16% in deciduous fruits and nuts, and the remaining 1% in pasture. Total applied water demand for these lands (i.e., in addition to precipitation) is approximately 2,900 acre-feet per year (AFY), which is met primarily by Kern River water, diverted pursuant to a combination of riparian and non-riparian water rights (73%) and by groundwater (27%). Thus, all irrigated lands within the Olcese GSA Area are supplied by a mixture of groundwater and Kern River water. In addition, the Canyon View Ranch well supplies the Anne Sippi Clinic with their raw water supply (about 80 AFY). This is the only known non-agricultural consumption of groundwater in the Olcese GSA Area and, according to U.S. Census Bureau data, there are no Disadvantaged Community Places, Tracts, or Block Groups identified within the Olcese GSA Area.

ES.4. Stakeholder Outreach Efforts

A Stakeholder Communication and Engagement Plan (SCEP) was completed to fulfill notice and communication requirements in order to achieve active engagement and input of the beneficial users of groundwater within the Olcese GSA Area during the development and implementation of this GSP. Public participation has been welcomed throughout the GSP development process. Venues for stakeholder engagement and input have included Stakeholder Workshops and Olcese GSA Board meetings. Other outreach has included the distribution and collection of a Stakeholder Survey and website communication. Olcese GSA representatives have also conducted extensive coordination with other GSAs in the Kern Subbasin.

ES.5. Hydrogeologic Conceptual Model

The Olcese GSA Area is located in the eastern portion of the Kern Subbasin. The Kern Subbasin occupies a large structural trough filled with thick sedimentary deposits of continental and marine origin. The Olcese GSA Area sits atop Miocene age and older sedimentary deposits, overlain by more recently-deposited (Quaternary) alluvial and terrace sediments associated with the Kern River (see figure at right).



Surficial Geology and Cross-Section Locations

The Olcese GSA Area is underlain by two water-bearing units: (1) a shallow and narrow alluvium deposit (referred to herein as the Shallow Alluvium) which is constrained on the sides and bottom by the relatively impermeable Round Mountain Silt, and (2) a deeper aquifer coincident with the Olcese Sand formation (referred to herein as the Olcese Sand Aquifer Unit). The Olcese Sand Aquifer Unit is considered as the "principal aquifer", as it is the only aquifer zone from which significant quantities of groundwater are pumped in this area. To the northeast of the Olcese GSA Area, subsurface inflows to the groundwater system are laterally restricted by the Kern Gorge Fault.

The Olcese GSA Area is essentially a relatively flat alluvial floodplain along the Kern River surrounded by steep-sloping hills/escarpments on its northern, eastern, and southern margins. Soils mostly have average infiltration rates and moderately high runoff potential. The Olcese Sand Aquifer Unit is predominantly recharged by local precipitation where it outcrops at the surface, but likely also receives some limited portion of its recharge from the Kern River and/or the overlying Shallow Alluvium near the very eastern portion of the Basin near the Kern Gorge Fault.

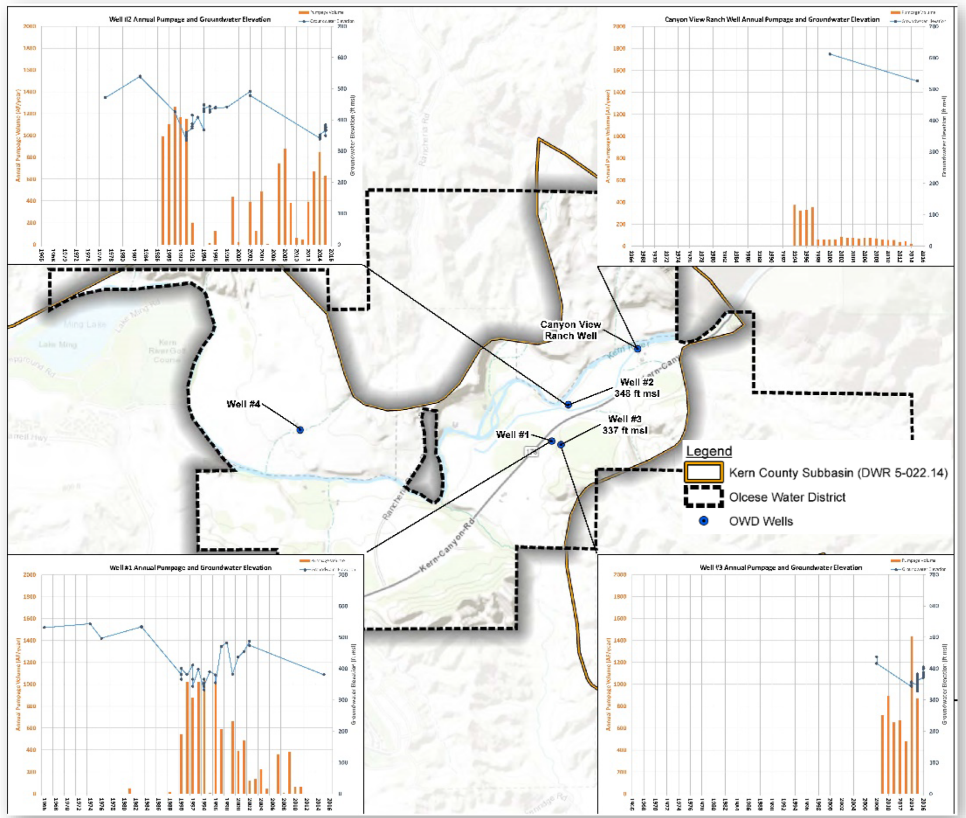
ES.6. Existing Groundwater Conditions

Information on groundwater conditions within the Olcese GSA Area is presented in this GSP with respect to the six "Sustainability Indicators" defined under SGMA, which include the following:

- Chronic lowering of groundwater levels
- Reduction in groundwater storage
- Seawater intrusion

- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

Water Levels: Groundwater elevation data are limited because few wells exist that are screened within the principal aquifer, and these have not always been monitored on a frequent or consistent basis. Based on available data, the groundwater levels appear to have fluctuated over time as both a function of pumping rates and hydrology. However, groundwater levels have been relatively stable since the 1980s when the current regime of land use and pumping began within the Olcese GSA Area, and there is no chronic long-term decline in water levels. Given the location of the recharge areas to the north and northeast, it is likely that groundwater flows generally from the north/northeast, through the Olcese GSA Area to south/southwest.



Groundwater Elevations

Groundwater Storage: Changes in groundwater storage over selected time periods of interest is typically analyzed by comparing water levels at the beginning and the end of several different periods. However, due to lack of available groundwater level data to characterize the seasonal high levels of each year, change in groundwater storage was estimated for this Olcese GSP based on a calibrated water budget spreadsheet model. Annual change in storage is estimated to range between about -1,800 AFY (April 2013 – March 2014) to about +2,960 AFY (April 1998 – March 1999). Generally, annual change in storage is correlated to the water year type (i.e., wet, above normal, below normal, dry, and critical) and groundwater pumping rates.

Water Quality: Groundwater quality varies between wells within the Olcese GSA Area, depending on location and screened zone, but is generally of sufficient quality to meet the beneficial uses of irrigation and domestic supply. Groundwater samples from the Canyon View Ranch well are geochemically and isotopically similar to samples from the Kern River, and indicate generally good water quality, with the exception of elevated iron and manganese concentrations. Groundwater samples from District Wells #2, #3 and #4 are isotopically different from Kern River water (indicating limited connectivity to / recharge from the river) and have some naturally-occurring constituent concentrations (e.g., sulfate and total dissolved solids [TDS]) that are consistently in exceedance of their respective secondary Maximum Contaminant Levels (MCLs), but suitable for meeting irrigation demands. There are no known contamination sites or plumes documented by the State Water Resources Control Board (SWRCB) GeoTracker database within the Olcese GSA Area.

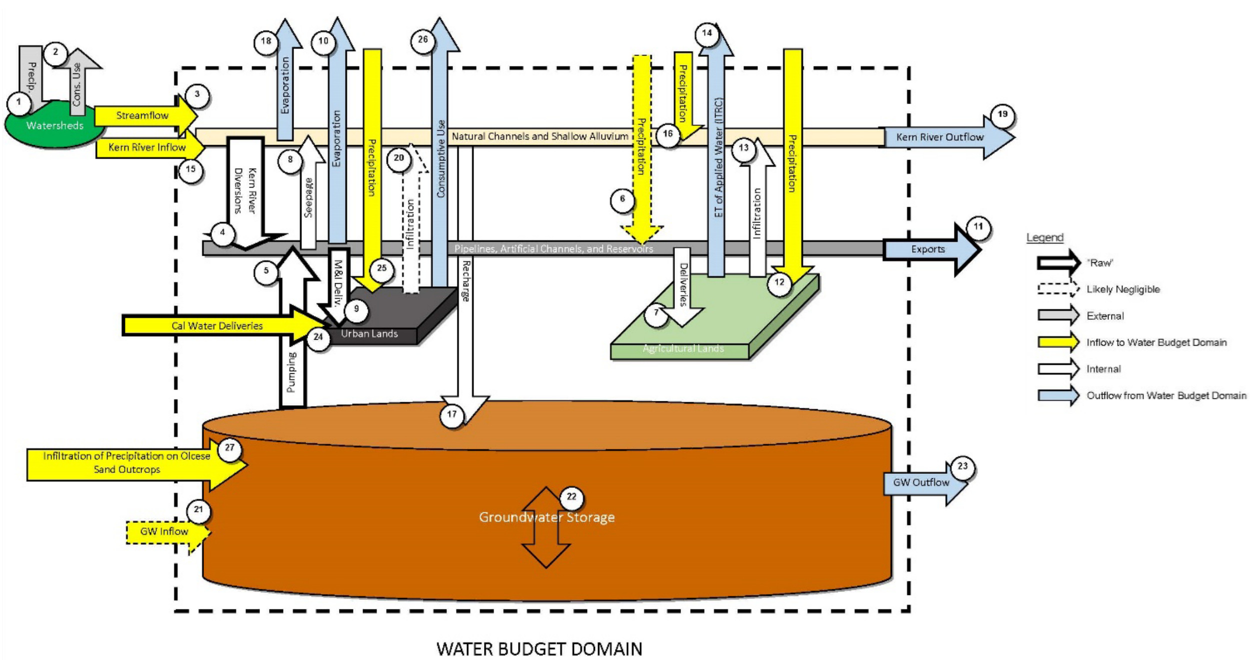
Land Subsidence: Limited data are available regarding land subsidence patterns within the Olcese GSA Area. However, according to the National Aeronautics and Space Administration Jet Propulsion Laboratory Interferometric Synthetic Aperture Radar (NASA JPL InSAR) dataset, the vertical displacement throughout the Olcese GSA between May 2015 and May 2016 was between 0 and -3 inches. Given the inherent uncertainty in InSAR data, the very low magnitude of this range of values (i.e., inclusive of zero) suggests that land subsidence in this area was negligible during this time frame. In addition to the lack of observed recent subsidence, there have been no anecdotal reports of undesirable effects related to land subsidence in the Olcese GSA Area. Highway 178 which passes through the Olcese GSA Area may be considered critical infrastructure but is not known to have been affected by subsidence.

Interconnected Surface Waters: The Olcese Sand Aquifer Unit receives recharge predominantly through infiltration of precipitation on Olcese Sand outcrops that are outside of the Kern Subbasin boundary. A smaller portion of recharge likely derives from deep percolation through the Kern River/Shallow Alluvium. However, the net recharge from the Kern River represents a very small fraction of the average annual Kern River flow and would occur whether or not the District were using local groundwater. This is further evidenced by the confined groundwater elevations measured in District wells, which are greater than 100 feet below the bottom elevation of the riverbed, suggesting that the river is fully disconnected from the deeper groundwater systems of the Olcese Sand Aquifer Unit. Furthermore, because a portion of the District’s applied water ends up recharging the Shallow Alluvium and Kern River, the District’s operations likely constitute a net addition of water to the Kern River that would otherwise not occur. These same lines of evidence also suggest that the District's pumping operations are unlikely to have any detrimental effects on Groundwater Dependent Ecosystems (GDEs) within the Olcese GSA Area.

Seawater Intrusion: The Olcese GSA Area is located far from coastal areas. As a result, seawater intrusion is not considered to be an issue for this area.

ES.7. Water Budget

For the Kern Subbasin as a whole, the Basin GSAs coordinated on two basin-wide water budget approaches, as described in the Coordination Agreement and Appendices thereto: (1) development of a numerical model based on the California Central Valley Groundwater/Surface Water Simulation Model (C2VSim) to estimate the basin-wide water budget, and (2) development of a "checkbook" water accounting method that estimates supply, demand, and shortages for projected Baseline conditions using assumptions related to water rights. These approaches will require additional refinement to increase their relevance to the Olcese GSA Area; for example, the numerical (C2VSim) model grid does not cover the entire Olcese GSA Area, and the "checkbook" approach assumes values for precipitation (0.42 AFY per acre) and native yield (0.15 AFY per acre)[2] that are not necessarily applicable to the local conditions in the Olcese GSA Area as they are based on conditions in a different principal aquifer than that utilized by OWD. Nevertheless, each approach provides valuable information that can support effective groundwater management within the Basin and the Olcese GSA Area. Available/applicable results from these basin-wide approaches are presented herein and show surpluses for the Olcese GSA Area (i.e., a surplus of approximately 552 AFY under projected Baseline conditions per the "checkbook approach" and a surplus of approximately 718 AFY under historical conditions per the numerical model), suggesting the Olcese GSA Area has been sustainable in the past and will remain sustainable in the future as well.



Conceptual Water Budget Components/Linkages

While the numerical model and "checkbook" water accounting approaches are described in the Coordination Agreement and Appendices thereto, the detailed water budget information presented herein for historical, current, and projected conditions is based on the use of a local analytical spreadsheet

[2] The use of acreage-normalized "native yield" values in the "checkbook" accounting approach should not be viewed as an "allocation" of groundwater pumping to lands in the Kern Subbasin, but rather are used to facilitate comparisons to commonly-used agronomic quantities (e.g., crop water demands in AFY/ac).

model developed using local data that quantifies each flow component of the water budget and enforces mass balance principles for each "subdomain" that collectively comprise the water budget domain (see figure above).[3] This approach was warranted given that the regional-scale numerical groundwater flow model used to develop a basin-scale water budget for the Kern Subbasin (i.e., DWR's C2VSim-FG model) does not fully cover the Olcese GSA Area. The local analytical spreadsheet model is the basis for the detailed historical and current water budget information presented herein but is not a determination of water rights.

An estimate of the sustainable yield of the groundwater system underlying the Olcese GSA Area can be made by adding the average annual change in storage to the average annual groundwater extraction. This approach provides a sustainable yield number corresponding to the volume of water that, if pumped over the water budget period of interest, would have resulted in a zero decline in groundwater levels and storage. The sustainable yield estimated by this method is 890 AFY over the 23-year period of Water Year (WY) 1995 – 2017. Because it is based on a calculation of pumping to achieve net zero decrease in groundwater storage, this sustainable yield is defined in such a way as to avoid the occurrence of Undesirable Results for relevant Sustainability Indicators (discussed further below). However, another study conducted in the District estimated a combined sustainable yield of 1,840 AFY. Monitoring will be crucial to track groundwater level trends relative to pumping rates and climate to better understand and refine the sustainable yield estimate.

Water budget information under projected (future) conditions was developed using the local analytical spreadsheet water budget model, with DWR-provided inputs for climate variables (i.e., adjusted precipitation and evapotranspiration) and water supply assumptions (i.e., changes to surface water supplies). The projected water budget assesses the magnitude of the potential water supply deficit under future conditions that would need to be addressed through future Projects and Management Actions (P/MAs) to prevent Undesirable Results and achieve the Sustainability Goal. Five projected water budget scenarios were developed for this analysis: a Baseline Scenario, a 2030 Climate Change Scenario, and three 2070 Climate Change Scenarios ("central tendency", "wetter with moderate warming", and "drier with extreme warming"). The results of this assessment, along with results for the historical and current periods, are summarized in the table below, and indicate relatively small projected changes in storages (i.e., deficits) that can be managed through monitoring and, if needed, future P/MAs to manage supply and demand.

It should be noted that the change in storage estimates based on the local analytical spreadsheet model for the projected Baseline condition, shown in the above table, are conservative when compared to results from the "checkbook" water accounting approach, and are therefore a conservative basis upon which to plan P/MAs. As part of GSP implementation, these numbers will be refined as additional information is developed.

[3] The water budget component of this GSP is provided to comply with SGMA/GSP Emergency Regulations. The water budget, and the data used therein, is believed to be the best and most accurate available. However, it is acknowledged that new, additional, and/or more accurate information/data may be later obtained. Therefore, this water budget, and data in this GSP, may be updated or modified as the Olcese GSA deems necessary and as may be required to avoid Undesirable Results in the Olcese GSA portion of the Kern Subbasin.

Period / Scenario	Basin-wide Numerical Model	Local Analytical Spreadsheet Model	Basin-wide "Checkbook" Water Accounting Approach
Historical Period (WY 1995 – 2014)	718	-47	Not applicable
Current Period (WY 2015)	-416	-369	Not applicable
Projected Period (50 years; 2021 – 2070) Baseline with no Projects	Not available	-25	552
Projected Period (50 years; 2021 – 2070) 2030 Climate Change Conditions (Moderate climate change effects) with no Projects	Not available	-15	Not applicable
Projected Period (50 years; 2021 – 2070) 2070 Climate Change Conditions (central tendency scenario) with no Projects	Not available	-122	Not applicable

ES.8. Sustainable Management Criteria

Sustainable Management Criteria (SMCs) are the metrics by which groundwater sustainability is judged under SGMA. Key terms related to SMCs under SGMA include the following:

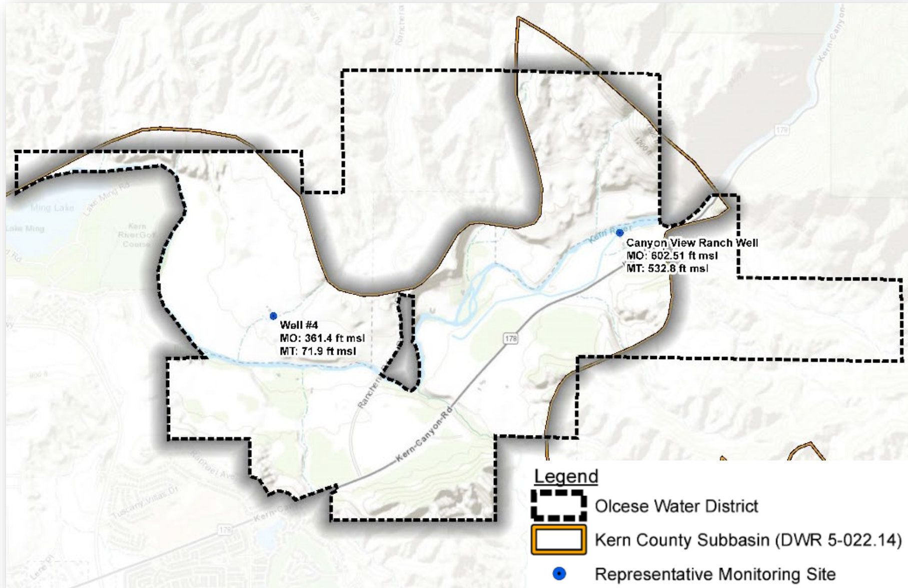
Undesirable Results: Undesirable Results are the significant and unreasonable occurrence of conditions, for any of the six Sustainability Indicators defined under SGMA, that adversely affect groundwater use in the Basin. Definitions of Undesirable Results for the Basin have been developed through a coordinated effort of the Basin GSAs. However, the progressive thinning, dipping, and displacement via faulting of the Olcese Sand Aquifer Unit (i.e., the principal aquifer within the Olcese GSA Area) to the north and southwest serves to bound usable groundwater resources of this unit to within the vicinity of the Olcese GSA Area and limits its connectivity to other principal aquifers in the Kern Subbasin. Therefore, the causes, criteria, and effects of Undesirable Results are described herein to reflect the particular hydrogeologic and groundwater conditions of the Olcese GSA Area.

Minimum Thresholds: Minimum Thresholds (MTs) are the numeric criteria for each Sustainability Indicator that, if exceeded in a locally-defined combination of monitoring sites, may constitute an Undesirable Results for that indicator. Where appropriate, the MTs for the Sustainability Indicators have been set using groundwater levels as a proxy.

Measurable Objectives: Measurable Objectives (MOs) are a specific set of quantifiable goals for the maintenance or improvement of groundwater conditions. MOs use the same units and metrics as the MTs and are thus directly comparable.

Interim Milestones: Interim Milestones are a set of target values representing measurable groundwater conditions in increments of five (5) years over the 20-year statutory deadline for achieving sustainability.

A summary of the approach to developing SMCs within the Olcese GSA Area is presented below.



Minimum Thresholds (MT) and Measurable Objectives (MO) for Chronic Lowering of Groundwater Levels

Chronic Lowering of Groundwater Levels is arguably the most fundamental Sustainability Indicator for the Olcese GSA Area, as it influences several other key Sustainability Indicators, including Reduction of Groundwater Storage and possibly Land Subsidence and Depletions of Interconnected Surface Water. The MTs for Chronic Lowering of Groundwater Levels consider the elevation of the top of well screens for wells within the Olcese Sand Aquifer Unit and general historical groundwater level trends. The MTs are defined as 71.90 feet above mean sea level (ft msl) for Well #4 and 532.80 ft msl for the Canyon View Ranch Well.

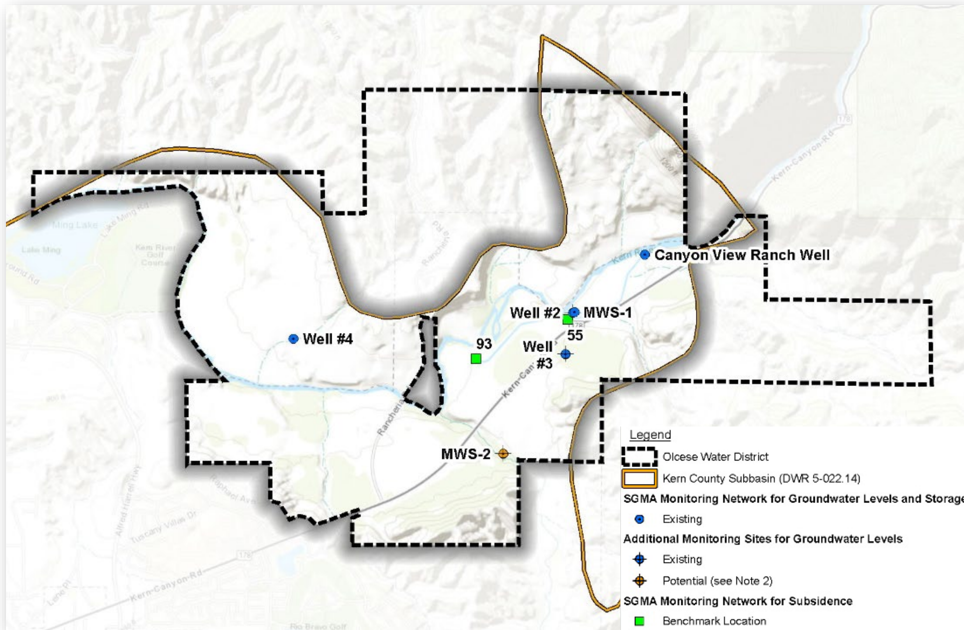
Reduction of Groundwater Storage is closely tied to Chronic Lowering of Groundwater Levels. The MT for Reduction in Groundwater Storage for the Olcese GSA Area is therefore defined as the available volume of "usable storage" above the MT for Chronic Lowering of Groundwater Levels. This volume of usable storage is approximately 7,030 acre-feet (AF).

SMCs for Degraded Water Quality are not defined in the Olcese GSA Area, because there are no observable mechanisms by which water management actions by the Olcese GSA could affect groundwater quality conditions within the Olcese GSA Area. Activities already being undertaken as part of other regulatory compliance efforts will continue during the SGMA implementation timeframe. If a causal nexus between groundwater quality and water management activities is discovered, the criteria for development of Undesirable Results and Minimum Thresholds for Degraded Water Quality will be revisited.

Although there is no indication based on available data that any significant subsidence has occurred in the Olcese GSA Area, or that any critical infrastructure has been affected by land subsidence, the Olcese GSA considers the Olcese Water District canal to be Management Area Critical Infrastructure (in accordance with the coordinated Basin-wide approach to subsidence which defines two categories of critical infrastructure). SMCs for Land Subsidence are developed with consideration of canal capacity, and the relationship between capacity and slope is used to establish an MT for subsidence in terms of a change in the relative elevation difference between two monitoring points located along the canal.

As discussed above, multiple lines of evidence suggest that the principal aquifer is hydraulically separated from the Shallow Alluvium. Therefore, no SMCs for Depletion of Interconnected Surface Water are defined in this GSP. A shallow groundwater monitoring well was installed in 2019 as part of a planned P/MA (discussed further below). This well will be used to further assess the degree of hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and the Shallow Alluvium. If monitoring results indicate a hydraulic connection between the two zones does exist, and that changes to groundwater level conditions in the Olcese Sand Aquifer Unit are likely to have an effect on Shallow Alluvium groundwater levels and interconnected surface water, the criteria for defining Undesirable Results for Depletion of Interconnected Surface Water will be revisited, and MTs will be developed, as appropriate.

ES.9. Monitoring Network



Monitoring Networks for Chronic Lowering of Groundwater Levels and Land Subsidence

The objective of the Olcese GSA Area Monitoring Network is to continue to collect sufficient data to allow for assessment of the Sustainability Indicators relevant to the Olcese GSA Area, and potential impacts to the beneficial uses and users of groundwater. The network consists of three wells: two existing District production wells that are part of the CASGEM Monitoring Network (Well #4 and Canyon View Ranch Well) and a new shallow monitoring well (MWS-1) that was installed in 2019 as part of the Olcese GSA's planned P/MAs to monitor groundwater levels in the Shallow Alluvium. If results from monitoring of well MWS-1 show that a hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium does exist, an additional shallow monitoring well will be installed and monitored. A subsidence monitoring network was established that includes two benchmark survey locations along the District's canal, data from which are used to assess compliance with SMCs for Land Subsidence.

Monitoring data collected will be incorporated into the Olcese GSA's own Data Management System (DMS) for subsequent inclusion in the basin-wide DMS. These data will be used to support coordination efforts within the Kern Subbasin.

ES.10. Projects and Management Actions

Projects and Management Actions are proposed by the Olcese GSA to support achievement of the sustainability goal within the Olcese GSA Area. The primary objective of the P/MAs identified in this Olcese GSP is to improve the monitoring infrastructure in order to refine the understanding of groundwater conditions within the Olcese GSA Area, particularly with respect to potential hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and the Shallow Alluvium which is itself closely connected to surface water and potential GDEs.

Several "non-contingent" projects are planned for implementation upon adoption of this GSP, including:

- installation of a shallow monitoring well (already completed in 2019); and
- conducting a study of the potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium (in progress).

Additional "contingent" projects will be undertaken if indicated necessary by the aforementioned non-contingent projects.

In general, P/MAs being considered for implementation will be discussed during regular Board Meetings, which are open to the public. Additional stakeholder outreach efforts will be conducted prior to and during P/MA implementation, as required by law.

ES.11. GSP Implementation

Key GSP implementation activities that will be performed by the Olcese GSA over the next five (5) years include:

- Monitoring and data collection;
- P/MA implementation;
- Policy development to support GSP implementation, as needed;
- Technical and non-technical coordination with other water management entities in the basin;
- Continued outreach and engagement with stakeholders;
- Annual reporting; and
- Evaluation and updates, as necessary, of the Olcese GSP as part of the required periodic evaluations (i.e., "five-year updates").

ES.12. GSP Implementation Costs and Funding

Costs to implement this GSP can be divided into several groups, as follows:

- Costs of local groundwater management activities;
- Costs associated with participation in basin-wide groundwater management activities; and
- Costs to implement P/MAs, including capital/one-time costs and ongoing costs.

The costs of GSP implementation for Olcese GSA over the period from 2020 through 2024 are estimated at approximately $25,000 per year for local groundwater management activities, $15,000 per year for basin-wide groundwater management activities, and approximately $45,000 to $95,000 for implementation of planned P/MAs. In addition, the periodic GSP evaluation (i.e., "5-year update") is estimated to cost approximately $200,000. Costs beyond 2025 are to-be-determined but will likely be at least as great as the $40,000 per year of recurring costs for local and basin-wide groundwater management activities. The Olcese GSA will likely meet the estimate costs through a combination of contributions from its main landowners, Nickel Family LLC, and grant funding, if available.

ES.13. Conclusion

The passage of SGMA in 2014 ushered in a new era of mandatory groundwater management in California's most intensively used groundwater basins. The law was followed by promulgation of a robust regulatory framework for GSA formation, GSP development, and implementation thereof. The law and regulations emphasize the use of best available science, local control and decision making, and active engagement of affected stakeholders. Because of the breadth and scope of the groundwater sustainability problem in California and the legislative and regulatory response to it, SGMA presents significant challenges both for local implementing agencies and groundwater users alike. Achieving and maintaining sustainability in the face of uncertain future water supply conditions while addressing and balancing the needs of all beneficial uses and groundwater users will require significant effort, creative solutions, and unprecedented collaboration. As described herein, the Olcese GSA is committed to facing these challenges. Based on the available historical and recent data, groundwater conditions within the Olcese GSA Area have been maintained in compliance with (i.e., not exceeding) their respective SMCs, indicating sustainable management and avoidance of Undesirable Results.

INTRODUCTION

1. PURPOSE OF THE GROUNDWATER SUSTAINABILITY PLAN

The purpose of this Olcese Groundwater Sustainability Agency (Olcese GSA) Groundwater Sustainability Plan (GSP) is to, in combination with the other GSPs in the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; “Kern Subbasin” or “Basin”), meet the regulatory requirements set forth in the three-bill legislative package consisting of Assembly Bill (AB) 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA defines sustainable groundwater management as the “management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results”. Undesirable results are defined by SGMA as any of the following effects caused by groundwater conditions occurring throughout the basin:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply;
- Significant and unreasonable reduction of groundwater storage;
- Significant and unreasonable seawater intrusion;
- Significant and unreasonable degraded water quality;
- Significant and unreasonable land subsidence; and/or
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The Kern Subbasin has been identified by the California Department of Water Resources (DWR) as critically overdrafted. The Olcese GSP has been developed in coordination with the other GSPs for the Kern Subbasin to meet SGMA regulatory requirements by the 31 January 2020 deadline for critically-overdrafted basins while reflecting local needs and preserving local control over water resources. The Olcese GSP, in coordination with the other GSPs in the Kern Subbasin, provides a path to achieve and document sustainable groundwater management within 20 years following Plan adoption, and preserves the long-term sustainability of locally managed groundwater resources now and into the future.

The Olcese GSP was originally adopted by the Olcese GSA on 6 January 2020 and submitted to DWR by the 31 January 2020 deadline. This amended Olcese GSP has been prepared for submission to DWR in response to their 28 January 2022 letter entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin* (**Appendix A**). It is recognized that additional, more recent data (i.e., through 2022) are available at the time of preparation of this amended Olcese GSP. However, as this Olcese GSP does not constitute an updated GSP, but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions.

Based on the available historical and recent data, groundwater conditions within the Olcese GSA Area have been maintained in compliance with (i.e., not exceeding) their respective SMCs, indicating sustainable management and avoidance of Undesirable Results. That being said, specific revisions to the

Olcese GSP in response to the DWR determination letter, both to address specific deficiencies of the original Olcese GSP identified in the letter and to improve overall Basin coordination, are summarized below.

Deficiency #1 – The [Basin] GSPs Do Not Establish Undesirable Results that are Consistent for the Entire Subbasin

- Updated Local Undesirable Results Criteria (i.e., triggers) for each applicable Sustainability Indicator to be consistent with the updated Basin-wide definitions.
- Clearly identified Beneficial Users for each applicable Sustainability Indicator in the Undesirable Results section (see **Section 13 *Undesirable Results***).

Deficiency #2 – The [Basin] 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

- The DWR determination letter did not recommend any corrective actions at this time related to the Olcese GSP definition of groundwater level minimum thresholds, and therefore no changes to the groundwater level minimum thresholds were made.

Deficiency #3 – The [Basin] Plan's Land Subsidence Sustainable Management Criteria Do Not Satisfy the Requirements of SGMA and the GSP Regulations

- Revised the description of subsidence in the Groundwater Conditions (GWC) section to clarify the existence of critical infrastructure in the Olcese GSA Area (see **Section 8.5**).
- Added **Figure GWC-5** showing the major infrastructure within the Basin as identified by the Basin GSAs. As shown on **Figure GWC-5**, no Regional Critical Infrastructure is located within the Olcese GSA Area.
- Added a new **Appendix F** containing information on ground surface elevations at surveyed benchmarks within the Olcese GSA Area, showing negligible inelastic subsidence over the period 2000 through 2017.
- Updated **Figure GWC-4** that shows the Olcese GSA Area relative to the Interferometric Synthetic Aperture Radar (InSAR) data that represents total vertical ground surface displacement; the updated figure covers the period June 2015 to April 2022. As shown on **Figure GWC-4**, both historical and recent subsidence data indicate there has been negligible inelastic subsidence within the Olcese GSA Area.
- Defined sustainable management criteria for Land Subsidence based on consideration of beneficial uses/users and the basin-wide coordinated definitions of Undesirable Results (see **Sections 13.5**, **14.5**, and **15.5**).
- Defined a monitoring network for land subsidence (see **Table MN-1** and **Figure MN-1**).

Additional Revisions

- Revised the Sustainability Goal consistent with the Basin-wide revision thereto.
- Described the drilling of a new well by the Anne Sippi Clinic to serve as a back-up to the Canyon View Well.
- Added description of progress towards the implementation of the planned PMAs.

- Added **Table SMC-1** to summarize current conditions with respect to established sustainable management criteria and to demonstrate that continued proactive sustainable management of groundwater is occurring in the Olcese GSA Area.

In addition to the above specific revisions to portions of the Olcese GSP, the Olcese GSA has participated in the coordinated efforts by all Kern Subbasin GSAs, to address the DWR's overarching comment regarding its perception of fragmented approaches taken by the various GSPs. These efforts have resulted in updates to the Kern County Subbasin Coordination Agreement (see **Appendix J**).

2. SUSTAINABILITY GOAL

☑ **23 CCR § 354.24**

The Basin-wide Sustainability Goal adopted by all Basin GSAs, is as follows:

> "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 and beyond
> - 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 uses for municipal and domestic drinking water supply wells"

The Olcese GSA has developed a local sustainability goal for the Olcese GSA Area which is consistent with and in addition to the above Basin-wide sustainability goal being adopted by all GSAs in the Kern Subbasin. The Olcese GSA's local sustainability goal is as follows:

> "to maintain an economically-viable groundwater resource that supports the current and future beneficial uses of groundwater by utilizing the area's groundwater resources within the local sustainable yield. Long-term groundwater sustainability will be evaluated and maintained in compliance with locally-defined sustainability criteria, including through active monitoring and the conjunctive use of groundwater and Kern River surface water supplies."

3. AGENCY INFORMATION

3.1. Name and Mailing Address of the Groundwater Sustainability Agency

☑ 23 CCR § 354.6(a)

The Olcese GSA is the GSA for the portion of the Kern Subbasin that underlies the Olcese Water District (District).

The mailing address for the Olcese GSA is:

P.O. Box 60679
Bakersfield, CA 93386

3.2. Organization and Management Structure of the Groundwater Sustainability Agency

☑ 23 CCR § 354.6(b)

The Olcese GSA was formed by a resolution of the Olcese Water District Board of Directors on 28 November 2016. The Olcese GSA is governed by five Board Members. Information regarding current Olcese GSA Board members can be found on the GSA's website at https://olcesewaterdistrict.org/. Current Olcese GSA Board Members include:

- James L. Nickel – President
- Robert Teagarden
- Brian Grant
- Blaine Hanson
- Jeff Siemens

3.3. Plan Manager

☑ 23 CCR § 354.6(c)

The Plan Manager for the Olcese GSP is Jeff Siemens. Mr. Siemens can be reached at:

Jeff Siemens
Olcese GSA
15701 Hwy 178
Bakersfield, CA 93306

Phone: 661-872-5050

Email: jsiemens@nfllc.net

3.4. Legal Authority of the GSA

☑ **23 CCR § 354.6(d)**

Pursuant to Section 10723 et. Seq. of the California Water Code, the Olcese Water District formed the Olcese GSA and was granted exclusive GSA status for the Plan Area described herein by DWR under SGMA.

3.5. Estimated Cost of Implementing the GSP and the GSA's Approach to Meet Costs

☑ **23 CCR § 354.6(e)**

Information on estimated costs to implement the GSP within the Olcese GSA Area, and the Olcese GSA's plan to meet those costs is provided in **Section 19.2 *Plan Implementation Costs***.

4. GSP ORGANIZATION

This GSP is organized as follows, with the checklist for GSP Submittal included as **Appendix B**:

- Sections 1 through 4 comprise the **Introduction**, including the following sections:
  - Section 1. Purpose of the Groundwater Sustainability Plan
  - Section 2. Sustainability Goal
  - Section 3. Agency Information
  - Section 4. GSP Organization
- Section 5 provides a Description of the Plan Area.
- Sections 6 through 10 present the **Basin Setting**, including the following sections:
  - Section 6. Introduction to Basin Setting
  - Section 7. Hydrogeologic Conceptual Model
  - Section 8. Current and Historical Groundwater Conditions
  - Section 9. Water Budget Information
  - Section 10. Management Areas
- Sections 11 through 16 present the **Sustainable Management Criteria**, including the following sections:
  - Section 11. Introduction to Sustainable Management Criteria
  - Section 12. Sustainability Goal
  - Section 13. Undesirable Results
  - Section 14. Minimum Thresholds
  - Section 15. Measurable Objectives
  - Section 16. Monitoring Network
- Sections 17 and 18 present the **Projects and Management Actions**, including the following sections:
  - Section 17. Introduction to Projects and Management Actions
  - Section 18. Projects and Management Actions
- Sections 19 presents the Plan Implementation
- **References and Technical Studies** are included at the end of this document.
- Supporting information is provided in appendices as follows:
  - Appendix A. DWR Determination Letter on Kern Subbasin GSPs (January 2022)
  - Appendix B. Checklist for GSP Submittal
  - Appendix C. Undistricted Lands Outside of Olcese GSA Area Covered by Olcese GSP

- Appendix D. Stakeholder Communications and Engagement Plan
- Appendix E. Water Quality Trends Analysis
- Appendix F. Benchmark Survey Data along Olcese Water District Canal
- Appendix G. Methods and Data Used in the Water Budget Spreadsheet Model Approach
- Appendix H. CASGEM Monitoring Plan
- Appendix I. Details of Shallow Monitoring Well Installed in 2019
- Appendix J. Kern County Subbasin Coordination Agreement
- Appendix K. Board Resolutions

PLAN AREA

5. DESCRIPTION OF THE PLAN AREA

☑ **23 CCR § 354.8**

This section presents a description of the Olcese Groundwater Sustainability Agency (GSA) Area, subsequently called the “Olcese GSA Area”, and a summary of the relevant jurisdictional boundaries and other key land use features potentially relevant to the sustainable management of groundwater in the Olcese GSA Area. This section also describes the water monitoring programs, water management programs, and general plans relevant to the Olcese GSA Area and their influence on the development and execution of this Groundwater Sustainability Plan (GSP). This amended Olcese GSP was developed as an amended GSP for submission to the California Department of Water Resources (DWR) in response to their 28 January 2022 letter entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*, and has been closely coordinated with the amendments of the other GSPs in the Kern County Subbasin (DWR Basin 5-022.14; “Kern Subbasin” or “Basin”) (i.e., collectively the Kern Subbasin Plan).

It is recognized that additional, more recent data (i.e., through June 2022) are available at the time of preparation of this amended Olcese GSP. However, as the Olcese GSP does not constitute a five-year update to a GSP (per Article 7 of the GSP Regulations), but rather a response to the DWR determination letter, those additional data are not incorporated herein, with minor exceptions.

5.1. Summary of Jurisdictional Areas and Other Features

5.1.1. Area Covered by the Plan

☑ **23 CCR § 354.8(a)(1)**
☑ **23 CCR § 354.8(b)**

The Olcese GSA Area is located in the eastern portion of the Kern Subbasin and encompasses approximately 3,206 acres of the Olcese Water District (District) service area within the Basin (see **Figure PA-1**). The Olcese Water District service area extends to the north and the east into areas not within any DWR-identified groundwater basin. The Kern Subbasin is bounded on the north by the Tulare Lake Subbasin (DWR Basin 5-022.12), the Tule Subbasin (DWR Basin 5-022.13), the Kettleman Plain Subbasin (DWR Basin 5-022.17) and on the south by the White Wolf Subbasin (DWR Basin 5-022.18).

The Olcese GSA is an exclusive agency and is preparing its own GSP. As of June 2022, there are 13 other GSAs within the Kern Subbasin[4]: Buena Vista Water Storage District GSA, Cawelo Water District GSA, Greenfield County Water District GSA, Henry Miller Water District GSA, Kern Groundwater Authority (KGA) GSA, Kern River GSA, City of McFarland GSA, Pioneer GSA, Semitropic Water Storage District GSA, and West Kern Water District GSA, Arvin (GSA), Wheeler Ridge-Maricopa GSA, and Tejon-Castac Water District

[4] SGMA Portal: https://sgma.water.ca.gov/portal/gsa/all, queried on 8 June 2022.

(GSA). These GSAs were formed by other GSA-eligible public agencies in the Kern Subbasin and are preparing separate GSP documents or Management Area Plans that are coordinated with the Olcese GSP.

5.1.2. Adjudicated Areas

☑ 23 CCR § 354.8(a)(2)
☑ 23 CCR § 354.8(b)

The Kern Subbasin is not adjudicated, and no portion of the basin is being managed under an alternative plan.

5.1.3. Jurisdictional Boundaries

☑ 23 CCR § 354.8(a)(3)
☑ 23 CCR § 354.8(b)

The Olcese GSA Area falls entirely within Kern County. A portion of the Olcese GSA Area also falls within the City of Bakersfield city limits. As shown on **Figure PA-1**, nearby water agencies/public water systems include Arvin-Edison Water Storage District, East Niles Community Services District, California Water Service - Bakersfield District, Kern County Water Agency, Round Mountain Water Company, the Meadows of the Kern Mutual Water Company, the Anne Sippi Clinic, and the Choctaw Valley Mutual Water Company.

According to the information made available by the DWR[5] in support of the development of GSPs, there are no tribal lands within or in the vicinity of the Olcese GSA Area, nor are there federal or state lands within the Olcese GSA Area. However, a small federally-owned parcel managed by the Bureau of Land Management overlies a portion of the District outside the Kern Subbasin.

The Olcese GSA Area is located within the Kern County General Plan area and the Metropolitan Bakersfield General Plan area. The Kern County General Plan further identifies several Specific Plan areas, including the Kern River Specific Plan area and the Rancheria Specific Plan areas, which cover portions of the Olcese GSA Area.

According to U.S. Census Bureau data, there are no Disadvantaged Community Places, Tracts, or Block Groups identified within the Olcese GSA Area (see **Figure PA-2**).

5.1.4. Existing Land Use and Water Use

☑ 23 CCR § 354.8(a)(4)
☑ 23 CCR § 354.8(b)

The primary land uses within the Olcese GSA Area, based on the Kern County historical crop records for 2018, are shown on **Figure PA-3**. Approximately 1,196 acres within the Olcese GSA Area are irrigated and used for agricultural purposes. Of the irrigated area, 83% is used for cultivation of citrus (991 acres), 16% for cultivation of deciduous fruits and nuts (193 acres), and the remaining 1% for pasture (12 acres) (**Figure PA-3**). These lands are irrigated primarily by Kern River water, diverted pursuant to a combination of riparian water rights held by the Nickel Family, LLC and managed by the District and non-riparian rights

[5] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

held by the District. The District also pumps groundwater to supplement the Kern River surface water. Thus, all irrigated lands within the Olcese GSA Area are supplied by a mixture of groundwater and Kern River water. In addition, the Canyon View Ranch Well is used by the Anne Sippi Clinic as the raw water source for their domestic water supply (the Anne Sippi Clinic operates the well and treatment system); this is the only known potable consumption of groundwater in the District and the Olcese GSA Area. In March 2022, the Anne Sippi Clinic drilled a new well to serve as a back-up in case of an interruption to the supply provided by the Canyon View well.

5.1.5. Well Density per Square Mile

☑ **23 CCR § 354.8(a)(5)**
☑ **23 CCR § 354.8(b)**

Figure PA-4 shows the density of wells per square mile within the Olcese GSA Area, based on Well Completion Report records compiled by DWR.[6] According to these records, four domestic, six production and no public supply wells have been installed within the ten Public Land Survey System (PLSS) sections[7] that fall partially or entirely within the Olcese GSA Area. Based on District information, however, there are only four active production wells (Well #2, Well #3, Well #4, and the Canyon View Ranch Well) within the Olcese GSA Area.

5.1.6. Lands Outside of District Covered by the GSP

Under SGMA (CWC § 10724), counties are presumed to be the GSA for areas that are not otherwise covered by another GSA, unless the county specifically opts out of this GSA role. In the Kern Subbasin, the County of Kern, which had been part of the KGA GSA, opted out of this role in early 2019 which resulted in lands outside of the KGA and outside of other GSA boundaries being “uncovered”. To address this, the KGA sent notices to these “undistricted” landowners offering an opportunity to sign an agreement for coverage under the “Management Area Plans” of nearby KGA members. Similarly, the Olcese GSA extended an offer to cover certain undistricted lands for sustainable groundwater management purposes in its GSP. Given the late time at which this coverage was offered and accepted following the County’s withdrawal, it was determined that it would not be possible to cover these undistricted lands in the Olcese GSP to the same degree of detail as the lands within OWD service area; instead, it was determined that it would be appropriate to include the lands in an appendix to the GSP, providing basic information about each parcel including the owner, APN, area, land/water use, and well information. As such, **Appendix C** presents information on these lands, including a table with the above information as well as a figure showing their locations. It should be noted that these lands are non-irrigated native rangelands with no groundwater use, and therefore do not require the same level of management as lands with irrigated agriculture and significant groundwater use. It is the intention of the Olcese GSA to include additional information for these lands (if they still need GSP coverage) in their 2025 GSP update.

[6] DWR Well Completion Report Map Application website: https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37, accessed 08/23/2019.
[7] Each PLSS section represents approximately 1 square mile of area (i.e., 640 acres).

5.2. Water Resources Monitoring and Management Programs

5.2.1. Existing Monitoring Programs in the Olcese GSA Area

☑ 23 CCR § 354.8(c)

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program tracks long-term groundwater elevation trends in groundwater basins throughout California. The program's mission is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. In February 2018 the Olcese GSA was approved to be the CASGEM Monitoring Entity for the portion of the Kern Subbasin that underlies its service area.

Additional groundwater and surface water monitoring programs are active within the Kern Subbasin (e.g., California Data Exchange Center (CDEC), Groundwater Ambient Monitoring and Assessment Program [GAMA], United States Geological Survey (USGS) National Water Information System, etc.), but they do not cover the Olcese GSA Area.

These water resource monitoring programs are not expected to limit operational flexibility in the Olcese GSA Area portion of the basin. In fact, the Olcese GSA's CASGEM monitoring network will be integral to the on-going groundwater monitoring and reporting that will be conducted pursuant to this GSP (see **Section 16 *Monitoring Network***).

5.2.2. Water Management Programs in the Olcese GSA Area

☑ 23 CCR § 354.8(d)

The Olcese GSA Area falls within the Tulare Lake Basin portion of the Kern County Integrated Regional Water Management Region (Kern Region) and is therefore included in the November 2011 Kern Integrated Regional Water Management Plan (Kern IRWMP).

The Kern Region covers approximately 5,690 square miles of Kern County and a small portion of southern Kings County. The Kern Region is separated into nine subregions, in acknowledgement of the variation in geography, agency boundaries, and water management strategies. These subregions are: (1) Greater Bakersfield, (2) Kern Fan, (3) Mountains/Foothills, (4) Kern River Valley, (5) North County, (6) South County, (7) West Side, (8) KCWA and (9) the County of Kern. The Olcese GSA Area is identified as part of both the Kern Fan and Kern River Valley subregions[8] (Kern County, 2011).

The key issues, needs, challenges, and priorities for the Kern Fan subregion, according to the Kern IRWMP (2011), include the following:

- Decreased Imported Water Supply;
- Water Quality/Groundwater Contamination;
- Urban Growth Encroachment on Key Recharge Areas; and
- Water Rights.

[8] Section 4 of the Kern IRWMP describes this area as part of the Kern Fan subregion, but Figure 6-1 identifies the Olcese GSA Area as located within the Kern River Valley subregion.

The key issues, needs, challenges, and priorities for the Kern River Valley subregion, according to the Kern IRWMP (2011), include the following:

- Some areas have natural water quality problems due to the geology of the area, particularly with arsenic, uranium, and nitrates;
- Most areas are served by septic systems, which contribute to water quality issues;
- Most of the water supply is provided through small water purveyors and through community wells. The lack of central water treatment and distribution facilities creates vulnerabilities during drought situations because communities do not have alternate water sources if wells go dry;
- The subregion, consisting primarily of DACs, lacks local funding for new facilities;
- Some areas are subject to periodic flooding, including the South Fork of the Kern River, Kelso Creek, and Erskine Creek;
- The area is prone to wildfires, which impact water quality when rain washes fire debris into waterways; and
- The Isabella Dam and the Auxiliary Dam are located in the Kern River Valley subregion. Concerns with the dams include: seepage, a fault running under the dams, homogenous foundation composition, and complete penetration of the dam by the Borel Canal.

IRWMP and GSP development are complimentary management processes. To the extent that the issues identified for the greater IRWMP region affect the Olcese GSA Area, these issues will be identified in the following sections of this GSP. The implementation of this GSP will contribute to the sustainable use of water supplies within the IRWMP region. The IRWM program is not expected to limit operational flexibility in the Olcese GSA Area portion of the basin.

5.2.3. Conjunctive Use in the Olcese GSA Area

☑ **23 CCR § 354.8(e)**

There are no formal conjunctive use programs within the Olcese GSA Area. However, groundwater is used to meet any excess demands for irrigation that are not met by surface water from the Kern River, to which the District holds certain non-riparian rights and the District's primary landowner holds riparian rights. The coordinated use of these water resources within the Olcese GSA Area is managed by the District and is not expected to limit operational flexibility in the Olcese GSA Area.

5.3. Land Use Elements or Topic Categories of Applicable General Plans

☑ **23 CCR § 354.8(f)**

5.3.1. Kern County General Plan

☑ **23 CCR § 354.8(f)(1)**

The Olcese GSA Area is located within the Kern County General Plan area (Kern County, 2009). The current Kern County General Plan was first adopted in 2004 and has undergone several amendments, the most recent amendment approved in 2009 (County General Plan). The County is currently working to update the County General Plan through 2040, with completion of the "2040 General Plan" expected in 2019. This section identifies relevant policies in the current County General Plan that could: (1) affect water demands in the Olcese GSA Area (e.g., due to population growth and development of the built environment), (2) influence the GSP's ability to achieve sustainable groundwater use, and (3) affect implementation of General Plan land use policies.

Figure PA-5 shows the current County General Plan land use designations within the Olcese GSA Area. The land use designations include primarily agriculture, rural residential, open space, resource management, suburban residential, and incorporated city (Bakersfield). These designations are generally consistent with the predominantly open space and agricultural land uses within the Olcese GSA Area. The County General Plan identifies several Specific Plan areas, including the Kern River and Rancheria Specific Plan areas, which cover portions of the Olcese GSA Area.

The Land Use, Open Space, and Conservation Element (Chapter 1) of the County General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, and that could potentially influence the implementation of this GSP.

Physical and Environmental Constrains

- **Implementation Measure C.** Cooperate with the Kern County Water Agency to classify lands in the County overlying groundwater according to groundwater quantity and quality limitations.

Public Facilities and Services

- **Goal 5.** Ensure that adequate supplies of quality (appropriate for intended use) water are available to residential, industrial, and agricultural users within Kern County.
- **Goal 7.** Facilitate the provision of reliable and cost-effective utility services to residents of Kern County.
- **Policy 2.** The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur within or adjacent to areas with adequate public service and facility capacity.
- **Policy 2.a.** Ensure that water quality standards are met for existing users and future development

Residential

- **Goal 6.** Promote the conservation of water quantity and quality in Kern County.
- **Goal 7.** Minimize land use conflicts between residential and resource, commercial, or industrial land uses.

Industrial

- **Goal 2.** Promote the future economic strength and well-being of Kern County and its residents without detriment to its environmental quality.

Resource

- **Policy 7.** Areas designated for agricultural use, which include Class I and II and other enhanced agricultural soils with surface delivery water systems, should be protected from incompatible residential, commercial, and industrial subdivision and development activities.

- **Policy 10.** To encourage effective groundwater resource management for the long-term economic benefit of the County the following shall be considered:
- **Policy 10.a.** Promote groundwater recharge activities in various zone districts.
- **Policy 10.c.** Support the development of groundwater management plans.
- **Policy 10.d.** Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.

General Provisions

- **Goal 1.** Ensure that the County can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving valuable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.
- **Policy 40.** Encourage utilization of community water systems rather than the reliance on individual wells.
- **Policy 41.** Review development proposals to ensure adequate water is available to accommodate projected growth.
- **Policy 45.** New high consumptive water uses, such as lakes and golf courses, should require evidence of additional verified sources of water other than local groundwater. Other sources may include recycled stormwater or wastewater.
- **Implementation Measure U.** The Kern County Environmental Health Services Department will develop guidelines for the protection of groundwater quality which will include comprehensive well construction standards and the promotion of groundwater protection for identified degraded watersheds.

☑ **23 CCR § 354.8(f)(2)**
☑ **23 CCR § 354.8(f)(3)**

The above goals, policies and implementation measures established by the County General Plan are complementary to sustainable groundwater management of the Olcese GSA Area relative to future land use development and conservation (i.e., the General 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). Successful implementation of this GSP will help to ensure that the Olcese GSA Area groundwater supply is managed in a sustainable manner. Therefore, implementation of County General Plan policies is not expected to affect the ability of the Olcese GSA Area to achieve groundwater sustainability.

Likewise, implementation of this GSP is not anticipated to significantly affect the water supply assumptions or land use plans within the General Plan over the planning horizon. Given that the County General Plan is being updated concurrently with the development of this GSP, it is anticipated that the 2040 General Plan would take into account this GSP and utilize consistent water supply assumptions over the 2040 planning horizon. As required by California Government Code § 65352.5(d), the GSA will coordinate with and provide the necessary information to land use planning agencies that are adopting or amending their general plan.

5.3.2. Metropolitan Bakersfield General Plan

☑ 23 CCR § 354.8(f)(1)

The Olcese GSA Area overlies a portion of the City of Bakersfield and therefore is subject to the Metropolitan Bakersfield General Plan (City of Bakersfield, 2016; City General Plan). This City General Plan was first adopted in 2002 and was updated in 2016. This section identifies relevant policies in the City General Plan that could affect water management in the Olcese GSA Area.

The City General Plan land use designations, shown on **Figure PA-6**, include primarily residential (low density, rural, and suburban), resource – extensive agriculture, and open space (including areas with slopes greater than 30%). These designations are generally consistent with the predominantly open space and agricultural land use within the Olcese GSA Area.

The Land Use Element (Chapter II) of the City General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, that could potentially influence the implementation of this GSP.

- **Goal 6.** Accommodate new development that is sensitive to the natural environment, and accounts for environmental hazards.
- **Policy 77.** Allow for the continuance of agricultural uses in areas designated for future urban growth.
- **Policy 79.** Provide for an orderly outward expansion of new "urban" development (any commercial, industrial, and residential development having a density greater than one unit per acre) so that it maintains continuity of existing development, allows for the incremental expansion of infrastructure and public services, minimizes impacts on natural environmental resources, and provides a high-quality environment for living and business.
- **Policy 80.** Assure that General Plan Amendment proposals for the conversion of designated agricultural lands to urban development occur in an orderly and logical manner giving full consideration to the effect on existing agricultural areas.
- **Implementation Measure 7.** Environmental Review. Local guidelines for project processing shall reflect California Environmental Quality Act (CEQA) Guidelines which state that the environmental effects of a project must be taken into account as part of project consideration.

The Conservation Element (Chapter V) of the City General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, that could potentially influence the implementation of this GSP.

Mineral Resources

- **Goal 4.** Protect land, water, air quality and visual resources from environmental damage resulting from mineral and energy resource development.

Soils and Agriculture

- **Goal 2.** Promote soil conservation and minimize development of prime agricultural land.
- **Goal 3.** Establish urban development patterns and practices that promote soil conservation and that protect areas of agricultural production of food and fiber crops, and nursery products.
- **Policy 4.** Monitor the amount of prime agricultural land taken out of production for urban uses or added within the plan area
- **Policy 10**. Encourage landowners to retain their lands in agricultural production.
- **Policy 14**. When considering proposals to convert designated agricultural lands to nonagricultural use, the decision-making body of the City and County shall evaluate the following factors to determine the appropriateness of the proposal: Ability to be provided with urban services (sewer, water, roads, etc.).

Water Resources

- **Goal 1.** Conserve and augment the available water resources of the planning area.
- **Goal 2.** Assure that adequate groundwater resources remain available to the planning area.
- **Goal 3.** Continue cooperative planning for and implementation of programs and projects which will resolve water resource deficiencies and water quality problems.
- **Goal 5.** Achieve a continuing balance between competing demands for water resource usage.
- **Goal 6.** Maintain effective cooperative planning programs for water resource conservation and utilization in the planning area by involving all responsible water agencies in the planning process.
- **Policy 1.** Develop and maintain facilities for groundwater recharge in the planning area
- **Policy 2.** Minimize the loss of water which could otherwise be utilized for groundwater recharge purposes and benefit planning area groundwater aquifers from diversion to locations outside the area.
- **Policy 3.** Support programs to convey water from other than San Joaquin Valley basin sources to the planning area.
- **Policy 4.** Support programs and policies which assure continuance or augmentation of Kern River surface water supplies.
- **Policy 5.** Work towards resolving the problem of groundwater resource deficiencies in the upland portions of the planning area.
- **Policy 6.** Protect planning area groundwater resources from further quality degradation.
- **Policy 7.** Provide substitute or supplemental water resources to areas already impacted by groundwater quality degradation by supporting facilities construction for surface water diversions.
- **Policy 8.** Consider each proposal for water resource usage within the context of total planning area needs and priorities-major incremental water transport, groundwater recharge, flood control, recreational needs, riparian habitat preservation and conservation.
- **Policy 9.** Encourage and implement water conservation measures and programs.

- **Implementation Measure 2.** Support all financially feasible and practical groundwater projects, for the augmentation of groundwater recharge for the south San Joaquin Valley basin by the construction and operation of additional recharge facilities or the importation of additional water for basin recharge.
- **Implementation Measure 5.** Initiate and/or support planning, financing, construction and implementation programs for supplying upland portions of the planning area having groundwater deficiencies with an adequate water supply.
- **Implementation Measure 10.** Support additional water conservation measures and programs of benefit to the planning area.

☑ **23 CCR § 354.8(f)(2)**
☑ **23 CCR § 354.8(f)(3)**

The above goals, policies and implementation measures established by the City General Plan are complementary to sustainable groundwater management of the Olcese GSA area relative to future land use development and conservation. The City General Plan establishes as a general goal for groundwater management to reach a condition of "safe yield" for the groundwater basin. Furthermore, it acknowledges the need to provide a stable water supply and considers water resources as a major factor for development decisions. Successful implementation of this GSP will help to ensure that the Olcese GSA Area groundwater supply is managed in a sustainable manner. Therefore, implementation of City General Plan policies is not expected to affect the ability of the Olcese GSA Area to achieve groundwater sustainability.[9] Likewise, implementation of this GSP is not anticipated to affect the City's water supply assumptions or land use plans. As required by California Government Code § 65352.5(d), the GSA will coordinate with and provide the necessary information to land use planning agencies that are adopting or amending their general plan.

5.3.3. Well Permitting Process

☑ **23 CCR § 354.8(f)(4)**

Well permits within the Olcese GSA Area are issued by the Kern County Public Health Services Department Water Well Program. 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 County staff.

[9] In the event that future municipal/urban development occurs within the Olcese GSA Area, such lands will be removed from the Olcese Water District jurisdiction and provided water by the City of Bakersfield per an agreement between the City, California Water Services Company, and Olcese Water District (1999).

5.4. Additional GSP Elements

☑ 23 CCR § 354.8(g)

Per California Water Code (CWC) §10727.4, a GSP shall include, where appropriate and in collaboration with the appropriate agencies, a discussion of all of the following:

Control of saline water intrusion

Because the Olcese GSA Area is located far from coastal areas, seawater intrusion is not considered to be an issue.

Wellhead protection

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 5.3.3 *Well Permitting Process***).

Migration of contaminated groundwater

There are no known contaminated groundwater sites within the Olcese GSA Area (see **Section 8.4 *Groundwater Quality***).

Well abandonment and well destruction program

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 5.3.3 *Well Permitting Process***).

Replenishment of groundwater extractions

There are no formal replenishment of groundwater extraction programs within the Olcese GSA Area. However, groundwater is only used to meet any excess demands for irrigation that are not met by the District and its primary landowner's (Nickel Family LLC) riparian and non-riparian rights to surface water from the Kern River (see **Section 5.2.3 *Conjunctive Use in the Olcese GSA Area***).

Conjunctive use and underground storage

There are no formal conjunctive use programs within the Olcese GSA Area. However, groundwater is used to meet any excess demands for irrigation that are not met by the District and its primary landowner's (Nickel Family LLC) riparian and non-riparian rights to surface water from the Kern River (see **Section 5.2.3 *Conjunctive Use in the Olcese GSA Area***).

Well construction policies

The Kern County Public Health Services Department Water Well Program issues permits to construct, reconstruct and destroy water wells (see **Section 5.3.3 *Well Permitting Process***).

Groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects

There are no groundwater contamination cleanup sites within the Olcese GSA Area nor any active projects related to recharge, diversions to storage, conservation, water recycling, conveyance, and extraction beyond what is described in **Section 5.2.3 *Conjunctive Use in the Olcese GSA Area***.

Efficient water management practices

The irrigated agriculture within the Olcese GSA Area uses 100% drip or micro-sprinkler irrigation techniques and is therefore highly efficient. In addition, the District's storage reservoirs are lined and the irrigation canal, which also serves as a conduit for the District's hydroelectric power generation facility is concrete-lined.

Relationships with State and federal regulatory agencies

The District has an ongoing relationship with the Federal Energy Regulatory Commission in relation to its hydroelectric power operations, and also interacts regularly with the USGS regarding gauging and calibration of the District's bypass structure and Parshall flume. The District manages the riparian water rights held by the primary landowner, Nickel Family LLC, including submitting reports of diversion to the State Water Resources Control Board (SWRCB).

Land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity

Land use planning within the Olcese GSA Area is robust and protective of natural resources, as discussed in **Section 5.3 *Land Use Elements or Topic Categories of Applicable General Plans***.

Impacts on Groundwater Dependent Ecosystems

As discussed further below in **Section 7.1.4 *Principal Aquifers and Aquitards*** and **Section 8.7 *Groundwater Dependent Ecosystems***, groundwater production within the Olcese GSA Area is sourced from the Olcese Sand Aquifer Unit, withdrawals from which do not contribute to depletion of Kern River or tributary flows or groundwater in the shallow alluvial aquifer system. Given that this Olcese Sand-sourced groundwater is used for irrigation which, despite being highly efficient, inevitably results in some deep percolation of applied water below the root zone, there is likely a net addition of water to the shallow subsurface on an annual basis. This suggests that the District's pumping operations are unlikely to have any detrimental effects on groundwater dependent ecosystems (GDEs) within the Olcese GSA Area.

5.5. Notice and Communication

☑ **23 CCR § 354.10**

The Olcese GSA has developed a Stakeholder Communication and Engagement Plan (SCEP) for the Olcese GSA Area to fulfill notice and communication requirements. The SCEP is available by request to Olcese Water District and is included herein as **Appendix D**. The SCEP includes sections on goals and desired outcomes of the GSP development process, stakeholder identification and mapping, messaging, venues for engagement, implementation schedule, and a stakeholder survey. The survey was distributed to landowners within the Olcese GSA Area.

5.5.1. Beneficial Uses and Users of Groundwater

☑ **23 CCR § 354.10(a)**

As part of the SCEP, beneficial uses and users of groundwater in the Olcese GSA Area were identified (see SCEP Section 3). Additionally, a Stakeholder Constituency "Lay of the Land" exercise was developed which identified stakeholders in the Olcese GSA Area, key interests and issues, and the level of engagement expected with each stakeholder (see SCEP Table 1). This exercise will be updated during select phases of GSP development and/or implementation.

The primary use and user of groundwater within the Olcese GSA Area is for irrigated agriculture to lands owned by the Nickel Family LLC and served by the Olcese Water District. This primary user has been kept informed throughout the GSP development process. The only other use of groundwater is for potable supply by the Anne Sippi Clinic and minor use for stock water. No active private domestic wells or commercial/industrial uses of groundwater exist within the Olcese GSA Area.

5.5.2. Public Meetings Summary

☑ **23 CCR § 354.10(b)**

The list below identifies public meetings, workshops, and direct outreach specific to GSP development.

GSA Notification

A public hearing was held 28 November 2016 where Olcese Water District elected to become a GSA. Notice of that public hearing was published in the Bakersfield Californian on 11 November 2016 and 18 November 2016.

GSA Board Meetings

The Olcese GSA Board meets quarterly at its offices. Regular Sustainable Groundwater Management Act (SGMA) and GSP development updates are provided by Staff and stakeholders are provided the opportunity to provide input on the GSP process.

Stakeholder Workshops

The Olcese GSA has hosted and/or participated in workshops intended to educate local landowners and other stakeholders within the Olcese GSA Area regarding SGMA, including:

- Olcese GSA SGMA Landowner Workshop #1 – Anticipated November/December 2019
- Kern Subbasin Open House – 14 May 2019
- Kern Subbasin GSP Public Review Open House – 26 September 2019

Direct Outreach

- 13 March 2018 – Meeting with Miller-Hagan Group. Attendees included: Mark Mulkay (Kern-Delta Water District), Bob Hartnack, Tim Ashlock (Buena Vista), EKI and Olcese Water District
- 27 March 2018 – Kern River GSA Manager's Meeting. Attendees included: Dick Diamond (North Kern Water District), Mark Mulkay (Kern-Delta Water District), Dave Beard (ID-4), Art Chianello (City of Bakersfield), Gene McMurtrey, EKI and Olcese Water District
- Outreach (verbal communications) to the Anne Sippi Clinic
- Meeting between Olcese Water District and Kern County
- Meeting between Olcese Water District and KGA GSA
- Meeting between Olcese GSA and Nickel Family LLC

5.5.3. Comments Received Regarding the GSP

☑ 23 CCR § 354.10(c)

A Public Draft version of the original 2020 Olcese GSP was posted to the Olcese GSA website on 6 September 2019, and the City of Bakersfield and Kern County provided notice of receipt dated 11 September 2019, starting a 90-day public review and comment period that ended on 9 December 2019. No written comments on the Public Draft Olcese GSP were received during the public comment period. **Table PA-1** below summarizes the input and feedback received from the public during the development of the Olcese GSP.

Table PA-1. Comments and Input Received from Public During GSP Development

Source	Date	Type of Input	How Input was Incorporated
The Nature Conservancy	February 2019	Verbal discussion regarding groundwater dependent ecosystems (GDEs)	Feedback taken into consideration during development of GSP.
The Nature Conservancy	13 June 2019	Follow-up correspondence regarding GDEs	Feedback taken into consideration during development of GSP.
Patty Poire, Kern Groundwater Authority	9 September 2019	Verbal comments on Executive Summary of Public Draft GSP	Comments taken into consideration and changes made to the Executive Summary.

Olcese GSA welcomes further comments during GSP implementation and will continue to conduct stakeholder outreach and engagement, as described in **Section 19.1.4 *Stakeholder Engagement***.

5.5.4. Communication

☑ 23 CCR § 354.10(d)

The SCEP outlines the Olcese GSA's communication goals for the Olcese GSA Area.

Decision-Making Process

☑ 23 CCR § 354.10(d)(1)

The SCEP Section 2.2 outlines the decision-making process for the Olcese GSA. Briefly, the process involves decision making by the Olcese GSA Board of Directors during Board meetings which are held quarterly and are open to the public.

Public Engagement Opportunities

☑ 23 CCR § 354.10(d)(2)

The SCEP Section 6 discusses public engagement opportunities and SCEP Sections 5 and 6 discuss how public input and responses will be handled.

Stakeholder Involvement

☑ 23 CCR § 354.10(d)(3)

The SCEP Section 5 outlines the GSA's goals, including open and transparent engagement with diverse stakeholders. Additionally, SCEP Section 4 outlines describes the Stakeholder Survey which the Olcese GSA used to gain additional knowledge on Kern Subbasin stakeholders. The Olcese GSA sent Stakeholder Surveys to 13 homeowners in and around the Olcese GSA Area; no responses from these homeowners were received as of 18 December 2019.

Public Notification

☑ 23 CCR § 354.10(d)(4)

The SCEP Sections 5 and 6 detail the methodology that is being followed to inform the public on GSP updates, status, and actions.

5.5.5. Interagency Coordination

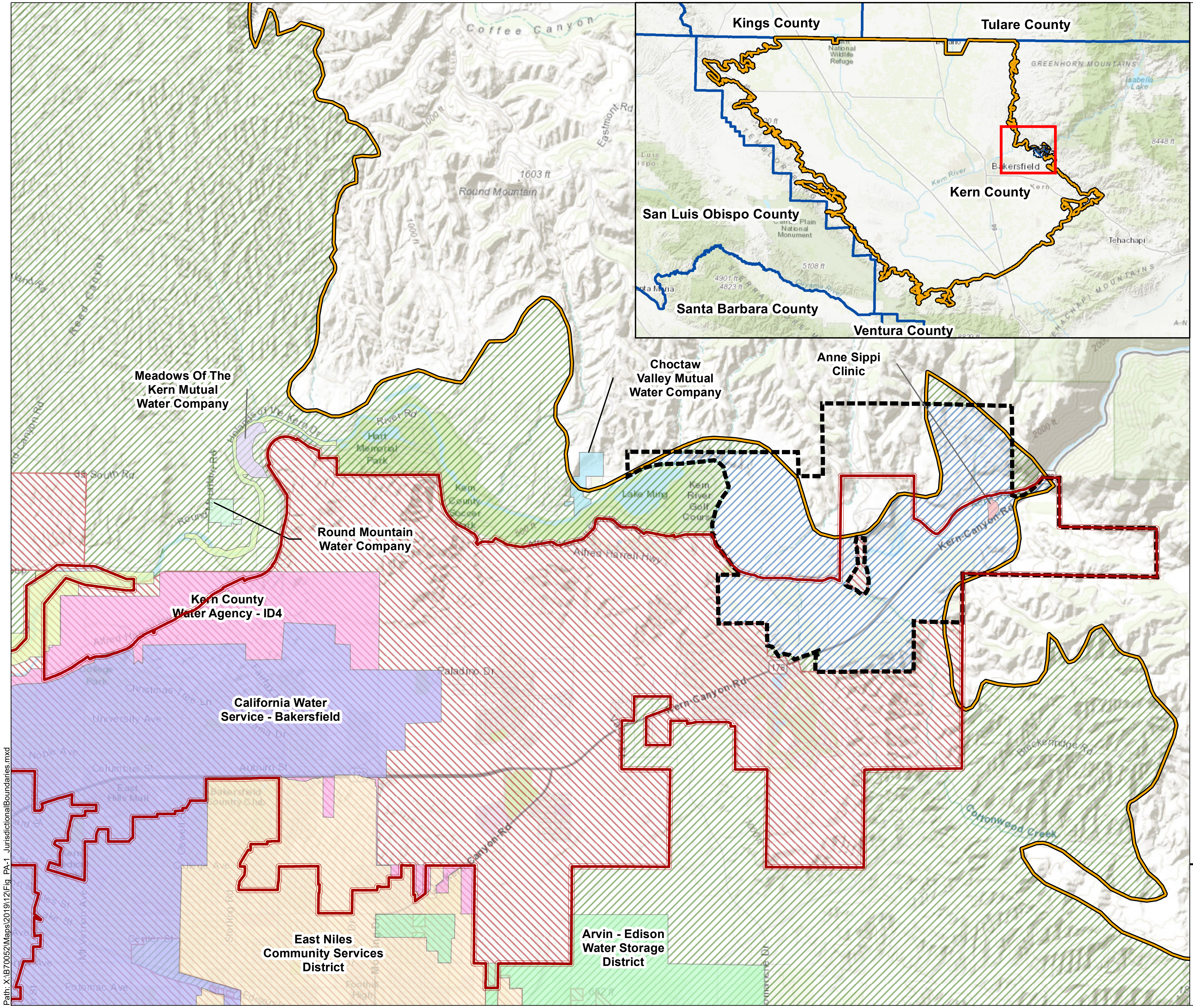
Olcese GSA has actively engaged in intra-basin coordination efforts through the GSP development process:

Kern Subbasin GSA Executive Committee Meetings

Representatives of each of the GSAs within the Kern Subbasin (i.e., including Olcese GSA; see **Section 5.1.1 *Area Covered by the Plan***), met approximately monthly throughout the original 2020 GSP development process to ensure high-level coordination of policy aspects related to the multiple GSPs being prepared in the basin. Meetings of the Kern Subbasin GSA Executive Committee were also held at least monthly during the first half of 2022 to discuss the collective GSAs' responses to the DWR 2022 Determination Letter and related matters.

Kern Managers Meetings

Representatives of each of the GSAs and the Managers of the KGA member agencies met weekly between late 2018 and early 2020 (i.e., when the original 2020 GSPs were adopted) at the Rosedale-Rio Bravo WSD offices for in-depth discussions of basin-wide SGMA topics ranging from monitoring network coordination to basin-wide modeling efforts and sustainable management criteria development. Kern Managers Meetings were also held on an approximately weekly basis during the first half of 2022 to discuss the collective GSAs' responses to the DWR 2022 Determination Letter.



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Legend

- City of Bakersfield
- County Boundary
- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District Service Area

GSA Name

- Olcese GSA
- Kern Groundwater Authority GSA (see note 5)
- Kern River GSA

Abbreviations

DWR	= California Department of Water Resources
GSA	= Groundwater Sustainability Agency
ID4	= Improvement District No. 4
KGA	= Kern Groundwater Authority
OWD	= Olcese Water District

Notes

1. All locations are approximate.
2. There are no basins adjacent to Kern County Subbasin near the Olcese GSA Area.
3. The pastel filled areas represent public and private water systems neighboring Olcese GSA.
4. The entire area shown is coverd by the Kern County General Plan.
5. GSA boundaries are current as of the date of adoption of this GSP (6 January 2020). The KGA GSA area, as shown, includes certain "undistricted" lands. It is understood that these undistricted lands are not covered by any GSP unless the landowner enters into an GSA inclusion agreement with a nearby GSA-eligible entity. Olcese GSA intends to cover certain undistricted lands in its GSP and has entered into such an agreement with the landowners (see Appendix B).

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 3 January 2020.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - 2018 Update.
3. OWD boundary obtained from OWD on 12 April 2017.

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Miles

Olcese GSA Plan Area and Relevant Boundaries

eki environment & water

Olcese Water District
Kern County, California
December 2019
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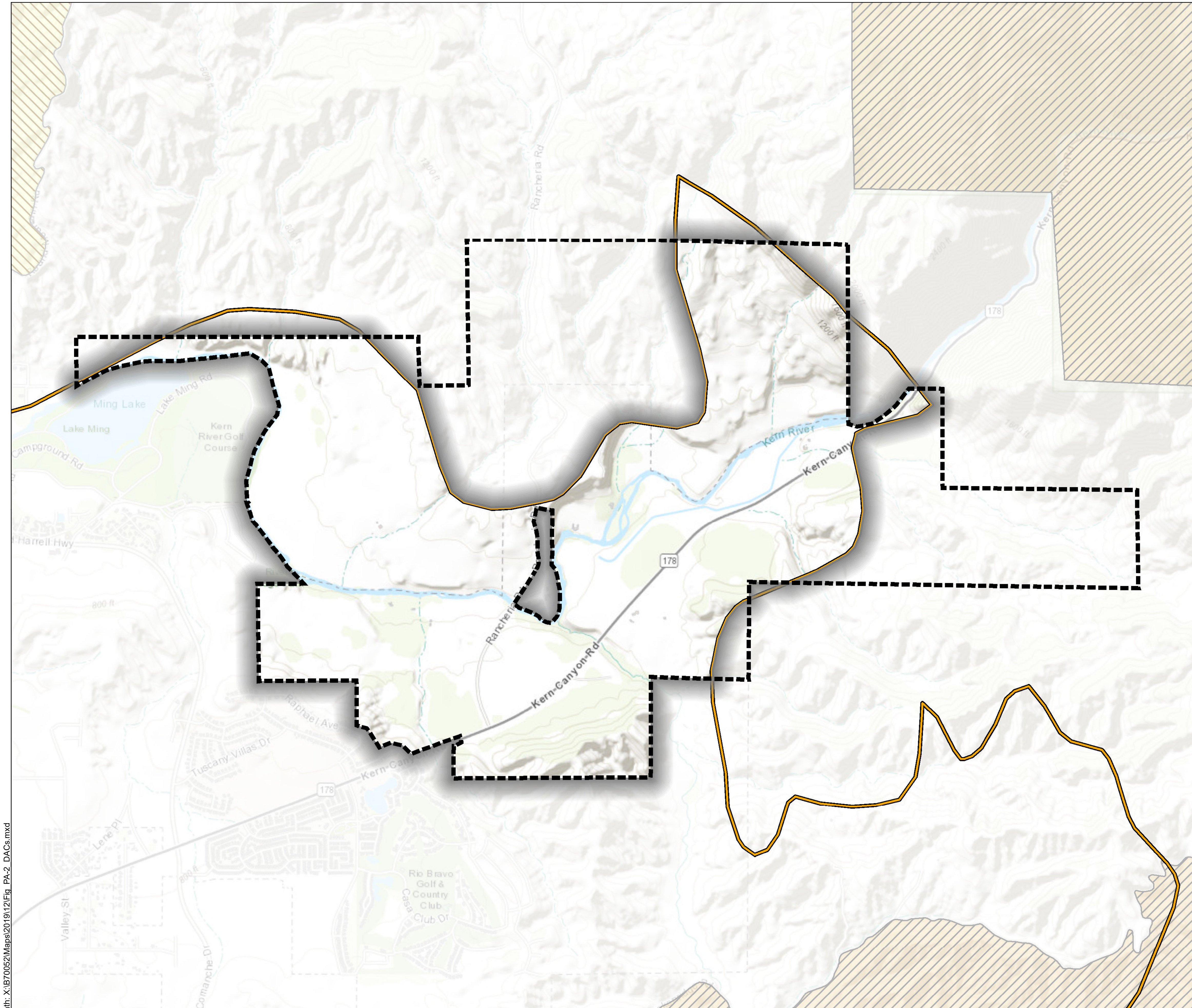
Figure PA-1



Legend

- Olcese Water District Service Area
- Kern County Subbasin (DWR 5-022.14)

Disadvantaged Community Census Tract

- Severely Disadvantaged Community
- Disadvantaged Community

Disadvantaged Community Census Block Group

- Severely Disadvantaged Community
- Disadvantaged Community

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Disadvantaged Communities information downloaded on 04 October 2018 from the SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer. Last updated 2016.

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Disadvantaged Communities near Olcese GSA

Olcese Water District
Kern County, California
December 2019
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Figure PA-2

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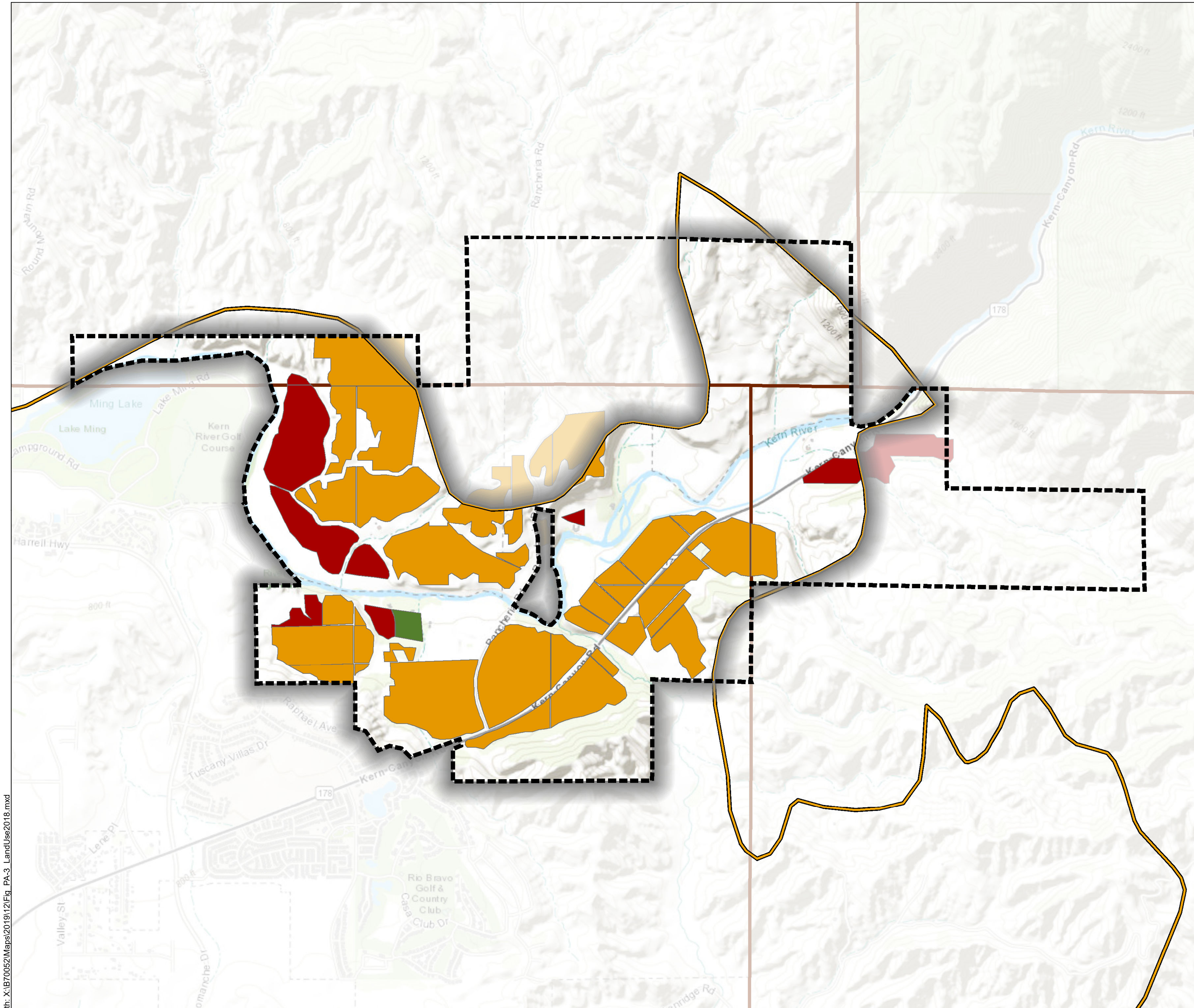

Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District

2018 Land Use / Crop Types

- Citrus
- Deciduous Fruits and Nuts
- Pasture

Abbreviations

DWR = California Department of Water Resources
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. The Olcese GSA Area comprises the Olcese Water District service area portion within the Kern County Subbasin.
3. All irrigated lands use a combination of Kern River water and groundwater.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Land use obtained from Kern County GIS website, on 16 August 2018. (http://esps.kerndsa.com/gis/gis-download-data)

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Land Use (2018) and Water Sources

Olcese Water District
Kern County, California
December 2019
B70052.03

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Figure PA-3

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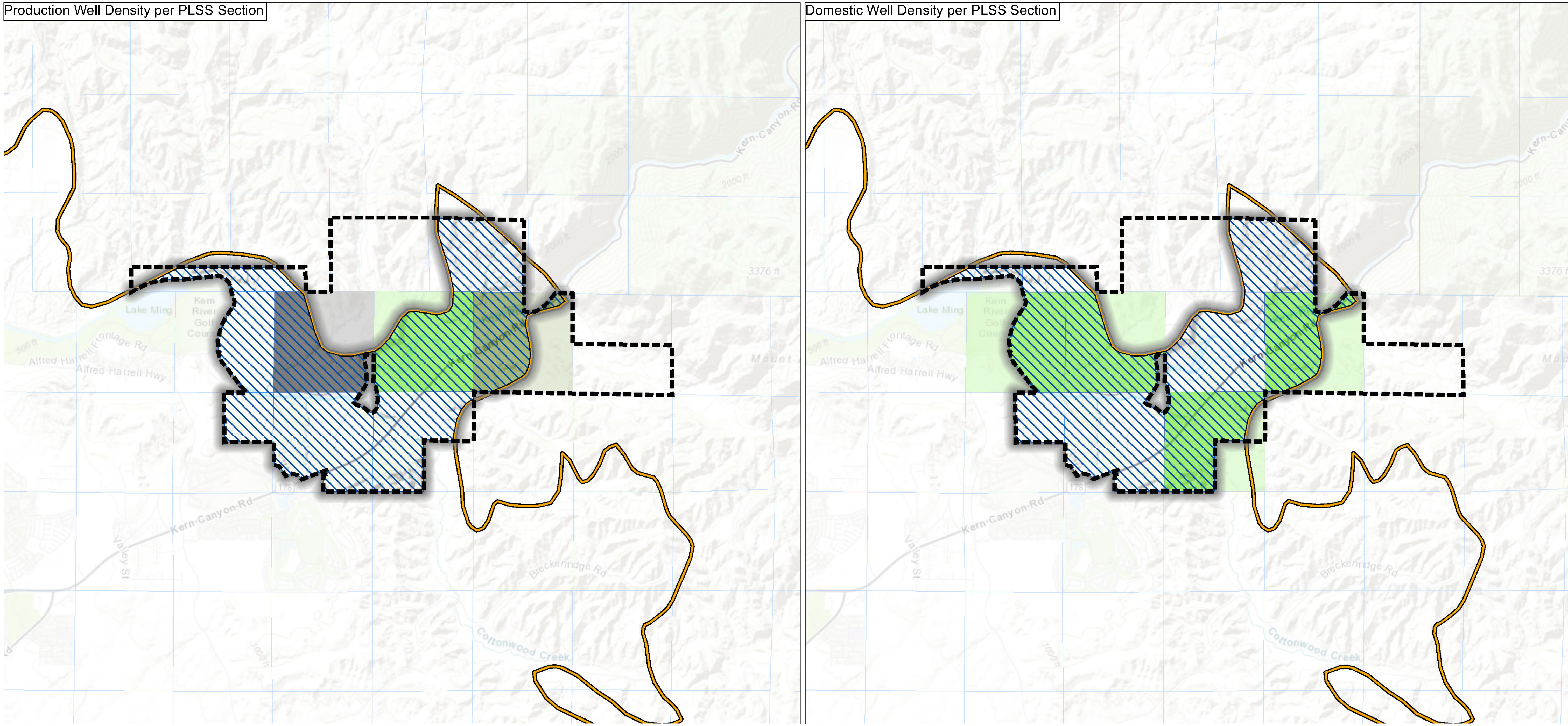

Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District Service Area
- Olcese GSA Area
- PLSS Section

Well Density per PLSS Section

- 1
- 2
- 3

Abbreviations

DWR	= California Department of Water Resources
GSA	= Groundwater Sustainability Agency
PLSS	= Public Land Survey System

Notes

1. All locations are approximate.
2. Well density per PLSS Section is shown in sections within the Olcese GSA Area.
3. There are no public supply wells within the Olcese GSA Area.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Well Count per square mile (PLSS section) from Well Completion Report Map Application, website: https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37

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Well Density by PLSS Section

Olcese Water District
Kern County, California
December 2019
B70052.03

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Figure PA-4

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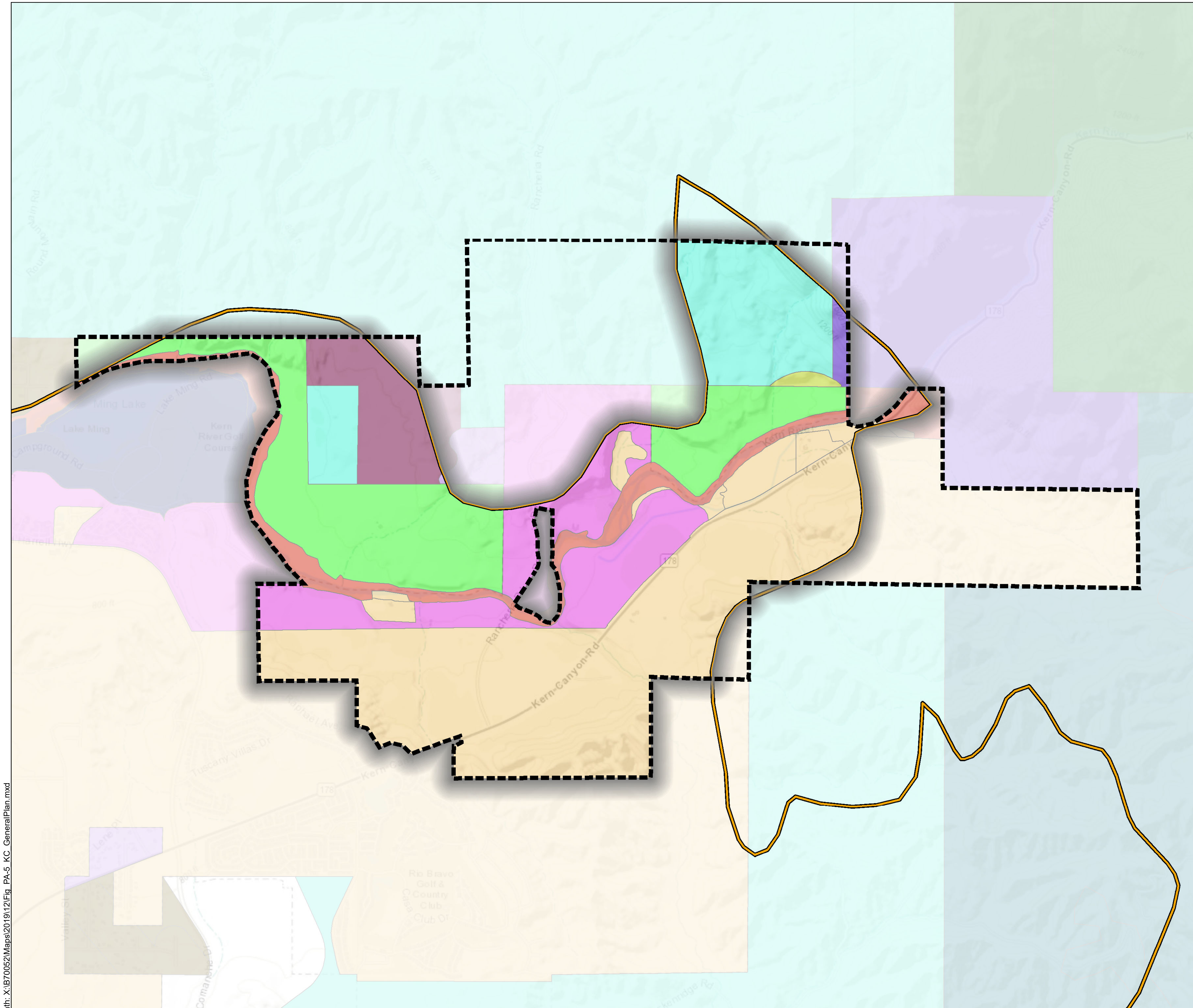

Legend

- Olcese Water District Service Area
- Kern County Subbasin (DWR 5-022.14)

Kern County General Plan Land Use Designation

- Estate Residential
- Extensive Agriculture
- Extensive Agriculture (Min. 20 Acre Parcel Size)
- Incorporated Cities
- Maximum 7.25 Units/Net Acre
- Minimum 2.5 Gross Acres/Unit
- Open Space - Slopes Exceeding 30%
- Public or Private Recreation Areas
- Resource Management (Min. 20 Acre Parcel Size)
- Rural Residential
- Specific Plan Required
- State or Federal Land
- Suburban Residential

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Kern County General Plan information obtained on 16 August 2018 from http://esps.kerndsa.com/gis/gis-download-data

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Kern County General Plan - Land Use Designations

Olcese Water District
Kern County, California
December 2019
B70052.03

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Figure PA-5

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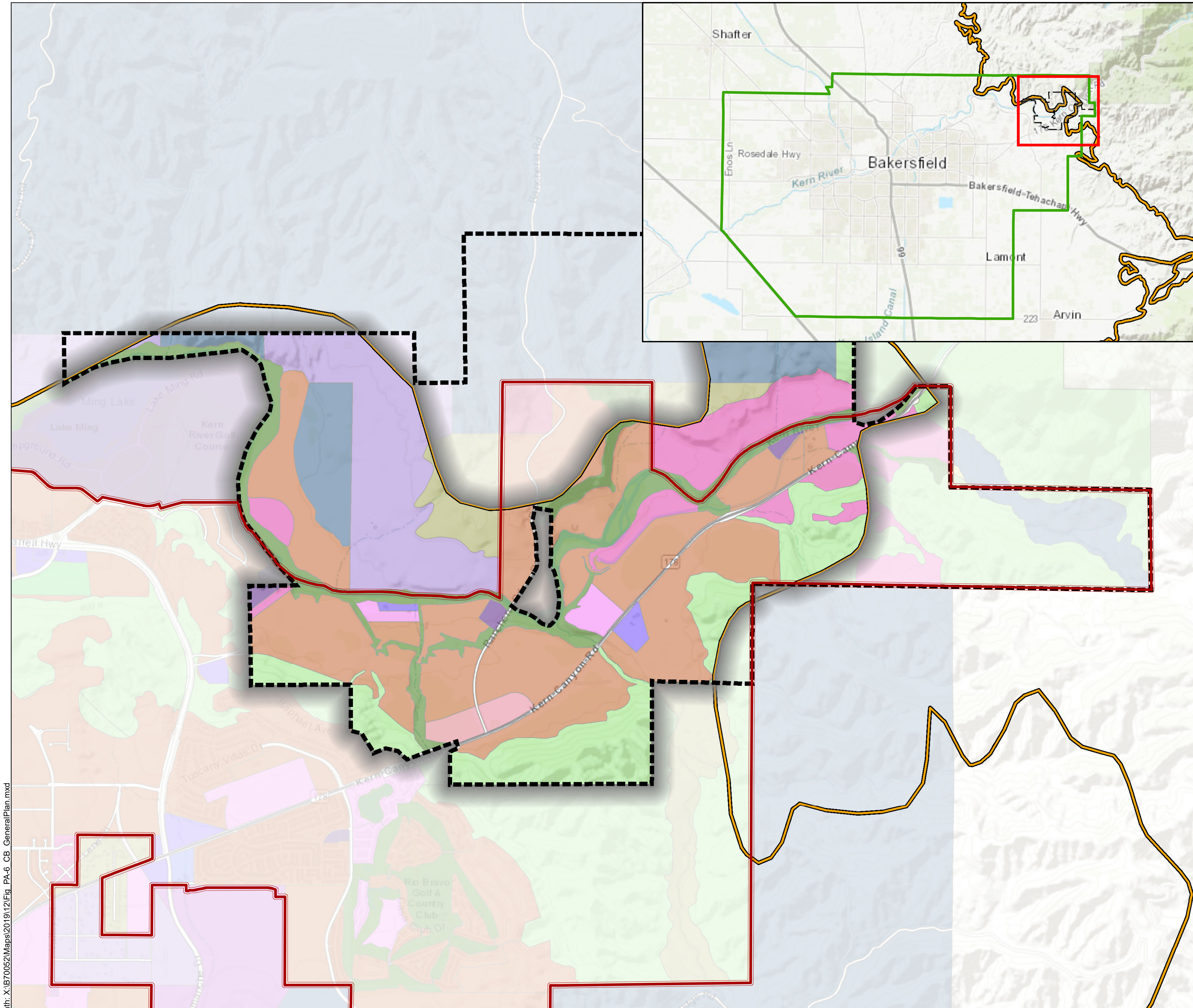

Legend

- City of Bakersfield
- Metropolitan Bakersfield General Plan Area
- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District Service Area

Land Use Designation Code / Description

- ER - Estate Residential
- GC - General Commercial
- HC - Highway Commercial
- HMR - High Medium Residential
- LMR - Low Medium Residential
- LR - Low Density Residential
- MUC - Mixed Use Commercial
- OC - Office Commercial
- OS - Open Space
- OS-P - Parks and Recreation
- OS-S - Slopes Exceeding 30%
- OTHER JURIS
- R-EA - Resource - Extensive Agriculture
- R-IA - Resource - Intensive Agriculture
- R-MP - Resource - Minerals and Petroleum
- RR - Rural Residential
- SR - Suburban Residential

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency

Notes

1. All locations are approximate.
2. Not all land use designations shown in the Legend are present in the Olcese GSA Area.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.

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Metropolitan Bakersfield General Plan - Land Use Designations

Olcese Water District
Kern County, California
December 2019
B70052.03

eki environment & water

Figure PA-6

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BASIN SETTING

6. INTRODUCTION TO BASIN SETTING

☑ 23 CCR § 354.12

This section presents Basin Setting information for the Olcese Groundwater Sustainability Agency (Olcese GSA) Area. As discussed previously in **Section 5 *Description of the Plan Area***, the Olcese GSA Area consists of the portion of the Olcese Water District (District) service area that is located within the Kern County Subbasin (Department of Water Resources [DWR] 5-022.14; "Kern Subbasin") (**Figure HCM-1**). In some cases, Basin Setting information for areas proximal to, but outside of, the Olcese GSA Area is provided for context. Basin Setting information includes the Hydrogeologic Conceptual Model, Groundwater Conditions, and Water Budget.

7. HYDROGEOLOGIC CONCEPTUAL MODEL

☑ 23 CCR § 354.14(a)

This section presents the hydrogeologic conceptual model (HCM) for the Olcese GSA Area which includes the portion of the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin") that lies within the District boundary (see **Figure HCM-1**). As described in the Hydrogeological Conceptual Model Best Management Practices (BMP) document (DWR, 2016a), an HCM provides, through descriptive and graphical means, an understanding of the physical characteristics of an area that affect the occurrence and movement of groundwater, including geology, hydrology, land use, aquifers and aquitards, and water quality. This HCM serves as a foundation for subsequent Basin Setting analysis including water budgets (**Section 9**), monitoring network development (**Section 16**), and the development of sustainable management criteria (**Sections 11** through **15**).

7.1. General Description

☑ 23 CCR § 354.14(b)

7.1.1. <u>Geological and Structural Setting</u>

☑ 23 CCR § 354.14(b)(1)

The Olcese GSA Area is located on the eastern edge of the southern end of the San Joaquin Valley. The San Joaquin Valley is a structural trough filled with tens of thousands of feet of Cenozoic continental and shallow marine sedimentary deposits shed from the surrounding mountains which include the Sierra Nevada Mountains to the east, the Coast Range Mountains to the west, and the San Emigdio and Tehachapi Mountains to the south (Davis et al., 1959). The structural trough is asymmetric, with its axis located west of the valley's centerline at land surface (Scheirer, 2013).

The Olcese GSA Area sits atop Miocene age and older sedimentary deposits, overlain by more recently deposited (Quaternary) alluvial and terrace sediments associated with the Kern River. The deposits generally dip to the west, with steeper dip angles for the older, deeper units. Running through the center of the Olcese GSA Area are Pleistocene to Recent-aged deposits of coarse- to medium-grained alluvium deposited by the Kern River as it flows out of the Sierra Nevada mountains through the Kern River Canyon.

Due to its location near the North American and Pacific plate boundary, the southern San Joaquin Valley underwent complex patterns of tectonic evolution during the Cenozoic era, including phases of extension, uplift, subsidence, faulting, and flexure (Goodman and Malin, 1992). The Bakersfield Arch is a broad east-west trending structural dome in the vicinity of the Kern River, west of the Olcese GSA Area. On the south side of the arch, sedimentary strata thin in a northward direction. Normal faults along the east side of the valley are concentrated in the area of the Bakersfield Arch. One of the principal faults is the Kern Gorge Fault which cuts through the Olcese GSA Area and delineates the boundary between the non-water bearing Mesozoic granodiorite bedrock of the southern Sierra Nevada and the Cenozoic sedimentary formations of the San Joaquin Valley. Along this fault, basement rocks to the southwest have been down-dropped more than 2,000 feet (Bartow, 1991). Two cross-sections through the Olcese GSA Area further illustrate the complex subsurface structural relationships are discussed further in **Section *7.2 Cross Sections***.

7.1.2. Lateral Basin Boundaries

☑ 23 CCR § 354.14(b)(2)

The Olcese GSA Area (shown on **Figure HCM-1**) is bounded on the north and east sides by either the Olcese Water District boundary or the Kern Subbasin extent. The latter is generally defined as the extent of Quaternary alluvial deposits, based on the surficial geologic map published by the California Division of Mines and Geology (CDMG, 1964) (see **Figure HCM-2**). The Kern Gorge Fault bounds the Olcese GSA Area (and the Kern Subbasin) on a small portion of the northeast side. To the south and west, the Olcese GSA Area boundary coincides with the District's administrative boundary. The more detailed surficial geologic map and cross-sections of Bartow (1984) further inform the discussion of geology in the Olcese GSA Area. **Figure HCM-3** shows the Bartow (1984) surficial geology in relation to the Olcese GSA Area, as well as the location of the two cross-sections developed for this HCM.

7.1.3. Bottom of the Basin

☑ 23 CCR § 354.14(b)(3)

As discussed above, the southern San Joaquin Valley is a deep structural trough filled with a thick sequence of Tertiary and Quaternary sediments including sandstone, siltstone, shale, and conglomerate. However, despite the substantial thickness of sedimentary strata overlying impermeable basement rock within this structural basin, within the Olcese GSA Area (and elsewhere in the Kern Subbasin), only certain geologic units are of sufficient permeability to constitute water-bearing zones or have sufficiently good water quality to support groundwater use. Thus, for the purposes of this Groundwater Sustainability Plan (GSP), and as described below the "bottom of the basin" is defined as the bottom depth of those units (i.e., at about 2,000 feet below ground surface [ft bgs]).

Deepest Groundwater Extractions and Depth to Basement Surface

Three of the four active District production wells pump groundwater from the (Lower Miocene) Olcese Sand formation, with the deepest production well (Well #4) screened to around 2,000 ft bgs or -1,418 feet above mean sea level (ft msl). The Olcese Sand formation is underlain by the (Lower Miocene) Freeman Silt formation, which is understood to be non-water bearing due to its silt-dominated texture. Therefore, the bottom of the basin underlying the Olcese GSA Area is defined herein to be the base of the Olcese Sand formation, which occurs between 1,200 and 2,000 ft bgs beneath the Olcese GSA Area (i.e., approximately -600 to -1,400 ft msl) as the unit generally dips and thins to the southwest.

Base of Fresh Water

Based on the State Water Resources Control Board (SWRCB) definition of "fresh water" as having a total dissolved solids (TDS) concentration less than 3,000 milligrams per liter (mg/L) (SWRCB Resolution No. 88-63),[10] recent and historical water quality data collected from District wells suggest that groundwater within the Olcese Sand formation underlying the Olcese GSA Area is "fresh" (maximum TDS concentrations around 1,100 mg/L).

[10] Elsewhere in the Kern County Subbasin, the Kern Groundwater Authority (KGA) GSA is using a criterion for fresh water of 3,000 microSiemens per centimeter (uS/cm) electrical conductivity (EC), which corresponds to a TDS concentration of approximately 2,000 mg/L.

However, salinity increases in the down-dip direction towards the southwest, and the relatively fresh groundwater transitions to brackish water quality. Well log reports published by Division of Oil, Gas, and Geothermal Resources (DOGGR) from the nearby Ant Hill Oil Field indicate that TDS concentrations begin to exceed 3,000 mg/L as the Olcese Sand formation dips below -2,500 ft msl approximately 1.5 miles southwest of the Olcese GSA Area, coincident with the presence of hydrocarbons near the top of the Olcese Sand formation in this area. Interestingly, these DOGGR logs report the "base of fresh water" as occurring at much shallower depths of only 850 ft bgs, due to the presence of high Boron concentrations in groundwater.

7.1.4. Principal Aquifers and Aquitards

☑ **23 CCR § 354.14(b)(4)**

Principal aquifers are defined in the Groundwater Sustainability Plan (GSP) Emergency Regulations (23 CCR §351) Sustainable Groundwater Management Act (SGMA) as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems" (23 CCR §351(aa)). The Olcese GSA Area is underlain by two water-bearing units: (1) a shallow and narrow alluvium deposit (referred to herein as the Shallow Alluvium) which is constrained on the sides and bottom by the relatively impermeable Round Mountain Silt, and (2) a deeper aquifer coincident with the Olcese Sand formation (referred to herein as the Olcese Sand Aquifer Unit). **Figure HCM-5** presents a conceptual illustration of these water-bearing zones in the Olcese GSA Area.

The District has four active production wells, identified by the District as Well #2, Well #3, Well #4, and the Canyon View Ranch well (see **Figure HCM-6**). There are the only known active wells within the Olcese GSA Area. The District also has one inactive/abandoned well – Well #1. Active Wells #2, #3, and #4 are screened within, and pump exclusively from, the Olcese Sand Aquifer Unit and are the primary sources of supply to the District, accounting for approximately 93% of the total pumping within the Olcese GSA Area; former Well #1 also pumped from this unit.

The Canyon View Ranch well is located in the far eastern portion of the Olcese GSA Area and is relatively shallow, screened from 140 to 340 ft bgs. This well accounts for approximately 7% of total pumping within the Olcese GSA Area. Based on the lithology described in the well log, the upper portion of the screened interval likely corresponds to the Round Mountain Silt formation (i.e., "blue-gray shale") whereas the bottom 46 feet of the screened interval corresponds to the Olcese Sand Aquifer Unit (i.e., "fine to medium blue-gray sand"). While the lithology and water-bearing properties of the screened materials indicate that Canyon View Ranch Well is screened within the upper portion of the Olcese Sand Aquifer Unit, water quality information (discussed further below) shows a similarity between this groundwater and Kern River water, suggesting that the source of recharge feeding this well may include percolation from the Shallow Alluvium and/or Kern River. The exact mechanism of this recharge is unknown but may include seepage along the Kern Gorge Fault or percolation from the Shallow Alluvium where the Round Mountain Silt is thin or absent at the eastern edge of the Kern Subbasin.

The Shallow Alluvium is not considered a principal aquifer in this GSP because: (a) the only known groundwater pumping within the Olcese GSA Area comes from the Olcese Sand Aquifer Unit, and (b) the Shallow Alluvium is limited in extent and intimately linked to the Kern River (i.e., it rather functions as "bed and banks" of the surface water system) as evidenced by the limited nature and thickness (see **Figure**

HCM-4) of the aquifer materials that are incised into the relatively impermeable Round Mountain Silt formation.

The following discussion of principal aquifers and aquitards, therefore, focuses only on the Olcese Sand Aquifer Unit materials and its confining layers. The surficial geology within Olcese GSA Area is discussed further below in **Section 7.3 *Physical Characteristics***, and the stratigraphic relations and well log information along the lines of section are presented on cross-sections A-A' and B-B', discussed further below in **Section 7.2**.

Formation Names

☑ **23 CCR § 354.14(b)(4)(A)**

The stratigraphy of the principal aquifer and aquitards is based largely on the detailed surficial geologic mapping and cross-sections of Bartow (1984). From shallowest to deepest (youngest to oldest), these units include: the Middle/Upper Miocene Round Mountain Silt, the Lower Miocene Olcese Sand formation, and the Lower Miocene Freeman Silt formation. Below the Freeman Silt are several additional marine formations ranging from Lower Miocene to Upper Eocene in age, including the Jewett Sand (which includes, in places, the Pyramid Hill Sand Member with a distinct "grit" zone at its base), the Rio Bravo Sand, and the Vedder Sand. The Walker formation is a non-marine sandstone which is typically the deepest and oldest of the sedimentary units overlying pre-Upper Cretaceous basement rocks (Bartow, 1984). The Miocene Bena Gravel formation is a fan delta deposit that is contemporaneous with the Olcese Sand and Round Mountain Silt and is located to the south of the Olcese GSA Area.

The Round Mountain Silt is a marine siltstone and claystone which varies in thickness up to almost 800 feet within the Olcese GSA Area depending on location. This low permeability unit separates the Olcese Sand Aquifer Unit from the Shallow Alluvium and the Kern River and creates confined groundwater conditions within the Olcese Sand Aquifer Unit, as evidenced by water levels in District Wells #2, #3, and #4 that are encountered above the Olcese Sand/Round Mountain Silt contact. Additionally, local outcroppings of the Round Mountain Silt are observed along the margins of the Kern River within the Olcese GSA Area, laterally constraining the extent of the Shallow Alluvium (see **Figure HCM-3**).

The Olcese Sand formation is a fine- to coarse-grained marine sandstone with silty sandstone and sandy siltstone interbeds. The formation dips to the southwest and is encountered at depths of approximately 200 to 800 ft bgs under the Olcese GSA Area (approximately 600 to -300 ft msl) and reaches depths of approximately 2,000 ft bgs (-1,400 ft msl). The average thickness of the Olcese Sand Aquifer Unit in the Olcese GSA Area is roughly 1,000 feet.

Underlying the Olcese Sand formation is the Freeman Silt formation, a marine siltstone that, due to its comparatively finer/siltier texture, is understood to effectively serve as the bottom of the groundwater basin underlying the Olcese GSA Area. The older formations (i.e., the Jewett, Rio Bravo and Vedder Sand formations and the Walker formation) are not discussed further herein, although they are shown on the two cross-sections prepared for this HCM.

Physical Properties of Aquifers and Aquitards

☑ **23 CCR § 354.14(b)(4)(B)**

Estimates of aquifer hydraulic properties (i.e., hydraulic conductivity and storage coefficient) for the Olcese Sand Aquifer Unit are derived from aquifer pump test data from District production wells, and information from nearby oil fields available from DOGGR.

Pump test data from District Wells #1 - #4 indicate specific capacities of between 22 and 92 gallons per minute per foot (Schmidt, 2016). A long-term aquifer test conducted in Wells #1 and #2 in 2002 provided an estimated value for aquifer transmissivity of about 30,000 gallons per day per foot (gpd/ft), equivalent to about 4,000 feet squared per day (ft^2/d) and a storativity value of 0.01 (Schmidt, 2002). Schmidt (2016) revised his estimate of the best transmissivity value to 47,000 gpd/ft or approximately 6,300 ft^2/d.

Given an aquifer thickness of approximately 1,000 feet, these test results indicate a hydraulic conductivity for the Olcese Sand Aquifer Unit on the order of 4 to 6 feet per day (ft/d). The DOGGR oil field data sheet from the Ant Hill Oil Field, located approximately 1.5 miles to the southwest of the Olcese GSA Area, reports permeability values for the Olcese Sand formation of 200 to 1,400 millidarcies (DOGGR, 1998) for the "pool" within the Olcese Sand formation, suggesting hydraulic conductivity values between approximately 0.55 and 3.8 ft/d.[11]

Other sources of information on the hydraulic properties of the Olcese Sand Aquifer Unit are numerical groundwater models developed for the area. The California Central Valley Groundwater-Surface Water Simulation Model - Fine Grid (California Central Valley Groundwater-Surface Water Simulation Model [C2VSim]-FG, Beta version) divides the Central Valley alluvial basin vertically into four layers (Brush et al., 2016). Based on layer depths and elevations, it is presumed that in the Olcese GSA Area Layer 4 is most representative of the Olcese Sand Aquifer Unit. In C2VSim-FG (Beta), Layer 4 nodes within the Olcese GSA Area have thickness ranging between approximately 1,300 and 1,450 feet and a uniform hydraulic conductivity of 14.4 ft/d and storage coefficient of 0.00145 (see **Figure HCM-4**). The fact that these values are uniform likely reflects the fact that little hydraulic property information exists for this deeper layer/zone.

Given the limited data, some uncertainty exists in values for the hydraulic properties of the Olcese Sand Aquifer Unit in areas other than around the District's pumping wells. This is not unexpected in the Olcese GSA Area, given the relatively sparse coverage of wells and small volume of groundwater use.

Structural Properties of the Basin that Restrict Groundwater Flow Within the Principal Aquifers

☑ **23 CCR § 354.14(b)(4)(C)**

To the northeast of the Olcese GSA Area, subsurface inflows to the groundwater system are laterally restricted by the Kern Gorge Fault which juxtaposes granodiorite bedrock of the Sierra Nevada against the alluvial and marine sedimentary deposits of the Kern Subbasin. Where it is present, the low permeability Round Mountain Silt further limits vertical flow between the overlying Shallow Alluvium and the underlying Olcese Sand Aquifer Unit (**Figure HCM-3**). The Olcese Sand Aquifer Unit progressively thins to the southwest before interfingering and pinching out into the Round Mountain Silt (Bartow, 1984), and

[11] Conversion from permeability to hydraulic conductivity after Table 2.3 of Freeze and Cherry (1979).

also thins to the southeast before pinching out and interbedding with the overlying Edison Shale formation roughly one to two miles south of the Olcese GSA Area.

The top of the Olcese Sand formation dips to greater than 2,300 ft bgs near the Ant Hill Oil Field (approximately 1.5 miles from the southwestern Olcese GSA boundary in the down-dip direction) and to greater than 3,500 ft bgs before pinching out northeast of Bakersfield, substantially below the overlying Kern River, Chanac, and Santa Margarita formations that are the primary sources for groundwater production in the southeastern portion of the Kern Subbasin. Several faults aligned in a northwest/southeast direction (Bartow, 1984) offset the Olcese Sand formation and likely reduce lateral transmissivity. Additional faults to the north of the Olcese GSA Area likely limit hydraulic connection to the north. The progressive thinning, dipping, and displacement via faulting of the Olcese Sand formation to the north and southwest serves to bound usable groundwater resources of the Olcese Sand Aquifer Unit to within the vicinity of the Olcese GSA Area and limits its connectivity to the principal aquifers of the Kern Subbasin.

General Water Quality of Principal Aquifers

☑ 23 CCR § 354.14(b)(4)(D)

General water quality information is based on samples collected from District wells between 2014 and 2017 (see **Figure HCM-7** and **Table GWC-1**). Groundwater in the principal aquifer (Olcese Sand Aquifer Unit) is generally of a sodium-potassium sulfate type, with some seasonal variability, as indicated by samples collected from Wells #2 and #3. The TDS concentrations in Wells #2 and #3 ranged from 860 to 1,100 mg/L. Sulfate concentrations exceeded the secondary Maximum Contaminant Level (MCL) of 250 mg/L in all samples collected between 2014 and 2017, ranging from 320 to 550 mg/L. Iron concentrations in Wells #2 and #3 exceeded the secondary MCL of 0.03 mg/L in eight out of 15 samples, ranging from non-detect to 1.2 mg/L. An analysis of groundwater quality data collected between 2014 and 2017 revealed no significant trends in concentrations of these constituents (see **Appendix E**). In contrast, groundwater from the Canyon View Ranch well is more of a calcium/bicarbonate type and has an average TDS concentration of 230 mg/L (i.e., similar to the Kern River).

Stable isotope data indicate that groundwater in the Olcese Sand Aquifer Unit is "heavier" than waters of the Kern River (see **Figure HCM-8**), but still somewhat lighter than the stable isotope ratios characteristic of local precipitation in the area (Visser et al., 2016). Based on the isotopic signature of the Olcese Sand Aquifer Unit groundwater, recharge sources appear to be dominated by local rainfall (presumably falling onto exposed outcrops of Olcese Sand formation east and north of the Olcese GSA Area) with the remainder coming from lighter waters sourced from the Kern River (i.e., via seepage through the Kern Gorge Fault and/or through areas of hydraulically-connected Shallow Alluvium near the eastern margin of the basin).

Groundwater from District Well #4 is of a sodium bicarbonate type and has lower concentrations of TDS (710 to 840 mg/L), sulfate (130 to 240 mg/L), and iron (0.066 mg/L) than those of Wells #2 and #3 (see **Figure HCM-7** and **Table GWC-1**). However, sulfate and TDS concentrations still consistently approach and exceed their secondary MCLs in this well. Waters in this well also show a more alkaline pH of 8.8 compared to the pH range of 7.7-8.5 observed in wells #2 and #3. Further discussion is provided in **Section 8.4 *Groundwater Quality Concerns***.

Primary Use or Uses of Each Aquifer

☑ 23 CCR § 354.14(b)(4)(E)

The primary use of groundwater within the Olcese GSA Area is to supply irrigated agriculture, primarily citrus and other permanent tree crops (see **Figure HCM-9**). Groundwater pumped from District Wells #2, #3, and #4 (and historically Well #1) is used to meet excess demands for irrigation that are not met by the District and its primary landowner's (Nickel Family LLC) riparian and non-riparian rights to Kern River surface water. The Canyon View Ranch is used by the Anne Sippi Clinic as the raw water source for their domestic water supply; this is the only known potable consumption of groundwater in the Olcese GSA Area. Additionally, some water is used by local ranchers for stock water. All of the pumped groundwater comes from the Olcese Sand Aquifer Unit. There are no known active wells completed in the Shallow Alluvium.

7.2. Cross-Sections

☑ 23 CCR § 354.14(c)

Two geologic cross-sections (A-A' and B-B') were developed in support of this HCM (see **Figure HCM-10** and **Figure HCM-11** respectively). The two cross-sections were drawn orthogonal to each other, with cross-section A-A' generally aligned parallel to the strike direction of the regional Round Mountain Silt and Olcese Sand Aquifer Unit and cross-section B-B' aligned along the dip direction of these units. The locations of the cross-sections with respect to the detailed surficial geology mapped by the United States Geological Survey (USGS) (Bartow, 1984) are shown on **Figure HCM-3**. The cross-sections extend horizontally beyond the boundaries of the Olcese GSA Area and extend vertically below the Olcese Sand Aquifer Unit. These cross-sections were developed in consideration of the following:

- Land surface elevation extracted from Google Earth (which is based on the National Elevation Dataset);
- DOGGR oil wells proximal to the cross-section lines and geophysical logs ("e-logs") which informed the contact points between major formations. Locations of DOGGR oil wells used in the development of the cross-sections are shown on **Figure HCM-12**.
- Subsurface geologic units, informed by Bartow (1984) and DOGGR oil well information;
- Well construction information for the District's wells; and
- Groundwater elevation data from two of the District's wells measured in 2015.

Cross-Section A-A'

Cross-sections A-A' extends for approximately five miles in a northwest-southeast direction crossing through the eastern portion of the Olcese GSA Area. The cross-section starts approximately one mile northwest the District service area boundary and about two miles north of the Olcese GSA Area boundary. In the northern portion of the cross-section outside of the Olcese GSA Area, the surficial geologic unit is the Round Mountain Silt. Based on DOGGR well records and e-logs, the Olcese Sand formation occurs at depths of approximately 1,000 ft bgs[12] and is underlain by low resistivity strata presumed (based on the regional cross-sections of Bartow [1984]) to be the Freeman Silt. The depth to the base of the Olcese Sand formation in this area is approximately 2,000 ft bgs. DOGGR well records in this area indicate the Vedder Sand at depths of roughly 3,000 ft bgs.

Further south, where the cross-section line crosses the northern Olcese GSA Area boundary, the surficial geologic unit is Younger Alluvium. On the southern side of the Kern River, the surficial geology along the cross-section line transitions to Older Alluvium comprising the southern terrace deposits. These Younger and Older Alluvium units are combined herein for purposes of this HCM into the "Shallow Alluvium" and based on limited well log information are likely no more than a few tens of feet thick.[13] Underlying the Shallow Alluvium is the Round Mountain Silt, which in turn overlies the Olcese Sand formation (i.e., Olcese Sand Aquifer Unit) the top of which is encountered at depths of approximately 700 to 1,000 ft bgs. The District's Wells #1, #2, and #3 are screened within the Olcese Sand Aquifer Unit. Groundwater elevations in Wells #2 and #3 in Spring 2015 (mid-March) were both approximately 381 ft msl.

South of the Olcese GSA Area, the Round Mountain Silt again appears at the surface, and at a point roughly one mile south the surficial geology transitions to the Bena Gravel formation. The exact nature of the interfingered spatial relationship between the Miocene Bena Gravel, Round Mountain Silt and Olcese Sand formation is uncertain. As in the areas to the north, the Round Mountain Silt in this area is underlain by the Olcese Sand formation, which has a thickness on the order of 1,000 feet and is in turn underlain by a low resistivity unit (likely the Freeman Silt), the Pyramid Hills member of the Jewett Sand formation, and the Vedder Sand.

Cross-Section B-B'

Cross-section B-B' extends roughly five miles in a southwest-northeast direction, sub-parallel to the Kern River through the southern portion of the Olcese GSA Area. In the far eastern portion of the cross-section the land surface is elevated and slopes steeply to the west, and the surficial geology is granitic bedrock. Moving southwestward, the cross-section line crosses over the Kern Gorge Fault approximately half a mile from the eastern cross-section extent and enters a small area of Older Alluvium associated with a small unnamed surface water drainage.

For the remainder of the cross-section the underlying stratigraphy consists of a series of westward-dipping Tertiary strata, decreasing in age from east to west (i.e., starting with the Walker formation in the east, and working stratigraphically upwards through the Vedder Sand, the Jewett Sand including the Pyramid Hill member, the Freeman Silt, the Olcese Sand, the Round Mountain Silt, the Chanac Formation, and the Kern River Formation).[14] These units are generally thinner in the northeast and dip down and thicken to the southwest. The easternmost DOGGR well record shows approximately 500 feet thickness of Round Mountain Silt, underlain by approximately 700 feet of Olcese Sand, and then relatively thin Freeman Silt, Jewett Sand and Vedder Sand on top of metamorphic basement rock (schist). The Olcese Sand outcrops

[12] Based on the surficial geologic map of Bartow (1984), the Olcese sand formation is exposed within valleys in the area north of the Olcese GSA Area.

[13] Well log data from wells in the alluvial valley of Kern River indicate thicknesses of coarse alluvium (boulders, gravel, and sand) of 12 ft (DWR Well Log #27558; Canyon View Ranch well), 40 ft (DWR Well Log #119735), 30 ft (DWR Well Log #76739), 20 ft (DWR Well Log #764374), 40 ft (DWR Well Log #76726), 47 ft (DWR Well Log #90921), 28 ft (USBR Well #29-29-12), and 80 ft (DWR Well Log #76710).

[14] Due to stratigraphic thinning and pinching out, as well as inconsistent information in DOGGR well records, not all stratigraphic units listed above are shown at each location in the cross-section.

along the line of section in a small valley in the eastern portion. This outcrop likely plays a role in recharging the Olcese Sand Aquifer Unit.

The middle of the cross-section is generally underlain by Round Mountain Silt, except where the section cuts through the southern edge of the Older Alluvium deposit on the south side of the Kern River. The top of the Olcese Sand formation is encountered at depths of roughly 700 to 1,300 ft bgs in this area, and the thickness is on the order of 1,000 feet. Near the southwestern Olcese GSA Area boundary the depths of the Olcese Sand, Jewett Sand, and Walker Formation, based on DOGGR well records, are elevated by approximately 500 feet relative to areas further east and west, suggesting offset by faulting in this area.

In the far southwestern end of the cross-section, the surficial geologic units (from east to west) are the Chanac Formation, Kern River Formation, and Older Alluvium. These units eventually thicken to the west, becoming the major aquifer units in the main portion of the Kern Subbasin. In this far western portion of the cross-section, the Round Mountain Silt is over 1,000 feet thick, and the Olcese Sand formation is encountered at depths between approximately 2,200 and 2,400 ft bgs.

7.3. Physical Characteristics

☑ **23 CCR § 354.14(d)**

7.3.1. Topographic Information

☑ **23 CCR § 354.14(d)(1)**

The Olcese GSA Area is essentially a relatively flat alluvial floodplain along the Kern River surrounded by steep-sloping hills/escarpments on its northern, eastern, and southern margins (**Figure HCM-13**). Specifically, the Olcese GSA Area is situated downstream of the Kern River Canyon, just west of the Kern Gorge Fault which elevates the Sierra Nevada granitic bedrock in the east relative to the rest of the Kern Subbasin. Elevations along the top of the mountain front east of the Olcese GSA Area exceed 2,500 ft msl. In the central part of the Olcese GSA Area, the Kern River is incised in a series of older alluvial terraces, with relatively steep escarpments separating the active flood plain from older terrace surfaces. Elevations within the valley floor area where most agricultural land use occurs range from approximately 550 to 800 ft msl. The Olcese GSA Area is also surrounded by foothills near its northern and southern boundaries, reaching elevations of 1,100 ft msl and 1,200 ft msl, respectively. Several small creeks drain into the Kern River from the north and south, the most prominent of which is Cottonwood Creek.

7.3.2. Surficial Geology

☑ **23 CCR § 354.14(d)(2)**

The following discussion of surficial geology is largely based on the *Geologic Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley* (Bartow, 1984), which was discussed previously in **Section 7.1.4 *Principal Aquifers and Aquitards*** and **Section 7.2 *Cross Sections***. **Figure HCM-3** shows the surficial geologic units within the Olcese GSA Area which include predominantly the (Holocene) Younger Alluvium ("Qya") within the bed of the Kern River and the (Pleistocene) Older Alluvium ("Qoa") at its margins.

Surrounding the alluvium on both sides of the Kern River are several outcroppings of the Miocene Round Mountain Silt ("Trm") formation. These outcroppings extend to the northwest and southeast through the Olcese GSA Area, abutting the Sierra Nevada bedrock along the Kern Gorge Fault on the north side of the Kern River valley, and abutting the underlying Lower Miocene Olcese Sand ("To") on the southern side of the valley. The Olcese Sand outcrops in some locations, typically at topographical low-points where the Round Mountain Silt was likely eroded. The most proximal Olcese Sand outcrops mapped by Bartow (1984) are shown within the valleys of the hills on the northern margins of the District (the valley traced by Rancheria Road, towards Pyramid Hill).[15] The next closest Olcese Sand outcroppings mapped by Bartow (1984) include a small wedge near the northeastern District boundary just west of the Kern Gorge Fault, and another outcrop adjacent to the Sierra Nevada bedrock roughly one mile southeast of the District. The foothills to the southwest of the Olcese GSA Area are predominantly underlain by Round Mountain Silt and further to the west by the Pliocene/Upper Miocene Kern River formation ("Qtkr").

7.3.3. Soil Characteristics

☑ **23 CCR § 354.14(d)(3)**

Figure HCM-14 shows the soil map units within the Olcese GSA Area, based on the Soil Survey Geographic Database (SSURGO), developed by the National Resources Conservation Service from the United States Department of Agriculture (USDA-NRCS). The predominant soil map units within the Olcese GSA Area are the Chanac-Pleito complex, silt loam, clay loam and Brecken-Cuyama-Pleito complex units found along the alluvial terraces; the xerofluvents and riverwash units found along the main Kern River channel; and the Pleito-Trigo-Chanac complex found mainly in areas underlain by Round Mountain Silt. Soils are almost entirely classified as Hydrologic Soil Group "C", indicating average infiltration rates and moderately high runoff potential, with a few areas classified by Hydrologic Soil Group "B" or "A", indicating above average to high infiltration rates and moderately low to low runoff potentials, respectively. Vertical saturated hydraulic conductivity is generally in the 0 to 10 feet per day (ft/day) range except for soils along the Kern River bed which have higher conductivities, up to and greater than 20 ft/day.

7.3.4. Recharge Areas

☑ **23 CCR § 354.14(d)(4)**

Analysis of water quality and stable isotope data suggests that the Olcese Sand Aquifer Unit is predominantly recharged by local precipitation (see **Figure HCM-8**), but likely also receives some portion of its recharge from the Kern River and/or the overlying Shallow Alluvium. The actual mechanisms and rates of recharge from these recharge sources to the Olcese Sand Aquifer Unit, however, are not well understood. Recharge areas for direct precipitation include Olcese Sand outcroppings within and proximate to the Olcese GSA Area (see **Figure HCM-3**) as well as those further to the north and southeast along the eastern margins of the Kern Subbasin. Recharge mechanisms from the Kern River likely include seepage through the Kern Gorge Fault zone and/or through the Shallow Alluvium where the Round Mountain Silt has been eroded on the very eastern edge of the Olcese GSA Area.

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[15] Electric log data from DOGGR oil wells collected near these mapped outcroppings indicates that the contact between the Round Mountain Silt and the Olcese Sand occurs 300-400 ft bgs in this area, suggesting some inconsistency with the Olcese Sand outcroppings interpreted and mapped by Bartow (1984). Regardless, both Bartow (1984) and CDMG (1964) map substantial outcrops of lower Miocene rocks in the area to the north of the Olcese GSA Area.

7.3.5. Surface Water Bodies

☑ 23 CCR § 354.14(d)(5)

Significant natural surface water features are shown on **Figure HCM-15**. The Kern River and its contributing watersheds are important to the management of the groundwater system underlying Olcese GSA Area. Based on water budget further discussed in **Section 9 *Water Budget Information***, the District obtains roughly 79% of its total water supply from the Kern River through a system of long-standing riparian and non-riparian rights that it owns or manages on behalf of its primary landowner, Nickel Family LLC, with the remaining demands (approximately 21%) met by groundwater pumping. The Kern River is fed from some of the highest elevation watersheds in the Sierra Nevada before discharging into Isabella Lake, where outflows are controlled by the Isabella Dam. The river then receives additional runoff from approximately 234 square miles of contributing watersheds as it flows through the Kern River Canyon, through the Olcese GSA Area, and into the central part of the Kern Subbasin. The only other significant (i.e., named) natural surface water body contributing to the Olcese GSA Area is Cottonwood Creek (drainage area of approximately 51 square miles), which crosses into the Olcese GSA Area from the south.

7.3.6. Source and Point of Delivery for Imported Water Supplies

☑ 23 CCR § 354.14(d)(6)

The Olcese GSA Area does not receive any imported water supplies. A small amount of domestic supply is provided by the California Water Service Company (Cal Water) to District headquarters, local residents, and the community on Rancheria Road (which is technically outside of the Olcese GSA boundaries). This domestic water supply is sourced from a treatment plant downstream of the Olcese GSA Area near Lake Ming and is delivered directly to individual service connections via a network of underground pipelines. District facilities, including production wells, canals, pipelines, turnouts, reservoirs, and the Rio Bravo Hydroelectric Plant are shown on **Figure HCM-16**.

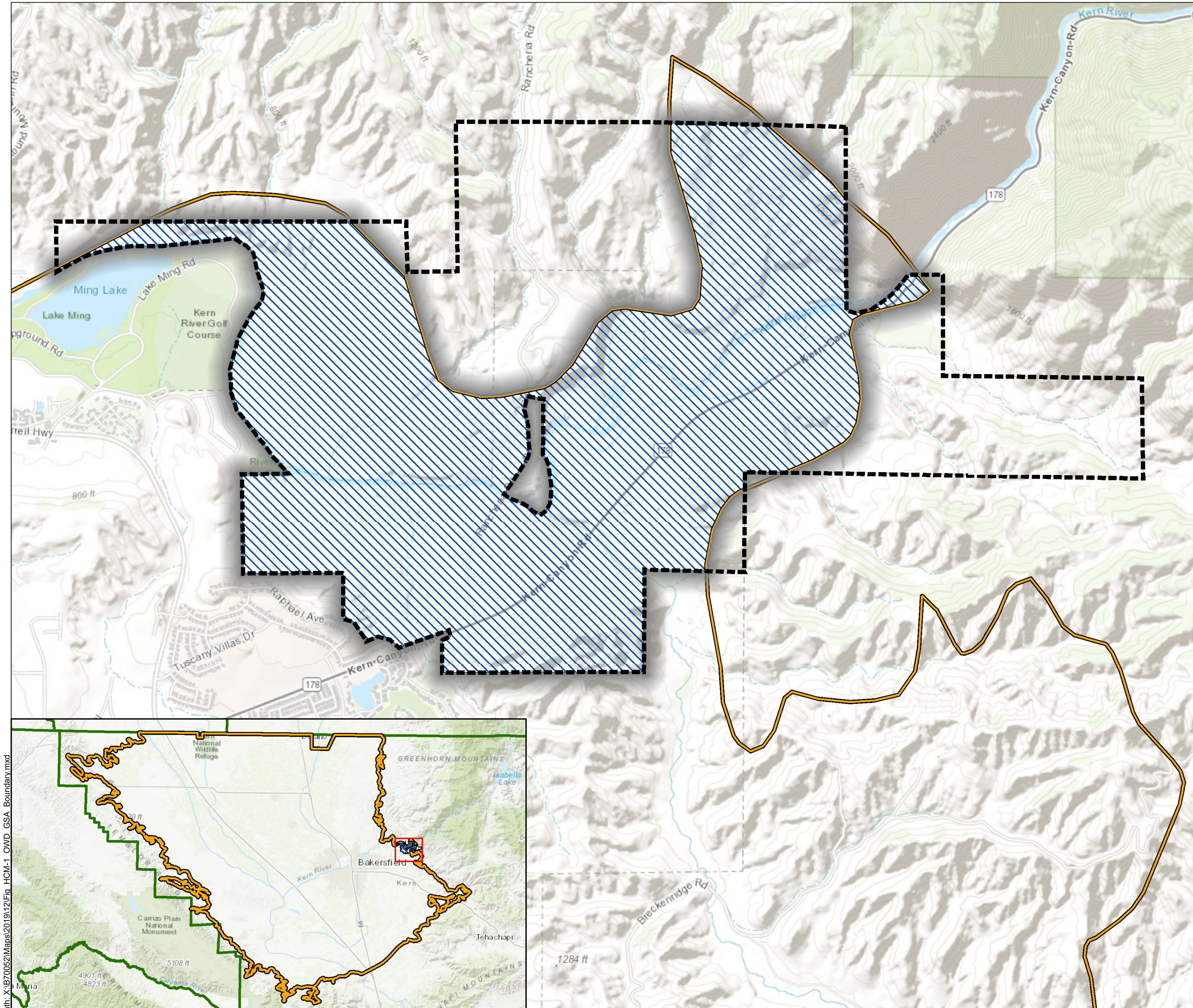
7.4. Data Gaps

☑ 23 CCR § 354.14(b)(5)

Existing data gaps and sources of uncertainty in the HCM include:

- Uncertainty regarding the aquifer properties of the Olcese Sand Aquifer Unit;
- Uncertainty about the degree of connection between the Olcese Sand Aquifer Unit and Shallow Alluvium in the northeastern portion of the Olcese GSA Area;
- Uncertainty about the source and rate of recharge of the Olcese Sand Aquifer Unit;
- Uncertainty about the location and extent of the Olcese Sand formation outcrops on the north side of Olcese GSA Area;
- Uncertainty about groundwater elevations outside the Olcese GSA boundary, resulting in uncertainty in the estimation of groundwater outflows; and

- Lack of consistent long-term historical water level data from District wells, and resultant uncertainty about groundwater gradients. This is discussed further below in **Section 8.1 *Groundwater Elevations and Flow Direction***.



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Legend

- County Boundary
- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District GSA
- Olcese Water District Service Area

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. Hatched portion of the OWD Service Area is the OWD GSA.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - 2016 Update.
3. OWD boundary obtained from OWD on 12 April 2017.

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Olcese Water District
Service Area and GSA Area

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Kern County, California
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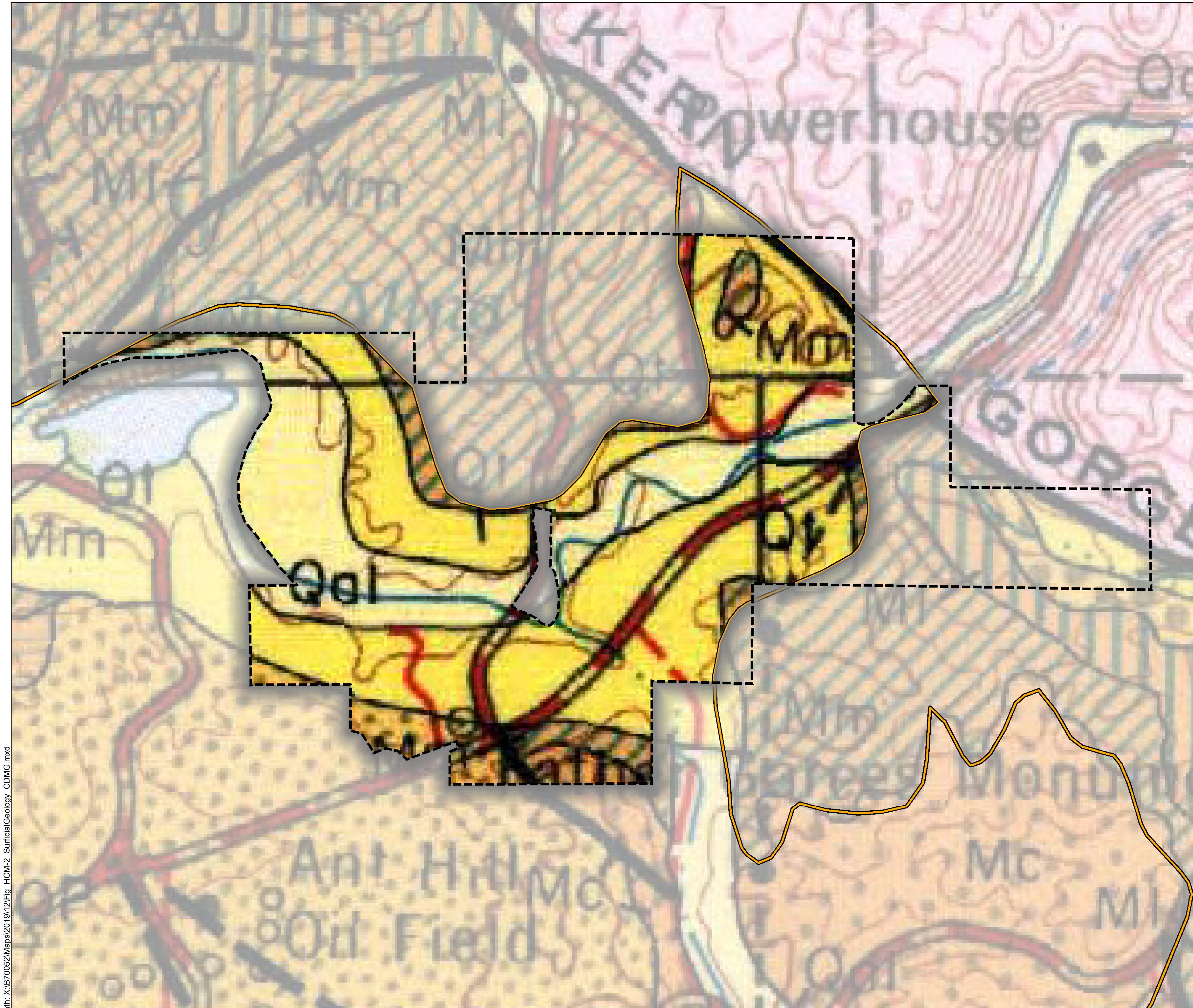
Figure HCM-1



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District

Geologic Units (in stratigraphic order)

- Qal — Recent alluvium
- Qt — Pleistocene nonmarine
- QP — Plio-Pleistocene nonmarine
- Qt — Pleistocene nonmarine terrace deposits
- Mc — Undivided Miocene nonmarine
- Mu — Upper Miocene marine
- Mm — Middle Miocene marine
- Ml — Lower Miocene marine
- Tc — Tertiary nonmarine
- gr — Mesozoic granitic rocks
- ls — Pre-Cretaceous metamorphic rocks

Abbreviations

C.D.M.G. = California Division of Mines and Geology
DWR = California Department of Water Resources
OWD = Olcese Water District

Notes

1. All locations are approximate.

Sources

1. C.D.M.G., Geologic Map of California, Olaf P. Jenkins Edition, Bakersfield Sheet (1964) and Los Angeles Sheet (1969).

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Surficial Geology - C.D.M.G.

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Figure HCM-2

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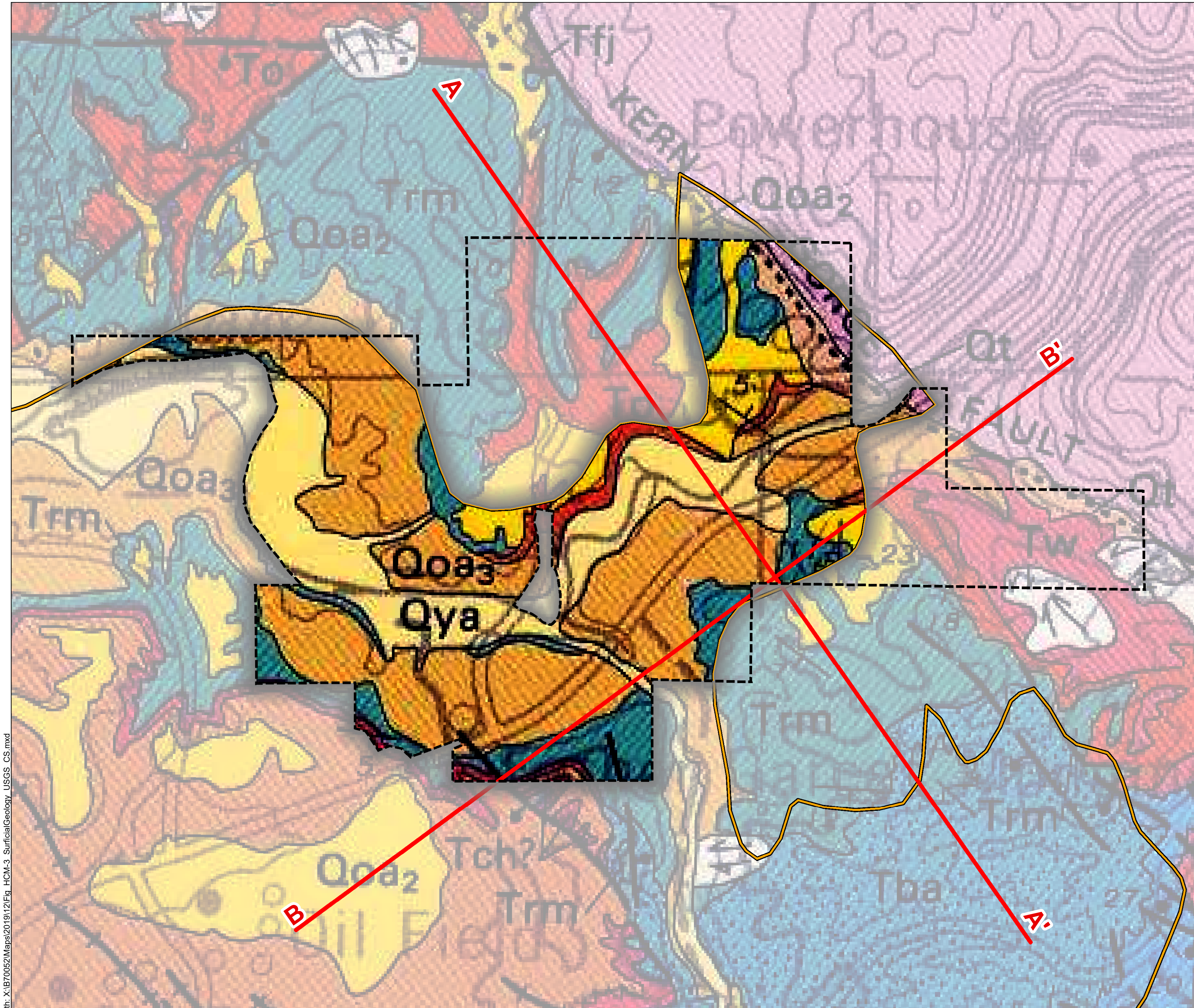

Legend

Kern County Subbasin (DWR 5-022.14)

Olcese Water District

Cross-Section Location

Geologic Units (in stratigraphic order)

- Qya — Younger Alluvium (Holocene & Upper Pleistocene)
- Qoa_1 — Older Alluvium (Pleistocene) - Low Terraces
- Qoa_2 — Older Alluvium (Pleistocene) - High Terraces
- Qoa_3 — Older Alluvium (Pleistocene) - Dissected Fans
- QTkr — Kern River Formation
- Tch — Chanac Formation
- Tsm — Santa Margarita Formation
- Trm — Round Mountain Silt
- To — Olcese Sand
- Tf — Freeman Silt
- gr — Granitic Rocks

Abbreviations

OWD = Olcese Water District

U.S.G.S. = United States Geological Survey

Notes

1. All locations are approximate.

Sources

1. Bartow, J. Alan, 1984. Geologic Map and Cross Sections of the Southeastern Margin of the San Joaquin Valley, California, U.S. Geological Survey, Miscellaneous Investigation Series, Map I-1496.

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Surficial Geology - U.S.G.S.

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Figure HCM-3

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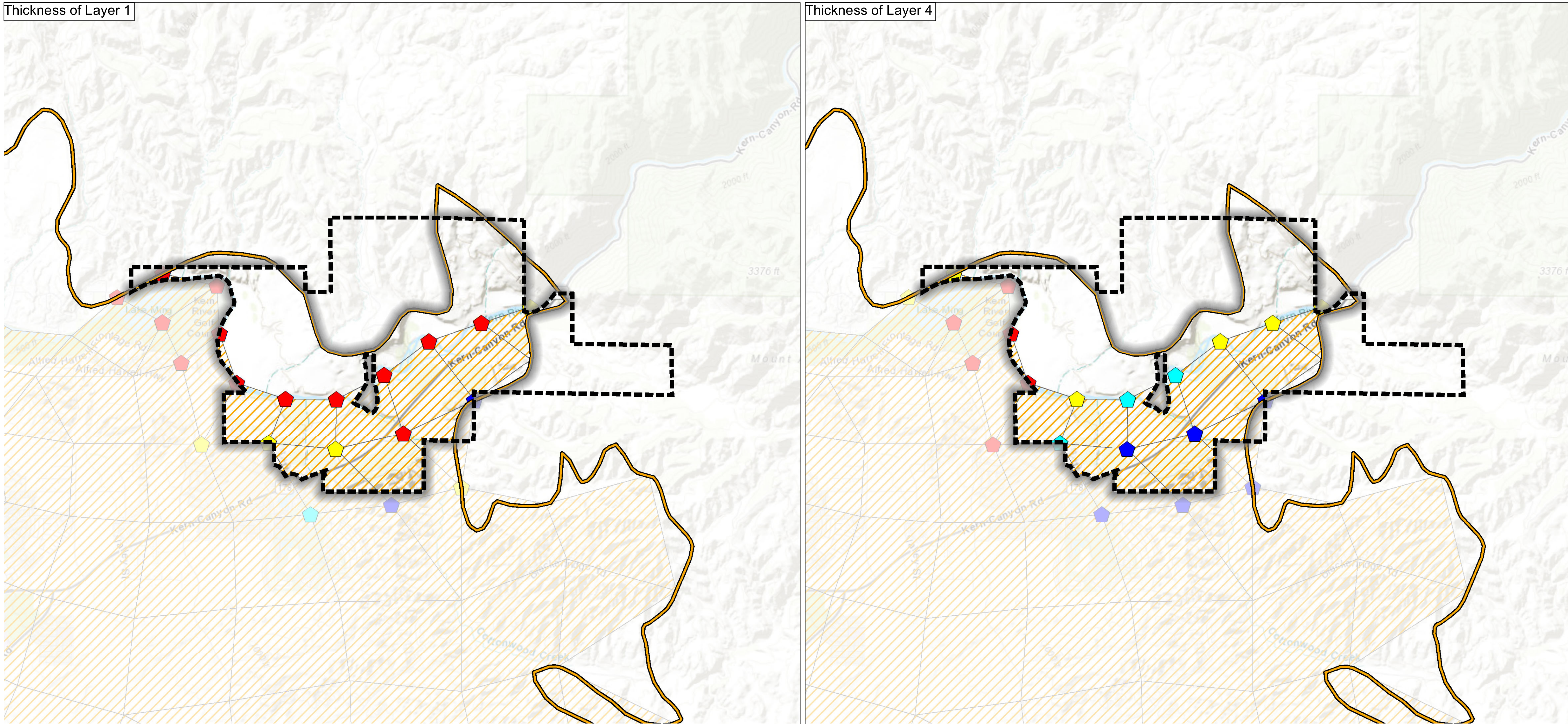

Legend

- Olcese Water District Service Area
- Kern County Subbasin (DWR 5-022.14)
- C2VSim-FG Elements

Layer 1 Thickness (ft)

- 150 - 300
- 300 - 450
- 450 - 600
- > 600

Layer 4 Thickness (ft)

- 1300 - 1350
- 1350 - 1400
- 1400 - 1450
- >1450

Abbreviations

C2VSim-FG = California Central Valley Groundwater - Surface Water Simulation Model - Fine Grid
CNRA = California Natural Resources Agency
DWR = California Department of Water Resources
ft bgs = feet below ground surface
GSA = Groundwater Sustainability Agency

Notes

1. All locations are approximate.
2. Layer 1 represents the Shallow Alluvium, Layer 4, the Olcese Sand Aquifer.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. C2VSim-FG Model data obtained from CNRA website:
   https://data.cnra.ca.gov/dataset/c2vsimfg-beta-mode

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Thickness of Layers 1 and 4 in C2VSim-FG Model (Beta Version)

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Figure HCM-4

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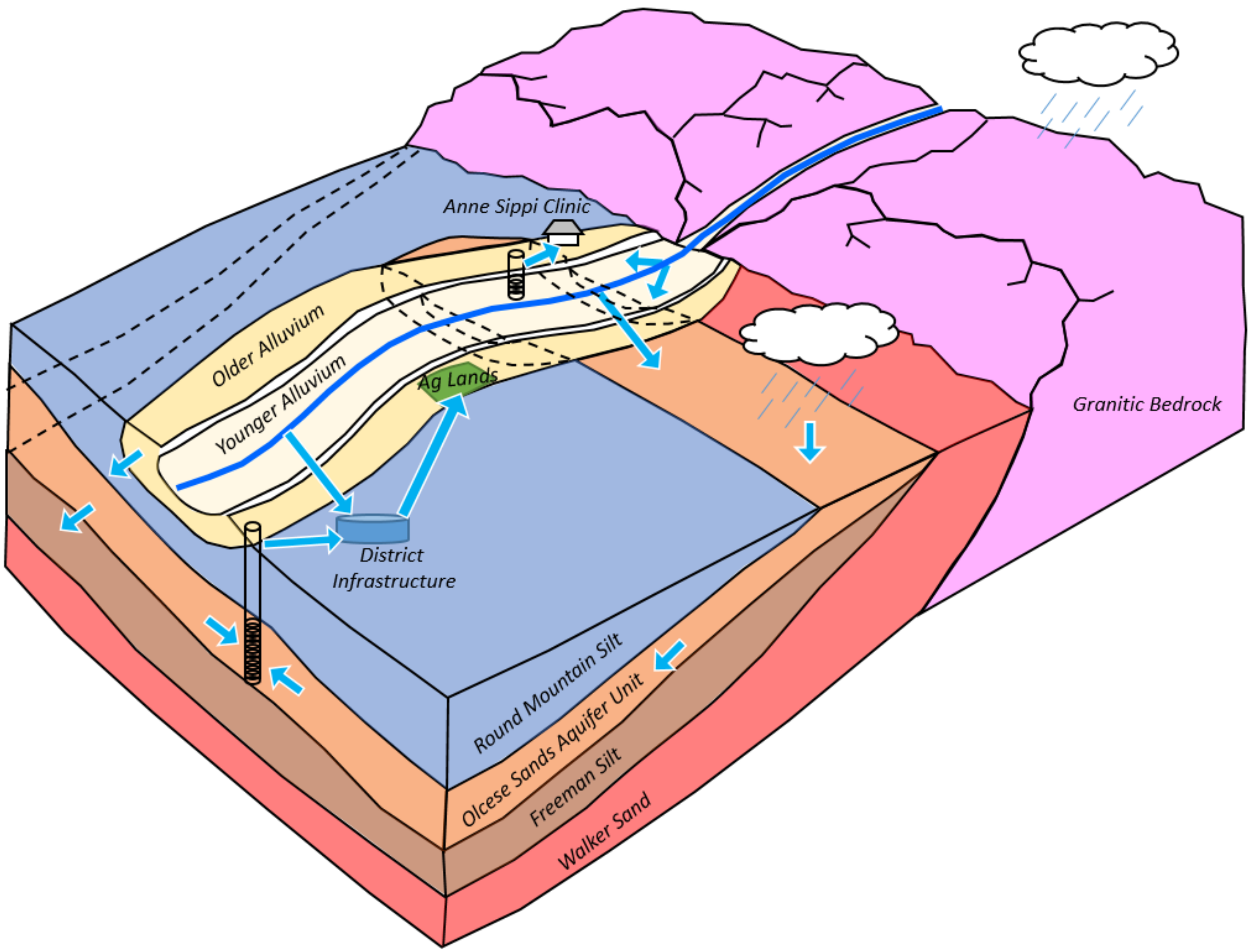

Abbreviations

Ag = agricultural

Notes

1. Not to scale – for illustration purposes only.

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Hydrogeologic Conceptual Model Diagram

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Kern County, California
December 2019
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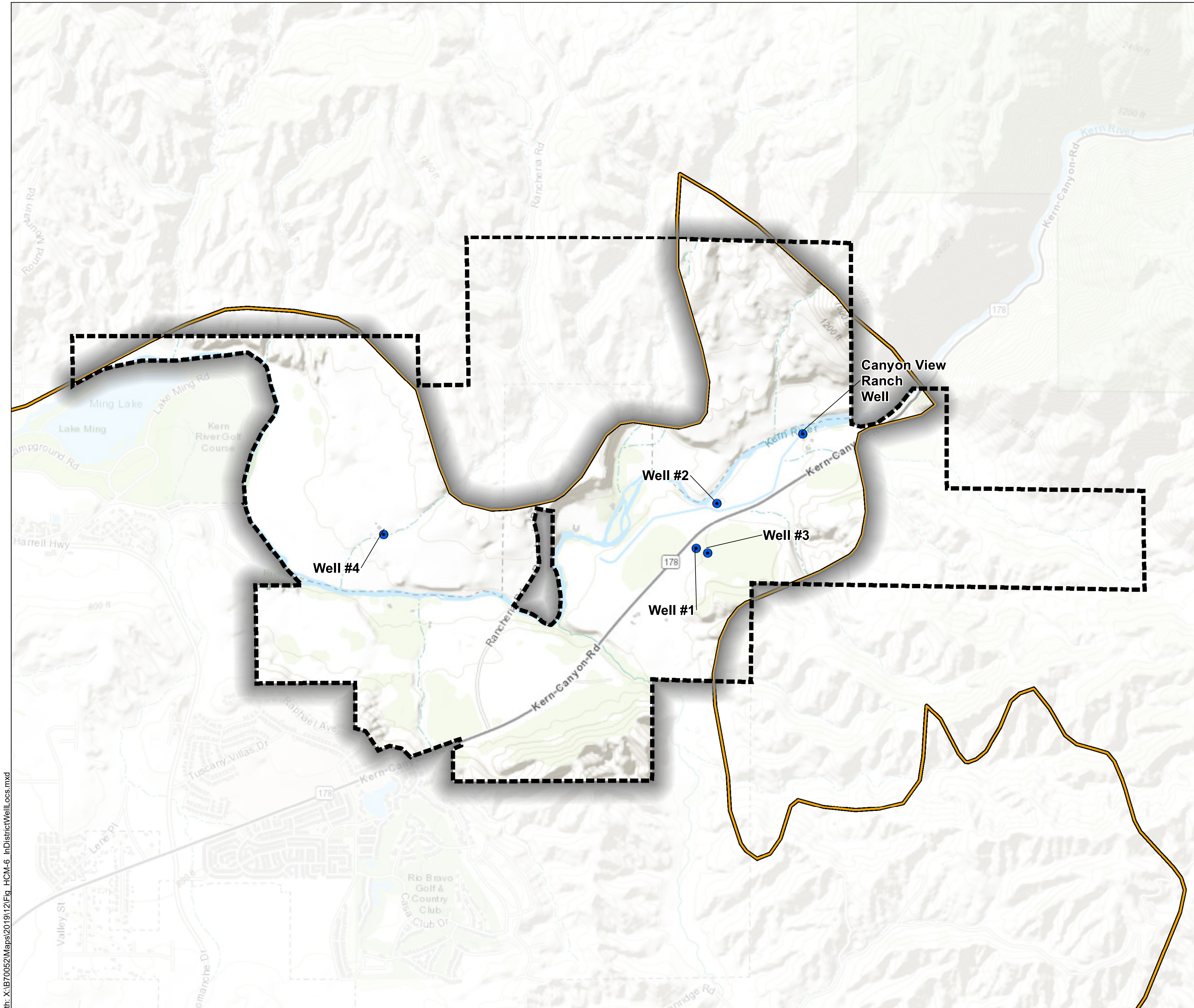
Figure HCM-5



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Service Area
- OWD Wells

Abbreviations

DWR = California Department of Water Resources
OWD = Olcese Water District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Well information obtained from OWD on 18 May 2017.

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In-District Well Locations

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Figure HCM-6

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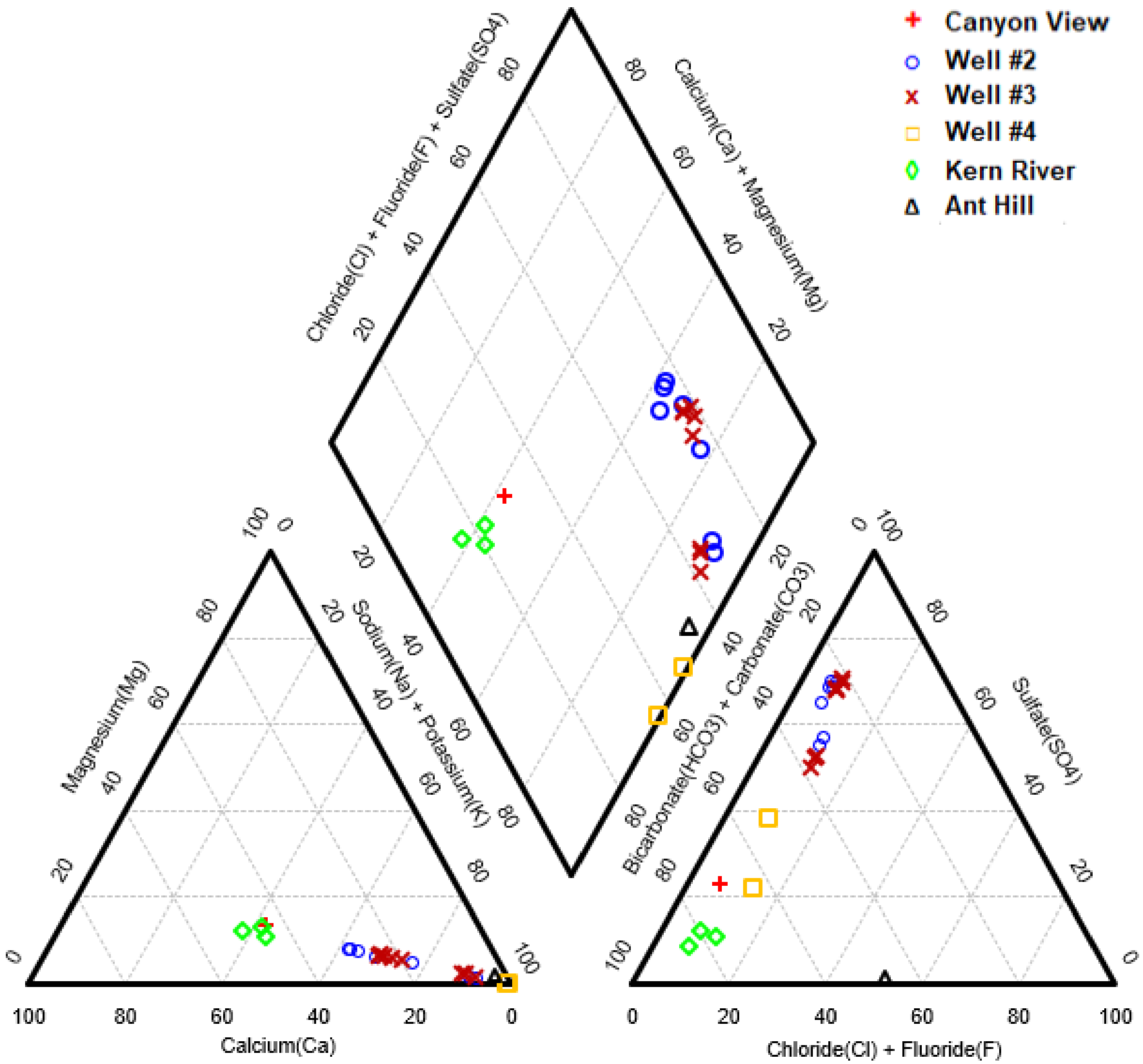

Abbreviations

OWD = Olcese Water District

Notes

1. Ant Hill Oil Field water quality based on historical data collected during initial phase of oil production (see Source 2).

Sources

1. In-District water quality data obtained from OWD on 2 May 2017.
2. Hill, F.L., 1972, oil and Gas Field Waters in Southeastern San Joaquin Valley, Kern County CA; 58th Annual Report of State Oil & Gas Superviso, Technical Paper v. 58 no. 1, pp. 31-44.

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Water Quality - Piper Diagram

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Kern County, California
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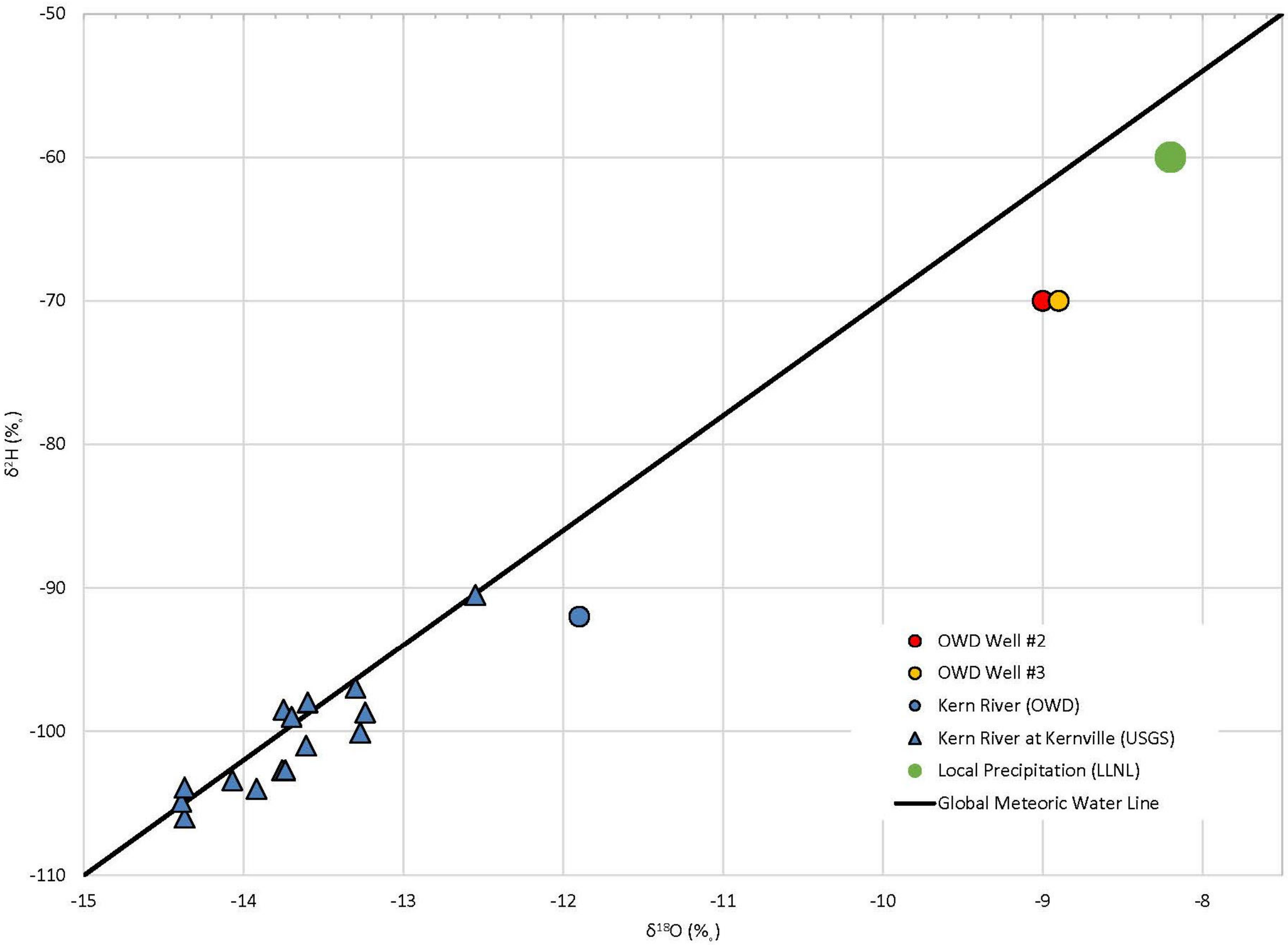
Figure HCM-7



Abbreviations

- ^2H = Deuterium
- ^{18}O = Oxygen-18
- LLNL = Lawrence Livermore National Laboratory
- OWD = Olcese Water District
- USGS = United States Geological Survey

Notes

1. Local precipitation isotope values do not represent actual data but are rather inferred from literature (see Source 2).

Sources

1. In-District isotope data obtained from OWD on 2 May 2017.
2. Visser, A., Moran, J.E., Singleton, M.J, Esser, B.K., 2016. California GAMA Special Study: Importance of River Water Recharge to Selected Groundwater Basins. LLNL, Cal State East Bay, CA
3. Coplen, T.B., Kendal, C., 2000. Stable Hydrogen and Oxygen Isotope Ratios for Selected Sites of the U.S. Geological Survey's NASQAN and Benchmark Surface-water Networks. USGS Open-File Report 00-160.

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Water Quality – Stable Isotopes

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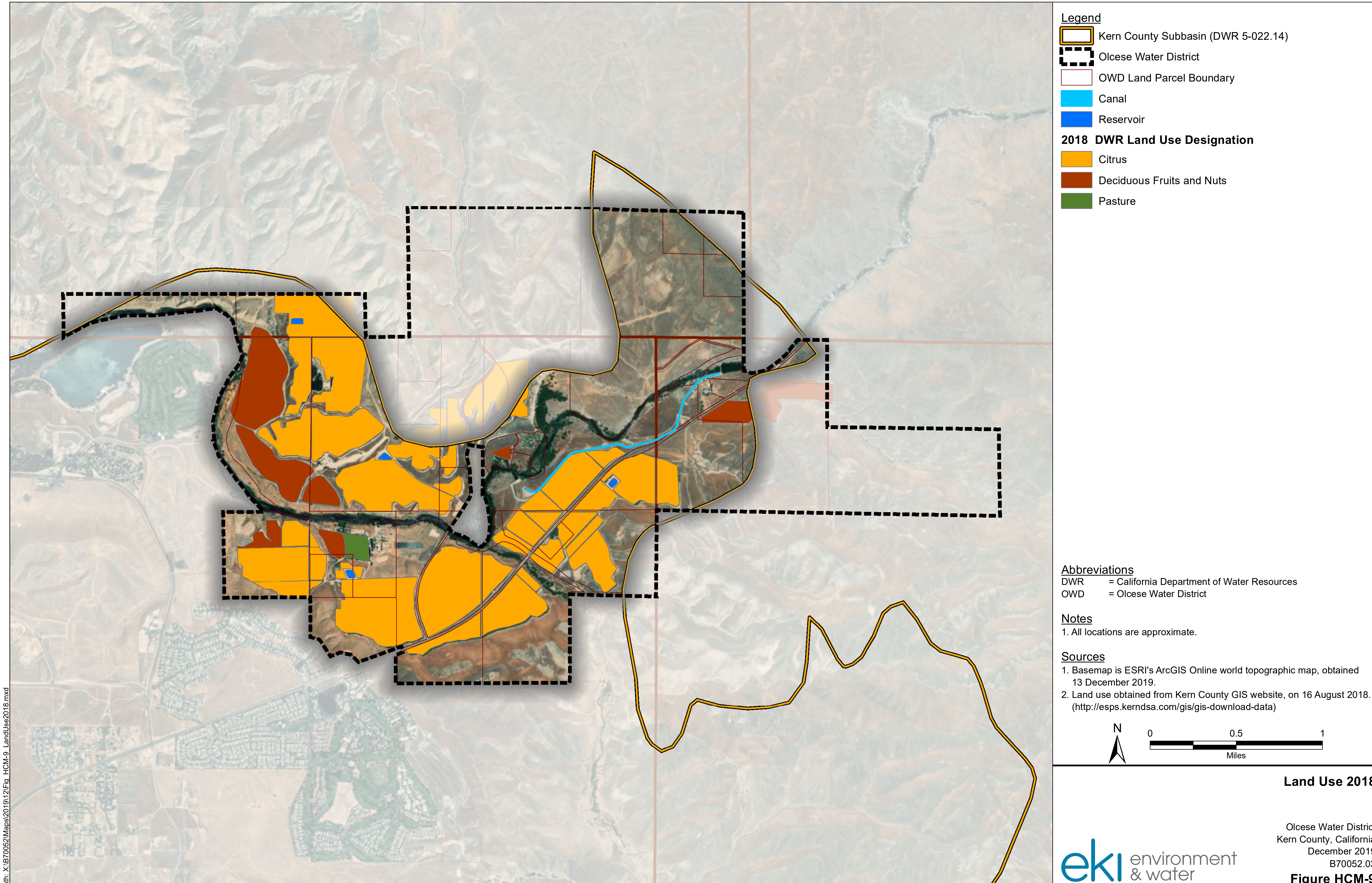
Figure HCM-8



Abbreviations

DWR = California Department of Water Resources
OWD = Olcese Water District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Land use obtained from Kern County GIS website, on 16 August 2018. (http://esps.kerndsa.com/gis/gis-download-data)

Land Use 2018

Olcese Water District
Kern County, California
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Figure HCM-9

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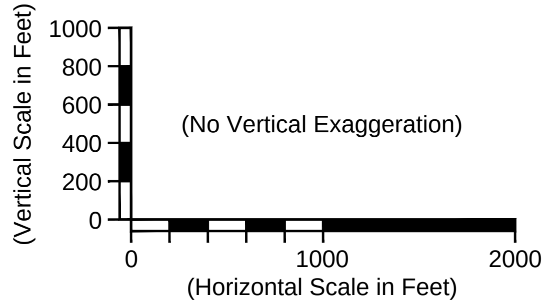
GEOLOGIC CROSS-SECTION A - A'



Legend:

- 2932056 — DOGGR Well API Number
- DOGGR Well Top Elevation
- Contact Line
- Spring 2015 Water Level
- DOGGR Well Total Depth
- District Well Elevation
- District Well Screened Interval

Geologic Units (after Bartow, 1984)

- Qya = Younger Alluvium
- Qoa = Older Alluvium
- Trm = Round Mountain Silt
- Tba = Bena Gravel
- To = Olcese Sand
- Tf = Freeman Silt
- Tj = Jewett Sand
- Tv = Vedder Sand

Abbreviations:

ft msl	= feet above mean sea level
DOGGR	= Division of Oil, Gas and Geothermal Resources
GSA	= Groundwater Sustainability Agency
OWD	= Olcese Water District

Notes:

1. Geologic contacts dashed where approximate.
2. Ground surface elevation profile along line of section from Google Earth.
3. Elevations of contacts between geologic units are based on depths derived from DOGGR well records, adjusted for the dip of the units and projected distance of wells from the section line.

GEOLOGIC CROSS-SECTION A-A'

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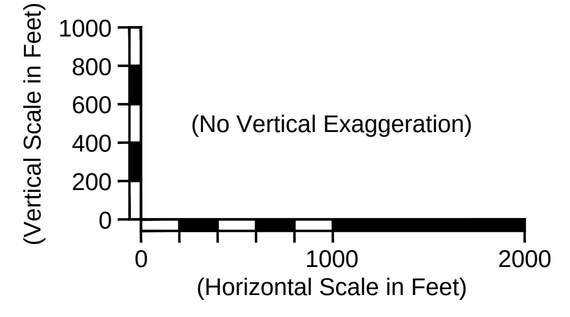
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure HCM-10

GEOLOGIC CROSS-SECTION B - B'



Legend:

- 2932056 — DOGGR Well API Number
- DOGGR Well Top Elevation
- Contact Line
- Spring 2015 Water Level
- DOGGR Well Total Depth
- District Well Elevation
- District Well Screened Interval

Geologic Units (after Bartow, 1984)

- Qya = Younger Alluvium
- Qoa = Older Alluvium
- QTkr = Kern River Formation
- Tch = Chanac Formation
- Trm = Round Mountain Silt
- To = Olcese Sand
- Tf = Freeman Silt
- Tj = Jewett Sand
- Tv = Vedder Sand
- Tw = Walker Sand

Abbreviations:

ft msl	= feet above mean sea level
DOGGR	= Division of Oil, Gas and Geothermal Resources
GSA	= Groundwater Sustainability Agency

Notes:

1. Geologic contacts dashed where approximate.
2. Ground surface elevation profile along line of section from Google Earth.
3. Elevations of contacts between geologic units are based on depths derived from DOGGR well records, adjusted for the dip of the units and projected distance of wells from the section line.

GEOLOGIC CROSS-SECTION B-B'

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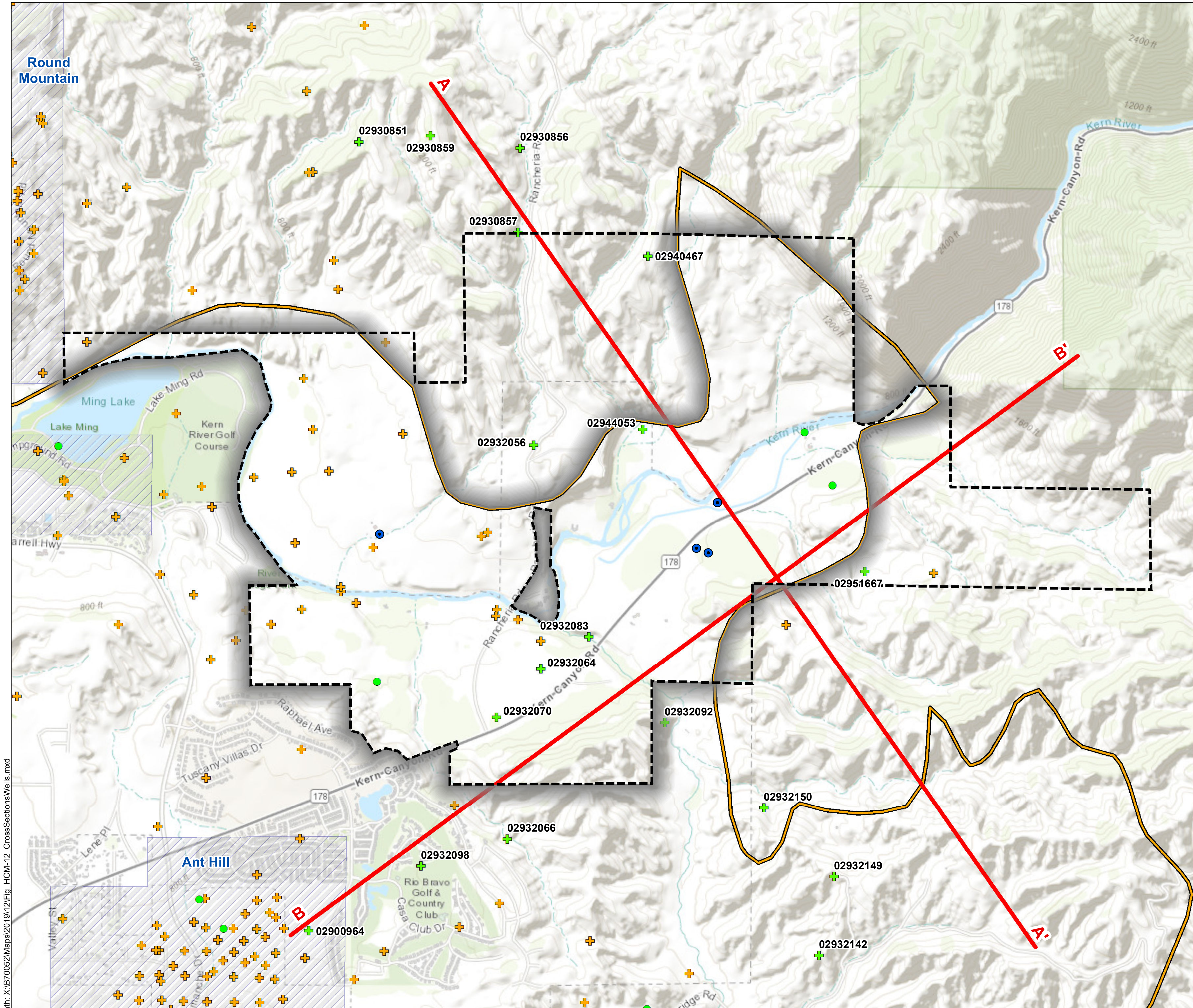
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure HCM-11



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- DOGGR Oil Field
- Cross-Section Location
- DOGGR Well or Test Well
- DOGGR Wells Selected for Cross-Sections
- OWD Wells

Abbreviations

DOGGR = Division of Oil, Gas, and Geothermal Resources
DWR = California Department of Water Resources
GAMA = Geotracker Groundwater Ambient Monitoring and Assessment Program
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. DWR well locations approximated based on description given in DWR well construction logs (see source 3).

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. DOGGR wells obtained from DOGGR online database on 1 April 2017.
3. DWR well log information obtained from DWR on 1 April 2017.
4. GAMA well locations obtained from GAMA online database on 1 November 2017.

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District Wells, DOGGR Wells, and Cross-Section Locations

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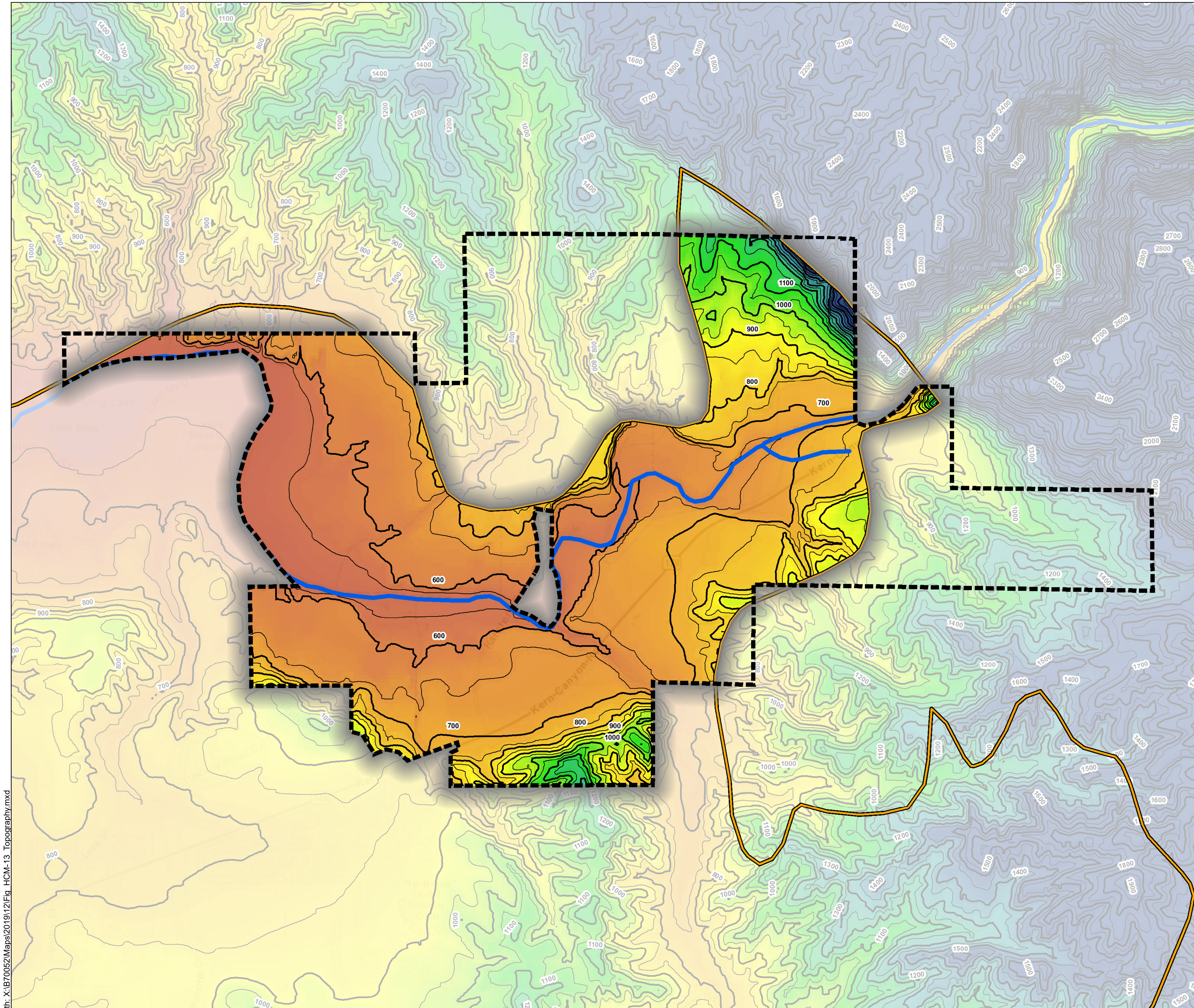
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure HCM-12

Path: X:\B70052\Maps\2019\12\Fig_HCM-12_CrossSectionsWells.mxd



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- Elevation Contour (50 ft interval)
- Kern River

Land Surface Elevation (ft msl)

High : 1500

Low : 500

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency
ft = foot
ft msl = feet above mean sea level
NED = National Elevation Dataset
OWD = Olcese Water District
USGS = United States Geological Survey

Notes

1. All locations are approximate.
2. Contour interval is 50 feet; bold contours are every 100 feet.
3. Color scale is based on maximum and minimum elevations within the Olcese GSA area.

Sources

1. Surface elevation data from USGS NED webpage: (https://viewer.nationalmap.gov/basic/).

N

0 0.5 1
Miles

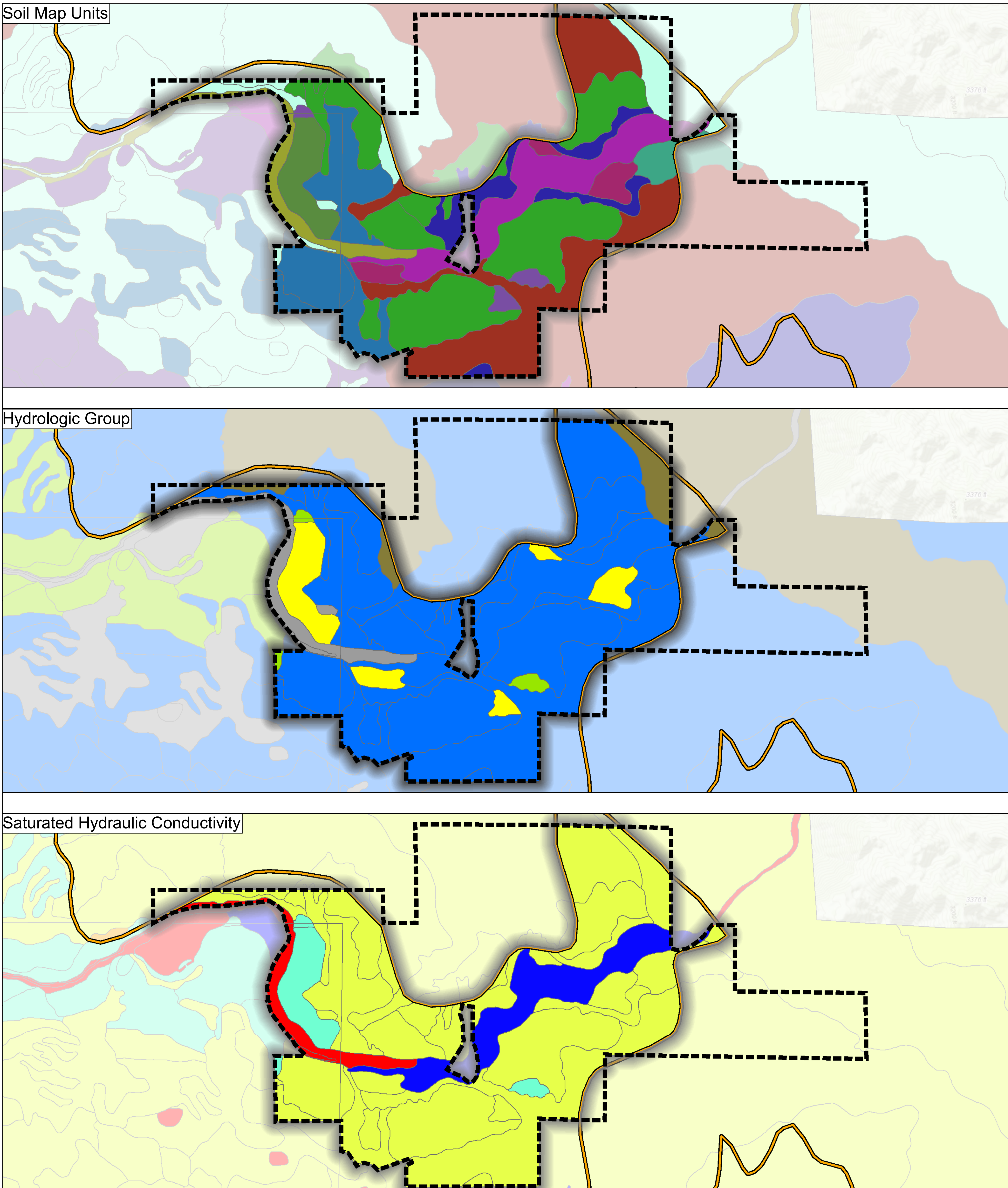
Topography

eki environment & water

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure HCM-13

Path: X:\B70052\Maps\2019\12\Fig_HCM-13_Topography.mxd



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District

Soil Map Units

- Brecken-Cuyama-Pleito complex
- Chanac-Pleito complex
- clay loam
- fine sandy loam
- Pleito-Chanac-Raggulch complex
- Pleito-Trigo-Chanac complex
- Riverwash
- sandy clay loams
- sandy loams
- silt loam
- Xerofluvents
- Other

Hydrologic Soil Group

- A - Low Runoff Potential
- B - Moderately Low Runoff Potential
- C - Moderately High Runoff Potential
- D - High Runoff Potential
- (unspecified)

Soil Saturated Conductivity (ft/day)

- <0.1
- 0.1 – 1
- 1 – 5
- 5- 10
- 10 – 20
- >20

Abbreviations

DWR = California Department of Water Resources
ft/day = feet per day
OWD = Olcese Water District
SSURGO = Soil Survey Geographic Database

Notes

1. All locations are approximate.
2. Hydrologic soil groups extracted from SSURGO data (see source 2).

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Soil data from SSURGO; (https://gdg.sc.egov.usda.gov/GDGOrder.aspx#).

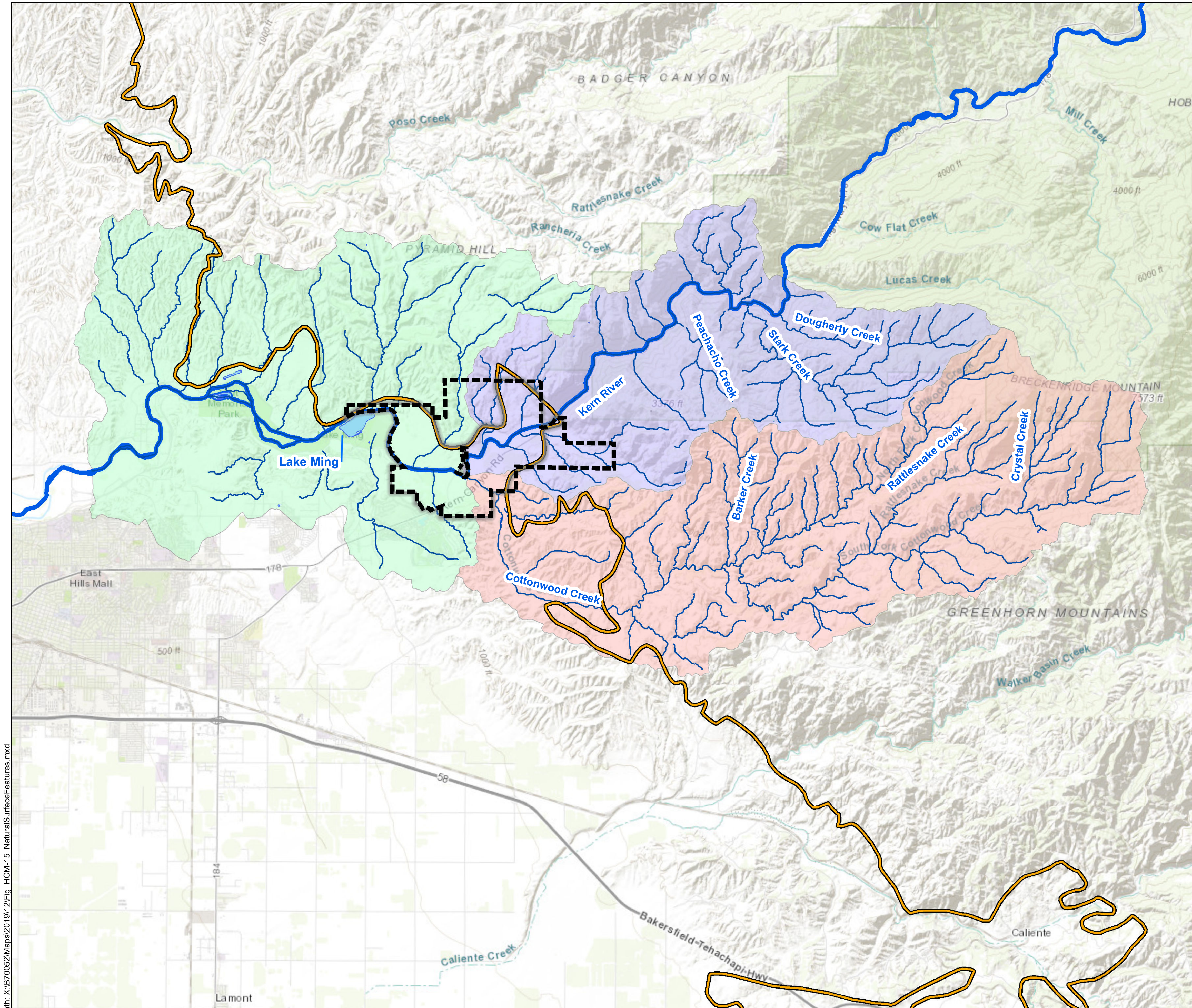
N 0 0.75 1.5
(Scale in Miles)

Soil Characteristics

Olcese Water District
Kern County, CA
December 2019
B70052.03

Figure HCM-14

Path: X:\B70052\Maps\2019\12\Fig_HCM-14_SoilMapUnits.mxd



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- Cottonwood Creek
- Lake Ming-Kern River
- Stark Creek-Kern River
- Kern River

Abbreviations

DWR = California Department of Water Resources
NHD = National Hydrography Dataset
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. The pastel filled areas are watersheds draining into District lands.
3. Watersheds draining into Kern River extend upstream to the northeast towards headwaters at Isabella Lake.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Surface water features and watersheds from NHD (https://viewer.nationalmap.gov/basic/).

N

0 2 4
Miles

Natural Surface Water Features and Watersheds Draining into District Lands

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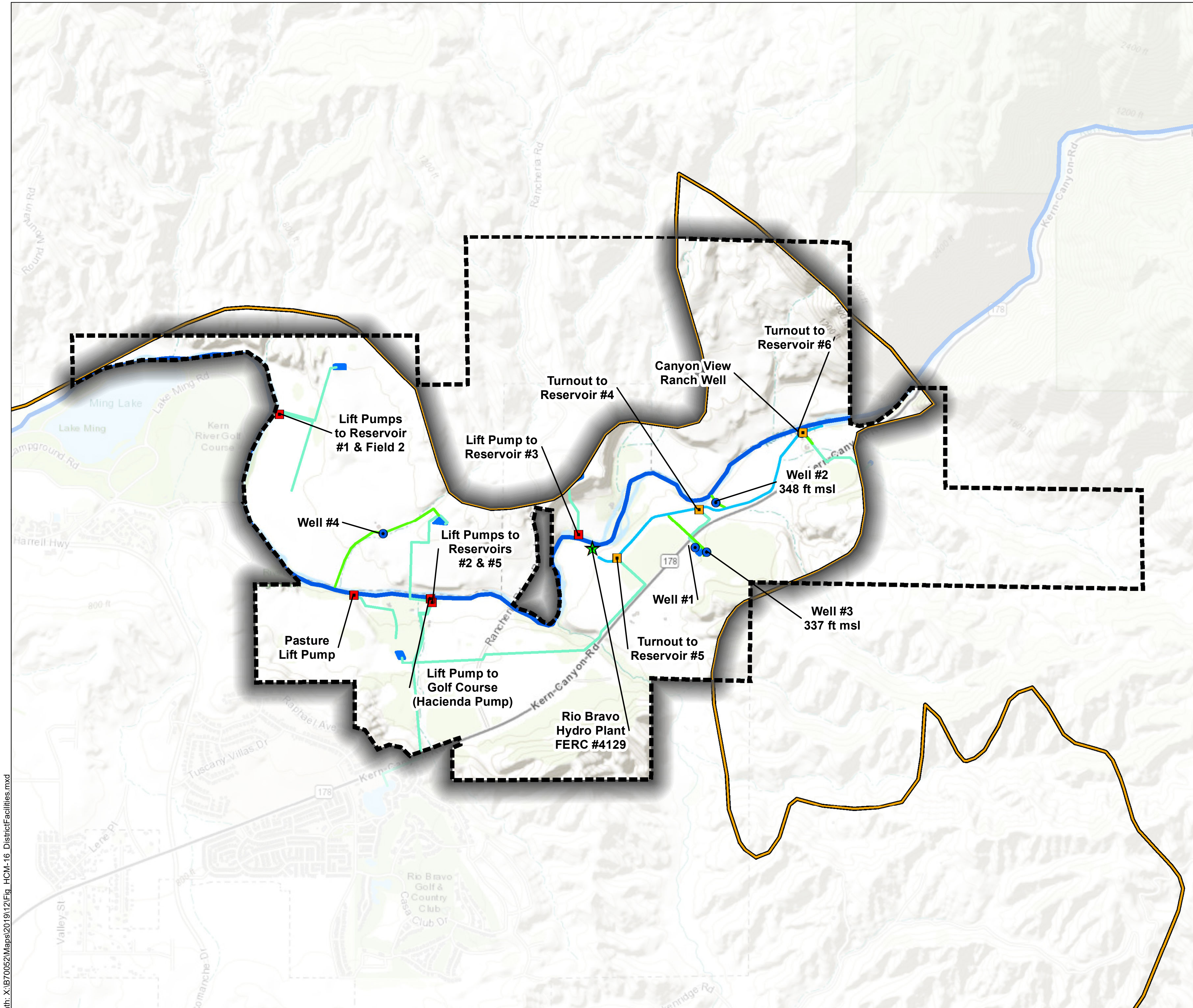
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure HCM-15

Path: X:\B70052\Maps\2019\12\Fig_HCM-15_NaturalSurfaceFeatures.mxd



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- Kern River

OWD Infrastructure

- Canal
- Pipeline to/from Well
- Pipeline to/from Turnout or Lift Pump
- Lift Pumps
- Turnouts
- Rio Bravo Hydro Plant
- Wells
- Reservoir

Abbreviations

DWR = California Department of Water Resources
FERC = Federal Energy Regulatory Commission
ft msl = feet above mean sea level
OWD = Olcese Water District

Notes

1. All locations are approximate.

Sources

1. Basemap is ESRI's ArcGIS Online world aerial map, obtained 13 December 2019.
2. District facilities information provided by OWD on 28 April 2017.

N

0 0.5 1
Miles

District Facilities

Olcese Water District
Kern County, California
December 2019
B70052.03

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Figure HCM-16

Path: X:\B70052\Maps\2019\12\Fig_HCM-16_DistrictFacilities.mxd

8. CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

☑ **23 CCR § 354.16**

This section presents information on historical and current groundwater conditions within the Olcese GSA Area based on available data. Sources of data used to inform this assessment of current conditions are described within each data topic section and include data from District records, various state and federal databases, and other reports.

For the purposes of this assessment, "current conditions" refers to conditions in Department of Water Resources [DWR] Water Year[16] (WY) 2015 (i.e., the effective date of SGMA), which is consistent with how "current" is defined by other GSAs in the Kern County Subbasin (DWR Basin No. 5-022.14; "Kern Subbasin"). Likewise, "historical" refers herein to the period from DWR Water Year (WY) 1995 to 2014 (i.e., October 1994 through September 2014), which is consistent with how other GSAs in the Kern Subbasin are defining this term and corresponds to the period for which most data are available. However, information prior to WY 1995 and post WY 2015 is presented since it provides valuable information to understand groundwater conditions in the Olcese GSA portion of the Kern Subbasin.

It is recognized that additional more recent data for certain groundwater conditions are available at the time of preparation of this amended Olcese GSP in 2022. However, as this amended GSP does not constitute an updated GSP, those additional data are not incorporated herein; rather, they will be incorporated in the next five-year update in 2025. One exception to this is for land subsidence data, the discussion of which is updated herein as part of the Olcese GSA's response to DWR's comments on the GSPs in the Kern Subbasin (i.e., collectively the Kern Subbasin Plan).

8.1. Groundwater Elevations and Flow Direction

☑ **23 CCR § 354.16(a)**

This section presents and discusses available groundwater level data for the principal aquifer underlying the Olcese GSA Area (i.e., the Olcese Sand Aquifer Unit). Because few wells exist that are screened within this aquifer (i.e., only District Wells #1 through #4), and these have not always been monitored on a frequent or consistent basis, the available data are limited. As such, this discussion focuses primarily on an assessment of temporal trends in individual wells as the assessment of vertical and lateral groundwater flow directions is not well supported by available data.

Figure GWC-1 shows available historical groundwater elevation data from District Wells #1, #2, #3, and the Canyon View Ranch Well along with annual pumping volume data. The data extend back to 1966 (Well #1), 1977 (Well #2), 2008 (Well #3), and 2000 (Canyon View Ranch Well). As shown on **Figure GWC-1**, the available water level data is not temporally continuous, and all wells have periods of missing data, some that are over ten years in length. However, even this sparse data is of use in characterizing the historical behavior of the principal aquifer.

Based on available data from Well #1 and Well #2, groundwater levels between 1966 and 1983 ranged between approximately 471 and 543 ft msl. During this period there was little to no groundwater

[16] DWR Water Years run from October of the previous year to September of the current year (e.g., DWR Water Year 2015 is October 2015 – September 2015).

pumping. Once groundwater pumping began in the late 1980s in Wells #1 and #2, groundwater levels adjusted to a new equilibrium state in the range of approximately 350 to 400 ft msl. Reduced pumping in the mid-1990s (Well #2) and late 1990s/early 2000s (Well #1) corresponded to a rise in groundwater levels back to a range of approximately 430 to 490 ft msl. Resumption of pumping in Well #2 and the start of pumping in Well #3 (a replacement for Well #1) in the late 2000s corresponded to a return, by late 2014, to the levels observed in the early 1990s. It should also be noted that in 2014 the District pumped approximately 1,000 acre-feet (AF) of additional groundwater to support a water sale to another entity within the Kern Subbasin (previous smaller volume sales occurred in 2004, 2005 and 2009). Data from Spring 2016 indicates a recovery of water levels in Wells #2 and #3 to elevations around 410 ft msl.

Clearly, an inverse correlation exists between annual pumping volumes and observed groundwater levels. This correlation likely also relates to climate since increased groundwater pumping appears to generally correspond with periods of drought. The relationship between groundwater levels, pumping rates, and climate is further born out on a seasonal timeframe. Higher frequency water level data collected in 2015 and 2016 illustrates that groundwater lows occur in the summer or fall and highs in the winter or spring (see **Figure GWC-2**). The relative degree to which water level fluctuations within the principal aquifer are dependent on pumping rates versus precipitation/recharge patterns is not certain at this time (i.e., no water level data exist for a period when either of the two potential causative factors are isolated or held constant). However, what is clear is that (the above fluctuations notwithstanding) groundwater levels have been relatively stable since the late 1980s/early 1990s when the current regime of land use and pumping began within the Olcese GSA Area, and there is no indication of a chronic long-term decline in water levels.

As indicated above, the limited available data are not conducive to development of contour maps of lateral groundwater flow or vertical gradient determination. However, given the location of the recharge areas to the north and northeast (see **Section 7.3.4 *Recharge Areas***), it is likely that groundwater flows generally from the north/northeast, through the Olcese GSA Area to south/southwest. Contemporaneous groundwater level measurements in Wells #2 and #3 taken on 27 occasions between February 2015 and July 2017 show that the groundwater elevation is, on average, lower in the well towards the southwest (Well #3) by about 1.8 feet, which supports this notion although is not conclusive. A single snapshot of gradient using data from Wells #2, #3 and #4 in July 2017 shows a southwards gradient at a magnitude of approximate 0.0095 feet per foot; however, this particular gradient direction/magnitude estimate may be higher than average since it includes data from when wells #2 and #3 had a water level difference of approximately 12 feet. Based on the larger set of 27 comparative water levels in Wells #2 and #3, a more representative groundwater gradient magnitude is likely on the order of 0.005.

8.2. Change in Groundwater Storage

☑ **23 CCR § 354.16(b)**

Change in groundwater storage over time within the principal aquifer (Olcese Sand Aquifer Unit) is estimated based on same historical water level data discussed above, an estimated storage coefficient (storativity), and the area of the Olcese GSA Area (3,206 acres) as follows:

*Change in Storage = [Ending Water Level – Starting Water Level] * Storativity * Olcese GSA Area*

Due to limitations in available water level data (discussed above), for the purposes of this calculation the water levels measured in the District's wells were assumed to be representative of the aquifer. This assumption likely results in a conservatively large estimate in change in storage because the District's wells, and their fluctuations related to pumping patterns likely only extend out some finite distance from the wells rather than over the entire Olcese GSA Area. The water levels used in this calculation are the averages of levels for each water year for Wells #1, #2, #3, and #4. The storage coefficient value used in this calculation is 0.01 which is based on the storativity value derived from the aquifer pumping tests conducted at Well #1 and #2 in 2002 (Schmidt, 2002).[17]

Change in groundwater storage varies significantly depending on the selected time frame. **Table GWC-2** shows calculations for the change in groundwater storage based on the period defined by the basin GSAs for their historical and current water budgets[18] and the most current available information.

Table GWC-2. Observed Change in Groundwater Storage

Period	Change in Groundwater Storage (AF)	Average Annual Change in Storage (AFY)
WY 1995 – WY 2015	-722	-34
WY 1995 – WY 2017	274	12

Average annual water levels in the District's wells have fluctuated within about a 118-foot range (365 to 483 ft msl) since the current pumping regime began in the late 1980s which suggests storage volume has varied over this same time by as much as about 3,780 AF.

Figure GWC-3 shows the annual and cumulative change in groundwater storage between seasonal high groundwater conditions (assume to occur in April of each year) for the period from April 1994 through March 2014, including the DWR Water Year type, and annual groundwater pumping. Annual change in storage is represented by bars, whose colors indicate the DWR Water Year type associated with the winter between seasonal high conditions (e.g., for the period April 1994 to March 1995, the color represents DWR WY 1995, which extends from October 1994 to September 1995). Due to lack of available groundwater level data to characterize the seasonal high levels of each year, this graph is based on the calibrated water budget spreadsheet model, described further below in **Section 9 *Water Budget Information***. Annual change in storage is estimated to range between about -1,800 AFY (April 2013 – March 2014) to about +2,960 acre-feet per year (AFY) (April 1998 – March 1999). Generally, annual change in storage is linked to DWR Water Year type and groundwater pumping.

[17] It should be noted that uncertainty exists regarding each of the parameters used in the storage change calculation (i.e., the degree to which average groundwater elevation data from the District's wells are representative of the aquifer as whole, the storativity value, and the area over which the storage change calculation applies). Further work including analytical or numerical modeling, as well as collection of additional water level data, could be performed to refine this change in storage estimate.
[18] The Kern Subbasin GSAs have defined WY 1995 – 2014 as the period for their historical water budget and WY 2015 for the current water budget, and these periods were used to present water budget results. However, since there are not available groundwater measurements for WY 2014, calculations for change in groundwater storage for the historical period are not presented; instead, WY 1995 – 2015 is used.

8.3. Seawater Intrusion

☑ 23 CCR § 354.16(c)

Because the Olcese GSA Area is located far from coastal areas, seawater intrusion is not an issue.

8.4. Groundwater Quality

☑ 23 CCR § 354.16(d)

As discussed in **Section 7.1.4 *Principal Aquifers and Aquitards***, groundwater quality varies between wells within the Olcese GSA Area, depending on location and screened zone (see **Table GWC-1**). Groundwater samples from the Canyon View Ranch well are geochemically and isotopically similar to samples from the Kern River, and indicate generally good water quality, with the exception of elevated iron and manganese concentrations.[19] Groundwater samples from District Wells #2 and #3 have high sulfate and total dissolved solids (TDS) concentrations, consistently in exceedance of their respective secondary Maximum Contaminant Levels (MCLs) (250 milligrams per liter [mg/L]and 500 mg/L), and roughly half of samples from these wells also exceeded the secondary MCL for iron. Water quality samples from District Well #4 indicate lower TDS, sulfate, and iron concentrations compared to Wells #2 and #3, but with TDS concentrations still exceeding the secondary MCL. Also, groundwater in Well #4 has a high alkalinity, with an average pH of 8.8 (greater than the secondary MCL for pH which is defined as a range of 6.5 to 8.5). The above notwithstanding, it should be noted that groundwater from District wells is of sufficient quality to support the predominant beneficial use within the Olcese GSA Area – i.e., irrigated agriculture.

There are no known contamination sites or plumes documented by the State Water Resources Control Board (SWRCB) GeoTracker database or the Department of Toxic Substances Control (DTSC) EnviroStor database within the Olcese GSA Area.

8.5. Land Subsidence

☑ 23 CCR § 354.16(e)

The Kern Subbasin has a documented history of subsidence, including historical and recent subsidence in various areas including portions of the basin south of the Kern River, portions on the western side, and in the north central portion near the Basin boundary. The Olcese GSA Area is not among the locations where subsidence is known to be a significant issue. According to the TRE Altamira Interferometric Synthetic Aperture Radar (NASA JPL InSAR) dataset, available on the SGMA Data Viewer portal, the vertical displacement throughout the Olcese GSA between June 2015 and April 2022 was between 0 and +6 inches, i.e., no subsidence (see **Figure GWC-4**), with point values ranging from approximately +0.02 ft to +0.08 ft. In addition to the lack of observed subsidence, there have been no anecdotal reports of undesirable effects related to land subsidence in the Olcese GSA Area. Additional studies of the occurrence and causes of land subsidence in the geologically complex Kern Subbasin are being conducted at the Basin level and are ongoing.

[19] Two of three samples collected from the Kern River between 2014 and 2016 and one sample for the Canyon View Ranch well show iron concentrations exceeding the secondary MCL of 300 mg/L.

Olcese Water District conducts periodic surveys of benchmark locations along its canal as part of its compliance with its license from the Federal Energy Regulatory Commission (FERC) to operate the Rio Bravo Hydroelectric Plant at the terminus of the canal. The most recent benchmark survey occurred in 2017, and data from that survey (contained in **Appendix F**) showed that the maximum observed change in elevation between 2000 and 2017 was -0.089 ft, or approximately -1 inch.

In response to DWR's 28 January 2022 letter entitled *Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin*, the Kern Subbasin GSAs have coordinated in the development of definitions of two categories of critical infrastructure including Regional Critical Infrastructure and Management Area Critical Infrastructure (see **Section *13.5 Undesirable Results for Land Subsidence***). Regional Critical Infrastructure includes the California Aqueduct and the Friant-Kern Canal, and because neither of these facilities are within the Olcese GSA Area, there is no Regional Critical Infrastructure in the Olcese GSA Area (see **Figure GWC-5**). However, based on its consideration of beneficial uses and users in the Olcese GSA Area, the Olcese GSA has determined that the District's canal can be considered Management Area Critical Infrastructure.

8.6. Interconnected Surface Water Systems

☑ **23 CCR § 354.16(f)**

As evidenced by the local hydrogeology and water quality information discussed in **Section 7.1 *General Description,*** the Olcese Sand Aquifer Unit likely receives some portion of its recharge from the Kern River. Analysis of the stable isotope ratios suggests that perhaps 20% to 30% of total recharge (estimated at approximately 730 AFY) comes from the Kern River and/or the interconnected Shallow Alluvium zone. However, the Kern River is one of the main drainages of the southern Sierra Nevada, with an average flowrate near the Olcese GSA Area on the order of 631,400 AFY based on 1995 to 2015 data. The estimated magnitude of the net recharge from the Kern River therefore represents a very small fraction (approximately 0.1%) of the average annual Kern River flow.

Given the presumed mechanism(s) and location of this recharge (i.e., at the far eastern portion of the Olcese GSA Area, far from the District's primary water supply wells, and via seepage through the Kern Gorge Fault or via possible hydraulic connections between the Olcese Sand Aquifer Unit and the Shallow Alluvium where the otherwise very thick Round Mountain Silt is thin or absent), this recharge occurs independent of District operations, and would occur whether or not the District were using local groundwater. This is further evidenced by the confined groundwater elevations measured in District wells, which are greater than 100 feet below the bottom elevation of the riverbed, suggesting that the river is fully disconnected from the deeper groundwater systems of the Olcese Sand Aquifer Unit. Furthermore, because a portion of the District's applied water ends up recharging the Shallow Alluvium and Kern River, the District's operations likely constitute a net addition of water to the Kern River and Shallow Alluvium that would otherwise not occur.

8.7. Groundwater Dependent Ecosystems

☑ **23 CCR § 354.16(g)**

Groundwater dependent ecosystems (GDEs) are those natural communities that depend on near-surface groundwater as a source of water. Guidance for identification of GDEs developed by The Nature

Conservancy (TNC) states that groundwater depths less than 30 feet below ground surface are “generally accepted as being a proxy” for assessing whether potential GDEs are actually supported by groundwater (TNC, 2019).[20]

The DWR has developed a map of “Natural Communities Commonly Associated with Groundwater” (NCCAG) for use by GSAs in identifying potential GDEs. **Figure GWC-6** shows the distribution of NCCAG within the Olcese GSA Area. As shown on **Figure GWC-6**, the primary area where NCCAG were identified is along the Kern River including areas of scalebroom, arrow-weed, Fremont cottonwood, California Sycamore, and three-square bulrush. The Final Program Environmental Impact Report the Rio Bravo Ranch project (RBF Consulting, 2008) identifies these areas along the Kern River as riparian corridor, “associated with the mineral rich alluvial soils of the floodplain” and “fed by winter rain and a high water table”. These descriptions suggest that these areas depend on surface water from rainfall and the Kern River and associated Shallow Alluvium. Considering that the District's groundwater production is sourced from the Olcese Sand Aquifer Unit, which is confined and typically encountered several hundred feet below ground surface within the Olcese GSA Area, and that this groundwater is used for irrigation, there is likely a net addition of water to the shallow subsurface on an annual basis. This suggests that the District's pumping operations are unlikely to have any detrimental effects on GDEs within the Olcese GSA Area. However, as a project during the SGMA implementation period, the Olcese GSA has installed and will begin to monitor a shallow well screened within the Shallow Alluvium zone to assess whether pumping in the Olcese Sand Aquifer Unit affects groundwater levels in the Shallow Alluvium and potential associated GDEs (see **Section 18** ***Projects and Management Actions***).

[20] https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_NCdataset_BestPracticesGuide_2019.pdf

Table GWC-1
Compiled Water Quality Data

Olcese Groundwater Sustainability Agency
Kern Subbasin

Analytical Results (a,b,c)

Primary MCL (d)

Well ID	Sample Collection Date	Total Recoverable Aluminum (ug/L)	Total Recoverable Antimony (ug/L)	Total Recoverable Arsenic (ug/L)	Total Recoverable Barium (ug/L)	Total Recoverable Beryllium (ug/L)	Total Recoverable Cadmium (ug/L)	Total Recoverable Chromium (ug/L)	Fluoride (mg/L)	Total Recoverable Mercury (ug/L)	Total Recoverable Nickel (ug/L)	Nitrate as N (mg/L)	Nitrite as N (ug/L)	Nitrate + Nitrite as N (mg/L)	Total Recoverable Selenium (ug/L)	Total Recoverable Thallium (ug/L)
Well #2	2/7/2014	ND	ND	ND	32	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND	ND
	6/3/2014	ND	ND	ND	ND	ND	ND	ND	0.74	ND	ND	ND	ND	ND	ND	ND
	3/26/2015	ND	ND	ND	26	ND	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND
	6/25/2015	ND	ND	5.6	10	ND	ND	ND	0.88	0.20	ND	ND	ND	ND	ND	ND
	3/31/2016	ND	ND	ND	30	ND	ND	ND	0.15	ND	14	ND	ND	ND	ND	ND
	6/28/2016	ND	ND	ND	24	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND
	3/16/2017	ND	ND	ND	28	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND
Well #3	2/7/2014	ND	ND	ND	33	ND	ND	ND	0.29	ND	ND	ND	ND	ND	ND	ND
	6/3/2014	ND	ND	ND	ND	ND	ND	ND	0.83	ND	ND	ND	ND	ND	ND	ND
	3/26/2015	ND	ND	ND	36	ND	ND	ND	0.25	ND	ND	ND	ND	ND	ND	ND
	6/25/2015	ND	ND	ND	14	ND	ND	ND	0.88	0.28	ND	ND	ND	ND	ND	ND
	11/2/2015	ND	ND	ND	31	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND
	3/31/2016	ND	ND	ND	24	ND	ND	ND	0.34	ND	ND	ND	ND	ND	ND	ND
	6/28/2016	ND	ND	ND	10	ND	ND	ND	0.81	ND	ND	ND	ND	ND	ND	ND
	3/16/2017	ND	ND	ND	36	ND	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND
Well #4	4/25/2016			ND					1.1			ND				
	3/16/2017	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND
Canyon View Well	6/25/2015	ND	ND	ND	69	ND	ND	ND	0.30	ND	ND	ND	ND	ND	ND	ND
Kern River	2/7/2014	120	ND	4.4	34	ND	ND	ND	0.37	ND	ND	0.16	ND	0.16	ND	ND
upstream	6/28/2016	250	0.12	6.7	16	ND	ND	ND	0.16	ND	ND	0.09	0.01	0.1	ND	ND
downstream	6/28/2016	240	ND	6.7	20	ND	ND	ND	0.16	ND	ND	0.09	ND	0.09	ND	ND
Maximum Contaminant Level		**1000**	**6**	**10**	**1000**	**4**	**5**	**50**	**2**	**2**	**100**	**10**	**1**	**10**	**50**	**2**
Minimum Detection Level		26	0.11	0.70	3.5	0.23	0.11	1.2	0.028	0.066	2.3	0.018	10	#N/A	0.19	0.10
Measurement Method		EPA-200.7	EPA-200.8	EPA-200.8	EPA-200.7	EPA-200.8	EPA-200.8	EPA-200.7	EPA-300.0	EPA-200.8	EPA-200.7	EPA-300.0	EPA-353.2	Calc	EPA-200.8	EPA-200.8

Secondary MCL (e)

Well ID	Sample Collection Date	Color (Color Units)	Total Recoverable Copper (ug/L)	MBAS (mg/L)	Total Recoverable Iron (ug/L)	Total Recoverable Manganese (ug/L)	Odor (Odor Units)	Total Recoverable Silver (ug/L)	Turbidity (NT Units)	Total Recoverable Zinc (ug/L)	Total Dissolved Solids @ 180 (mg/L)	Electrical Conductivity @ 25 C (umhos/cm)	Chloride (mg/L)	Sulfate (mg/L)
Well #2	2/7/2014	1.0	ND	ND	**1200**	49	ND	ND	2.2	ND	**980**	**1360**	33	**490**
	6/3/2014	1.0	ND	ND	ND	ND	ND	ND	0.16	ND	**870**	**1290**	49	**350**
	3/26/2015	1.0	ND	ND	**420**	29	1.0	ND	0.81	ND	**1000**	**1400**	37	**490**
	6/25/2015	1.0	ND	ND	ND	ND	ND	ND	0.42	ND	**900**	**1290**	49	**330**
	3/31/2016	2.0	44	ND	**610**	42	ND	ND	4.0	ND	**930**	**1340**	32	**460**
	6/28/2016	2.0	ND	ND	**660**	37	ND	ND	2.6	4.0	**980**	**1420**	39	**490**
	3/16/2017	1.0	ND	ND	**540**	48	ND	ND	1.8	ND	**860**	**1190**	30	**380**
Well #3	2/7/2014	1.0	ND	ND	**420**	33	ND	ND	0.77	ND	**1100**	**1500**	44	**510**
	6/3/2014	1.0	ND	ND	ND	ND	ND	ND	0.14	ND	**860**	**1310**	54	**330**
	3/26/2015	2.0	ND	ND	**360**	31	1.0	ND	0.90	ND	**1100**	**1550**	45	**550**
	6/25/2015	2.0	ND	ND	81	ND	ND	ND	0.21	ND	**920**	**1330**	53	**330**
	11/2/2015	1.0	ND	ND	210	31	ND	ND	1.0	ND	**1100**	**1690**	49	**540**
	3/31/2016	1.0	ND	ND	220	21	ND	ND	0.52	ND	**1000**	**1500**	44	**490**
	6/28/2016	2.0	1.7	ND	ND	4.3	ND	ND	0.22	ND	**880**	**1340**	56	**320**
	3/16/2017	1.0	ND	ND	**340**	32	ND	ND	0.87	ND	**1100**	**1480**	45	**500**
Well #4	4/25/2016										**710**	**1220**	59	130
	3/16/2017	1.0	13	ND	66	ND	ND	ND	0.45	ND	**840**	**1260**	39	240
Canyon View Well	6/25/2015	1.0	ND	ND	**420**	**200**	**20**	ND	4.9	ND	230	305	6.6	34
Kern River	2/7/2014	5.0	ND	ND	220	30	1.0	ND	2.2	ND	130	219	8.1	11
upstream	6/28/2016	10	ND	0.02	**360**	**56**	ND	ND	4.8	2.1	47	85.4	2.1	3.7
downstream	6/28/2016	10	ND	0.02	**380**	**54**	ND	ND	4.4	4.7	53	97.2	2.3	5.6
Maximum Contaminant Level		**15**	**1000**	**0.5**	**300**	**50**	**3**	**100**	**5**	**5000**	**500 (g)**	**900 (h)**	**250 (i)**	**250 (j)**
Minimum Detection Level		1.0	1.2	0.015	30	4.0	1.0	1.3	0.10	1.3	50	1.00	0.13	0.36
Measurement Method		SM-2120B	EPA-200.7	SM-5540C	EPA-200.7	EPA-200.7	SM-2150B	EPA-200.7	EPA-180.1	EPA-200.7	SM-2540C	SM-2510B	EPA-300.0	EPA-300.0

Other Monitoring Objectives (f)

Well ID	Sample Collection Date	Total Recoverable Calcium (mg/L)	Total Recoverable Magnesium (mg/L)	Total Recoverable Sodium (mg/L)	Total Recoverable Potassium (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hydroxide (mg/L)	Alkalinity as CaCO3 (mg/L)	Total Cations (meq/L)	Total Anions (meq/L)	Hardness as CaCO3 (mg/L)	pH (pH Units)	Total Recoverable Lead (ug/L)
Well #2	2/7/2014	87	14	200	12	210	ND	ND	170	15	15	270	8.03	ND
	6/3/2014	20	2.6	260	4.1	220	15	ND	210	13	13	60	8.72	ND
	3/26/2015	54	8.7	260	10	220	ND	ND	180	15	15	170	7.84	ND
	6/25/2015	17	2.2	270	4.0	220	17	ND	210	13	13	52	8.71	ND
	3/31/2016	77	13	180	11	210	ND	ND	170	13	14	250	8.01	1.8
	6/28/2016	71	11	220	9.5	200	ND	ND	170	14	15	220	7.71	ND
	3/16/2017	78	13	200	12	210	ND	ND	170	14	12	250	8.07	ND
Well #3	2/7/2014	79	13	250	15	220	ND	ND	180	16	16	250	8.11	ND
	6/3/2014	22	3.6	260	5.5	260	15	ND	240	13	13	71	8.68	ND
	3/26/2015	73	12	270	17	210	ND	ND	180	17	16	230	7.66	ND
	6/25/2015	25	4.1	280	7.3	260	11	ND	230	14	13	80	8.54	ND
	11/2/2015	74	13	250	14	210	ND	ND	170	16	16	240	7.94	ND
	3/31/2016	58	10	240	12	220	ND	ND	180	15	15	190	8.18	ND
	6/28/2016	18	2.9	280	5.6	280	15	ND	250	13	13	58	8.51	0.14
	3/16/2017	80	14	260	17	220	ND	ND	180	17	15	260	8.02	ND
Well #4	4/25/2016	1.9	0.17	280	4.5	410	34	ND		12	12	5.4	8.84	
	3/16/2017	2.9	0.28	320	8.3	360	28	ND	340	14	13	8.5	8.82	1.2
Canyon View Well	6/25/2015	29	5.4	29	4.7	130	ND	ND	100	3.3	3.0	94	8.10	ND
Kern River	2/7/2014	21	3.7	21	2.1	100	ND	ND	84	2.3	2.2	67	8.12	ND
upstream	6/28/2016	8.7	1.3	7.1	1.1	46	ND	ND	38	0.88	0.91	27	7.14	0.19
downstream	6/28/2016	9.5	1.4	9.8	1.3	45	ND	ND	37	1	0.94	30	7.3	0.18
Maximum Contaminant Level		**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**15 (k)**
Minimum Detection Level		0.014	0.019	0.051	0.10	10	5.0	2.8	4.1	0.10	0.10	0.10	0.05	0.10
Measurement Method		EPA-200.7	EPA-200.7	EPA-200.7	EPA-200.7	SM-2320B	SM-2320B	SM-2320B	Calc	Calc	Calc	Calc	EPA-150.1	EPA-200.8

Table GWC-1
Compiled Water Quality Data

Olcese Groundwater Sustainability Agency
Kern Subbasin

Notes:

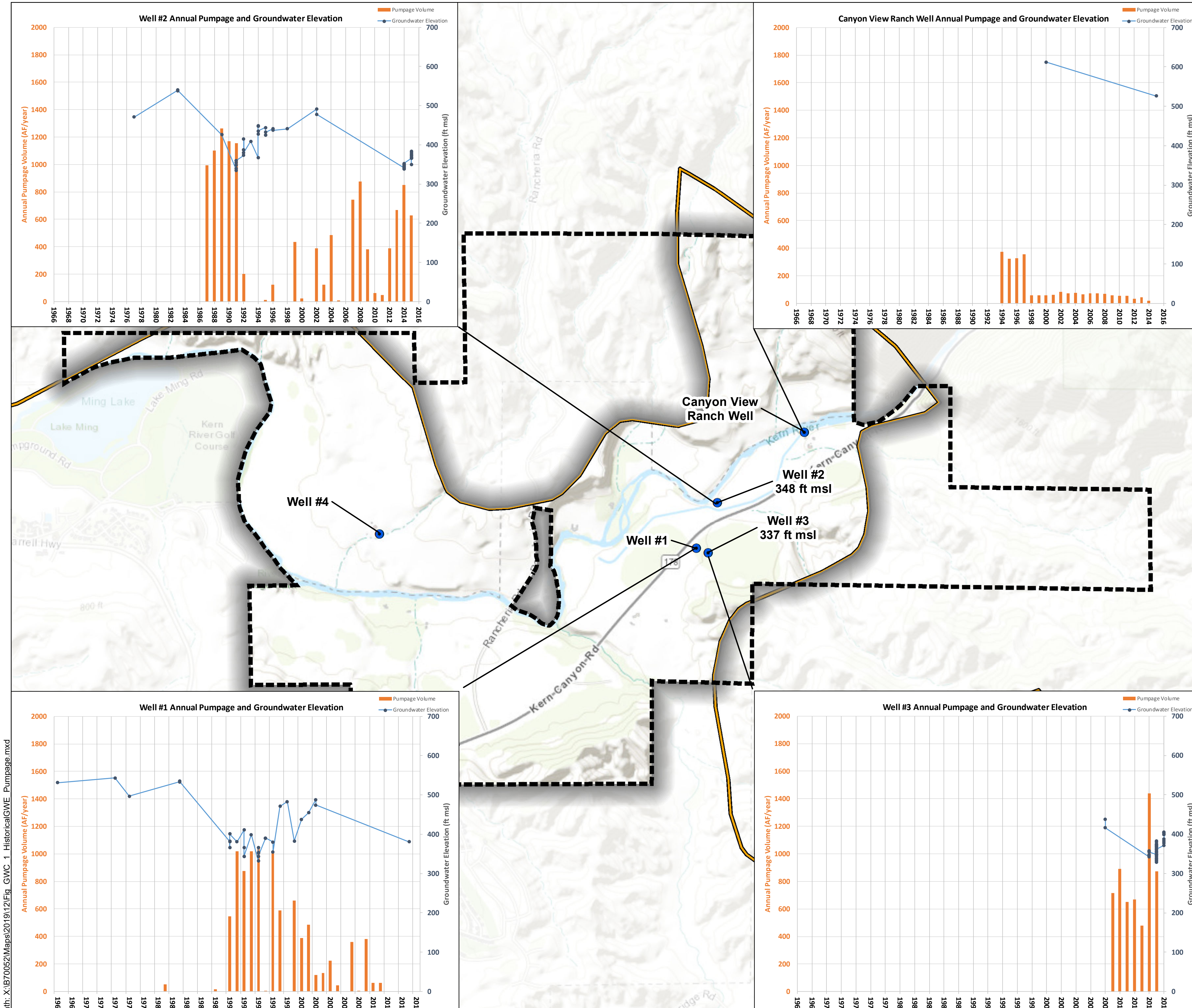
(a) This table summarizes analytical results for groundwater/surface water samples collected by the Olcese Water District as part of its quarterly water quality monitoring program.
(b) Water samples analyzed for listed constituents by BC Laboratories, Inc.
(c) Samples with constituents detected above the corresponding regulatory limit are listed in **bold** text (see notes d-k)
(d) Includes compounds with primary maximum contaminant levels (MCL's) under 22-CCR §64431 that are enforceable by the California SWRCB
(e) Includes compounds with listed secondary MCL "goals" under 22-CCR §64449 that are unenforceable by the SWRCB,
(f) Includes other monitoring objectives with notable implications to water quality that are unregulated by the SWRCB
(g) 22-CCR §64449 lists a "recommended" secondary MCL of 500 mg/L and "upper limit" of 1000 mg/L for total dissolved solids
(h) 22-CCR §64449 lists a "recommended" secondary MCL of 900 umhos/cm and "upper limit" of 1600 umhos/cm for electrical conductivity
(i) 22-CCR §64449 lists a "recommended" secondary MCL of 250 mg/L and "upper limit" of 500 mg/L for chloride
(j) 22-CCR §64449 lists a "recommended" secondary MCL of 250 mg/L and "upper limit" of 500 mg/L for sulfate
(k) Lead is a regulated trace element by the US EPA that established an Action Level (AL) of 15 µg/L. California's MCL for lead of 15 µg/L was rescinded with the adoption of the EPA regulatory AL effective 12/11/95 (22-CCR §64470).

Abbreviations:

CCR: California Code of Regulations
MCL: Maximum Contaminant Level
meq/L: milliequivalents per liter
mg/L: milligrams per liter
mmhos/cm: micromhos per centimeter
ND: not detected (sample below minimum detection limit)
NT Units: nephelometric turbidity units
ug/L: micrograms per liter
US EPA: United States Environmental Protection Agency
SWRCB: California State Water Resources Control Board

References:

Chapter 15, Division 2, Title 22 of the California Code of Regulations (CCR 22)



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- OWD Wells

Abbreviations

AF/yr = acre-feet per year
DWR = California Department of Water Resources
ft msl = feet above mean sea level
SGMA = Sustainable Groundwater Management Act
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. Pumpage volumes reported in AF/yr, groundwater elevations reported in ft msl.
3. OWD well labels represent July 2015 groundwater elevations as reported by the District. Well #4 was not constructed at that time.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Well pumpage and water level data obtained from OWD on 19 December 2017.

N

0 0.5 1

Miles

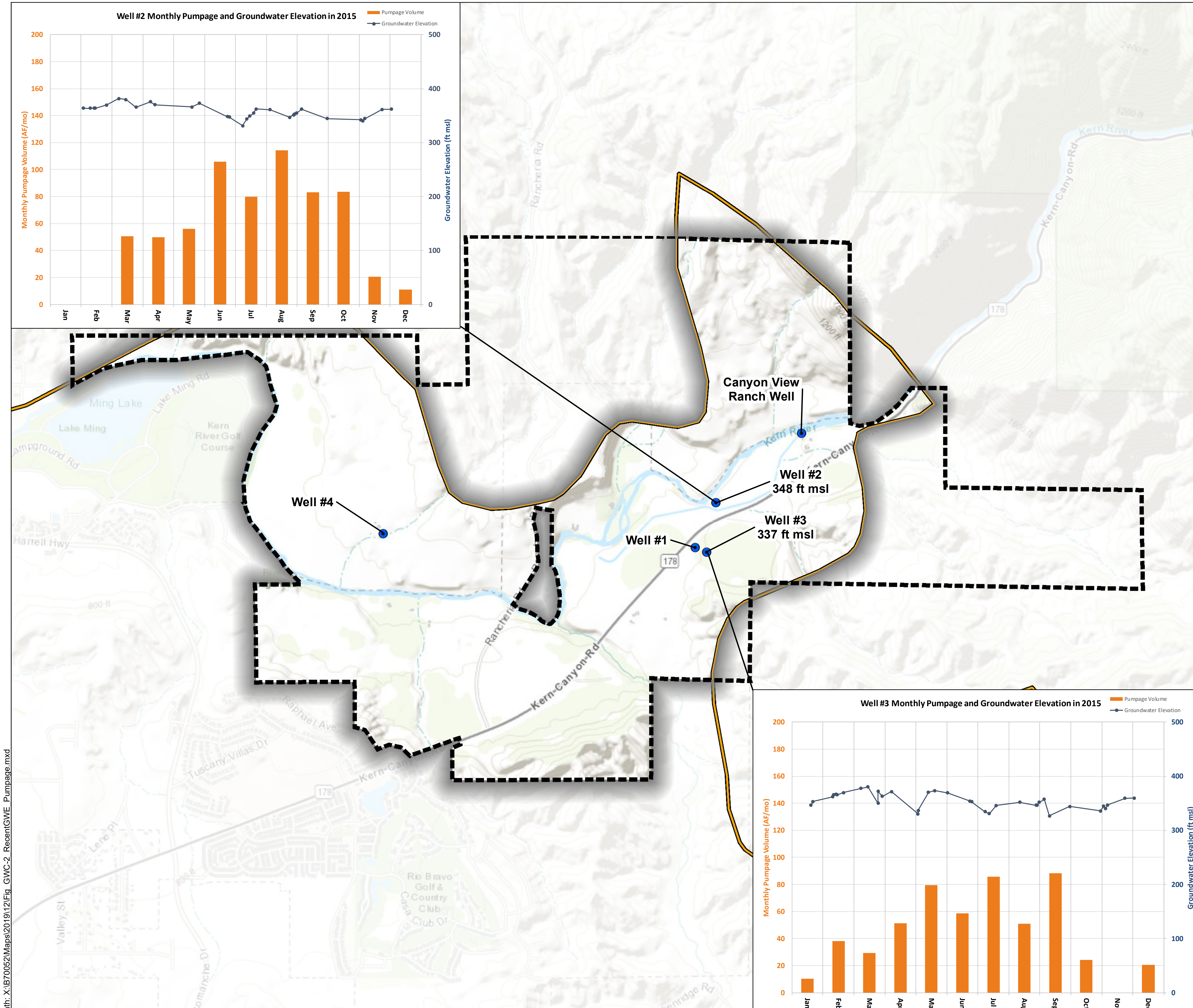
Historical Annual Well Pumpage Volumes and Groundwater Elevations

Olcese Water District
Kern County, California
December 2019
B70052.03

eki environment & water

Figure GWC-1

Path: X:\B70052\Maps\2019\12\Fig_GWC_1_HistoricalGWE_Pumpage.mxd



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- OWD Wells

Abbreviations

AF/mo = acre-feet per month
ft msl = feet above mean sea level
OWD = Olcese Water District

Notes

1. All locations are approximate.
2. OWD well labels represent July 2015 groundwater elevations as reported by the District. Well #4 was not constructed at that time.
3. Pumpage volumes reported in AF/mo, groundwater elevations reported in ft msl.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. Well pumpage and water level data obtained from OWD on 19 December 2017.

N

0 0.5 1

Miles

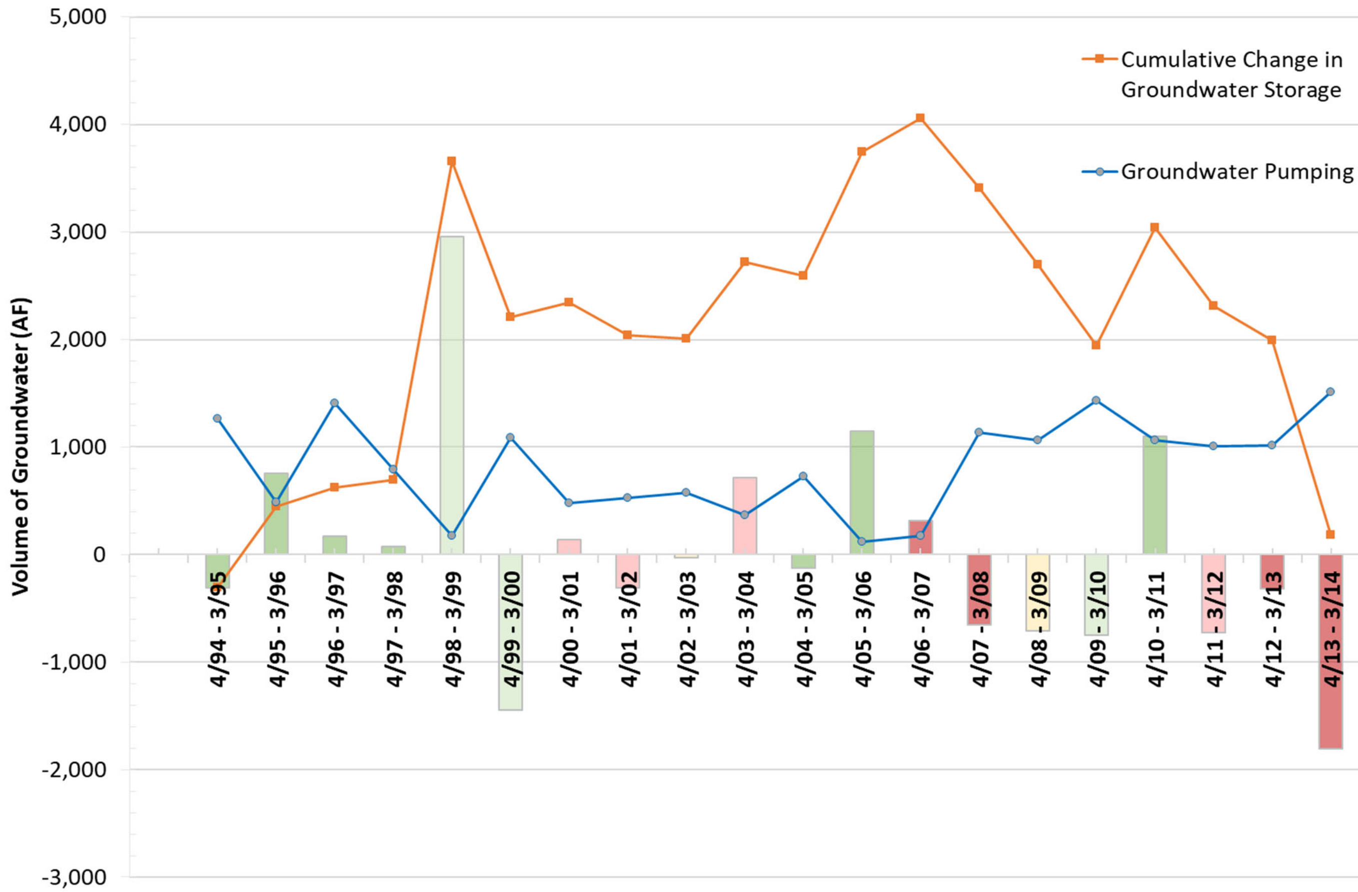
Monthly Well Pumpage Volume and Groundwater Elevation - 2015

Olcese Water District
Kern County, California
December 2019
B70052.03

eki environment & water

Figure GWC-2

Path: X:\B70052\Maps\2019\12\Fig_GWC-2_RecentGWE_Pumpage.mxd



Legend

DWR Water Year Type

= Wet

= Above Normal

= Below Normal

= Dry

= Critical

Abbreviations

AF = acre-feet

DWR = California Department of Water Resources

GW = groundwater

Notes

1. Bars represent annual change in storage between seasonal highs.
2. "Seasonal high" condition is defined as April – March of the following year.
3. The color of each bar represents the DWR Water Year type associated with the winter between seasonal high conditions (e.g., for the period 4/94-3/95, the color represents DWR Water Year 1995).

Sources

1. DWR Water Year Type is from DWR's Water Year Hydrologic Classification Indices <http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>.

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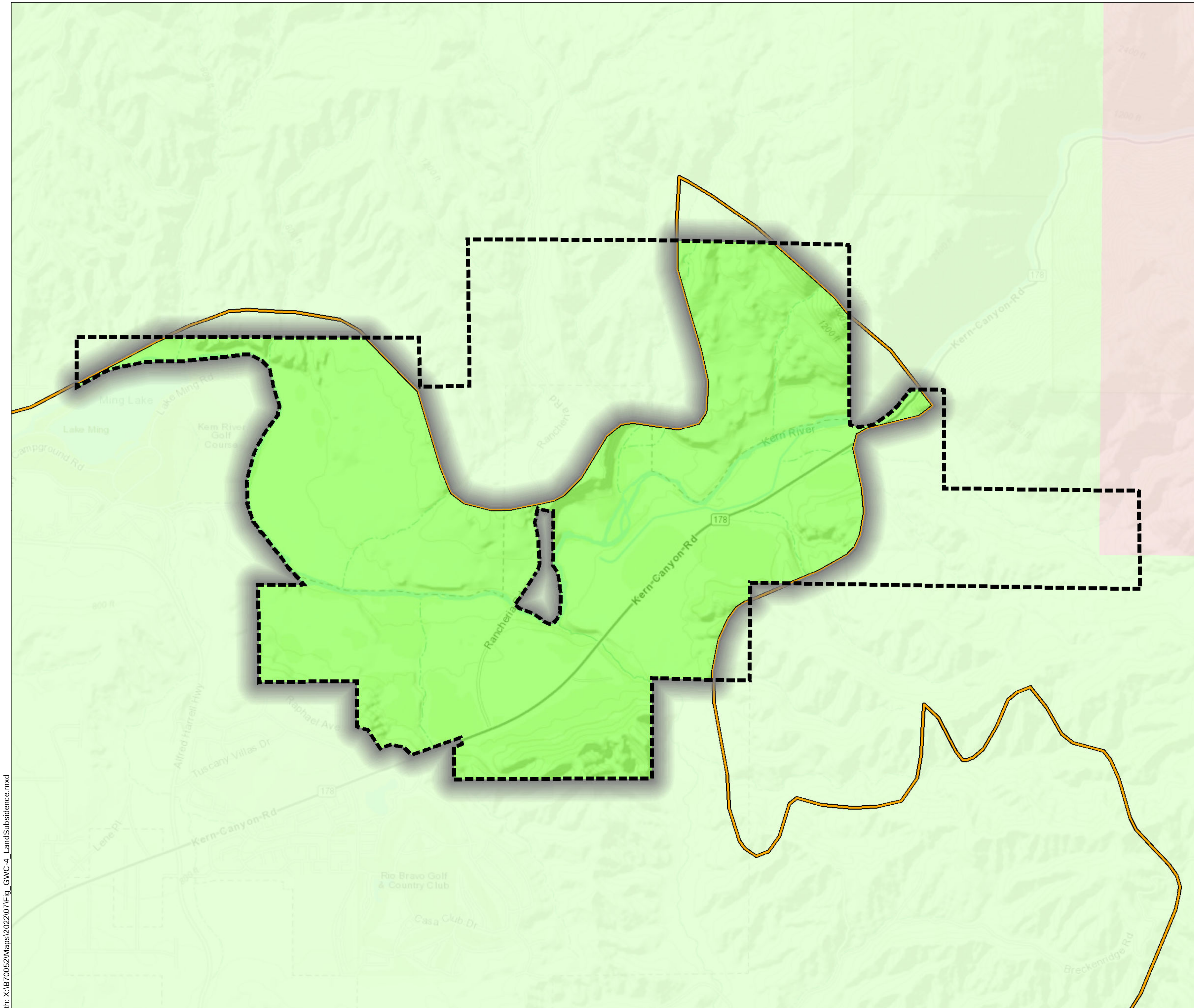
Change in Storage Between Seasonal Highs, Groundwater Pumping, and DWR Water Year Type

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure GWC-3



Legend

Kern County Subbasin (DWR 5-022.14)

Olcese Water District Service Area

Ground Surface Elevation Change

June 2015 to April 2022 (in)

< 0

0 to 1

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency
in = inches
InSAR = Interferometric Synthetic Aperture Radar
SGMA = Sustainable Groundwater Management Act

Notes

1. All locations are approximate.
2. Vertical displacement between 6/13/2015 and 4/1/2022, derived from InSAR data (source 2).

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 6 July 2022.
2. Land Subsidence dataset from TRE Altamira InSAR Dataset, obtained from the California Natural Resources Agency open data platform (https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence)

N

0 0.5 1

Miles

Potential Land Subsidence from InSAR Data

Olcese Water District
Kern County, California
July 2022
B70052.03

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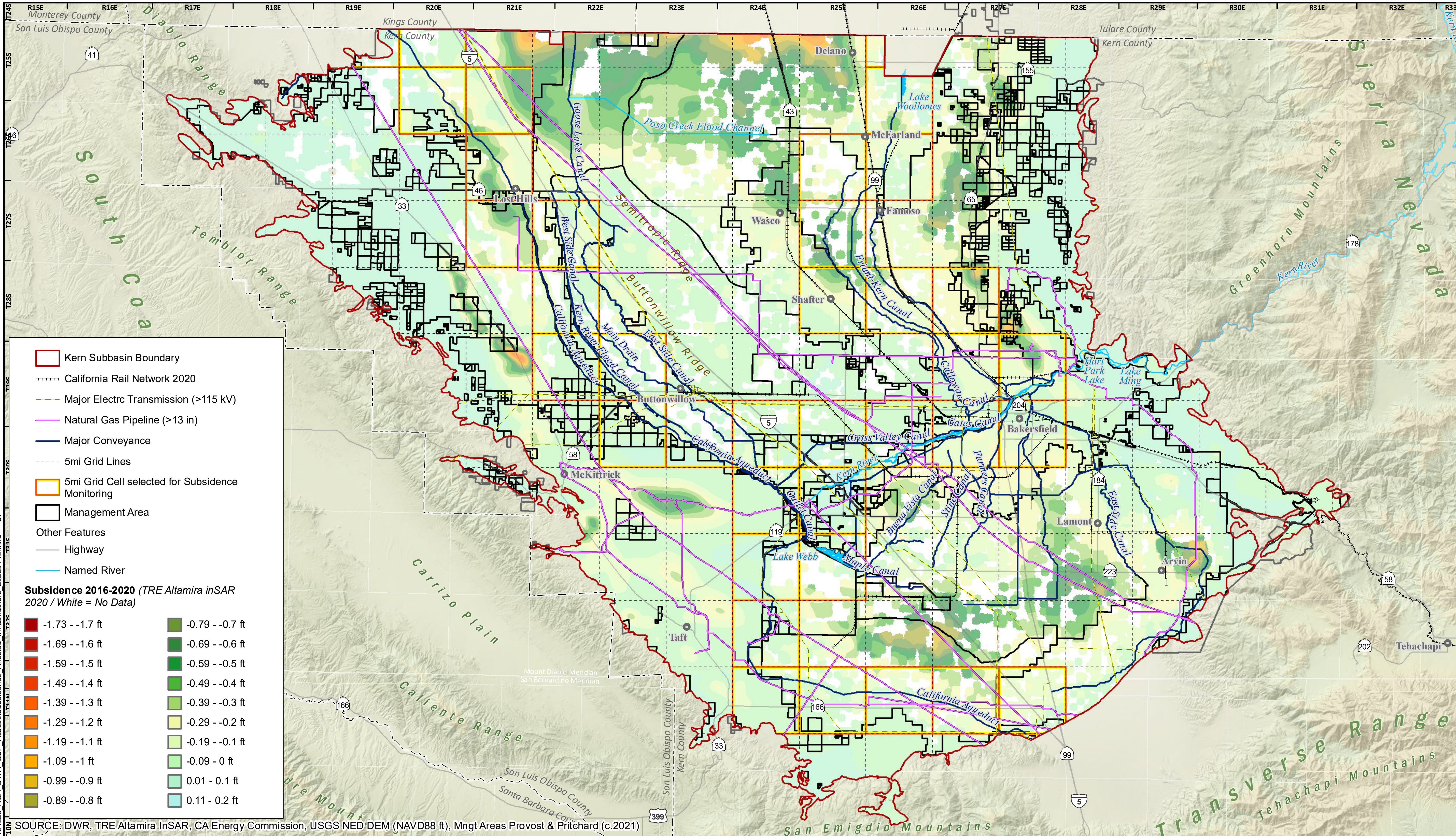
Figure GWC-4

Path: X:\B70052\Maps\2022\07\Fig_GWC-4_LandSubsidence.mxd

Figure GWC-5 Subsidence and Potentially Impacted Major Infrastructure

(From GEI, 2022*)*



Kern Groundwater Authority
Basin Setting

Kern County, California

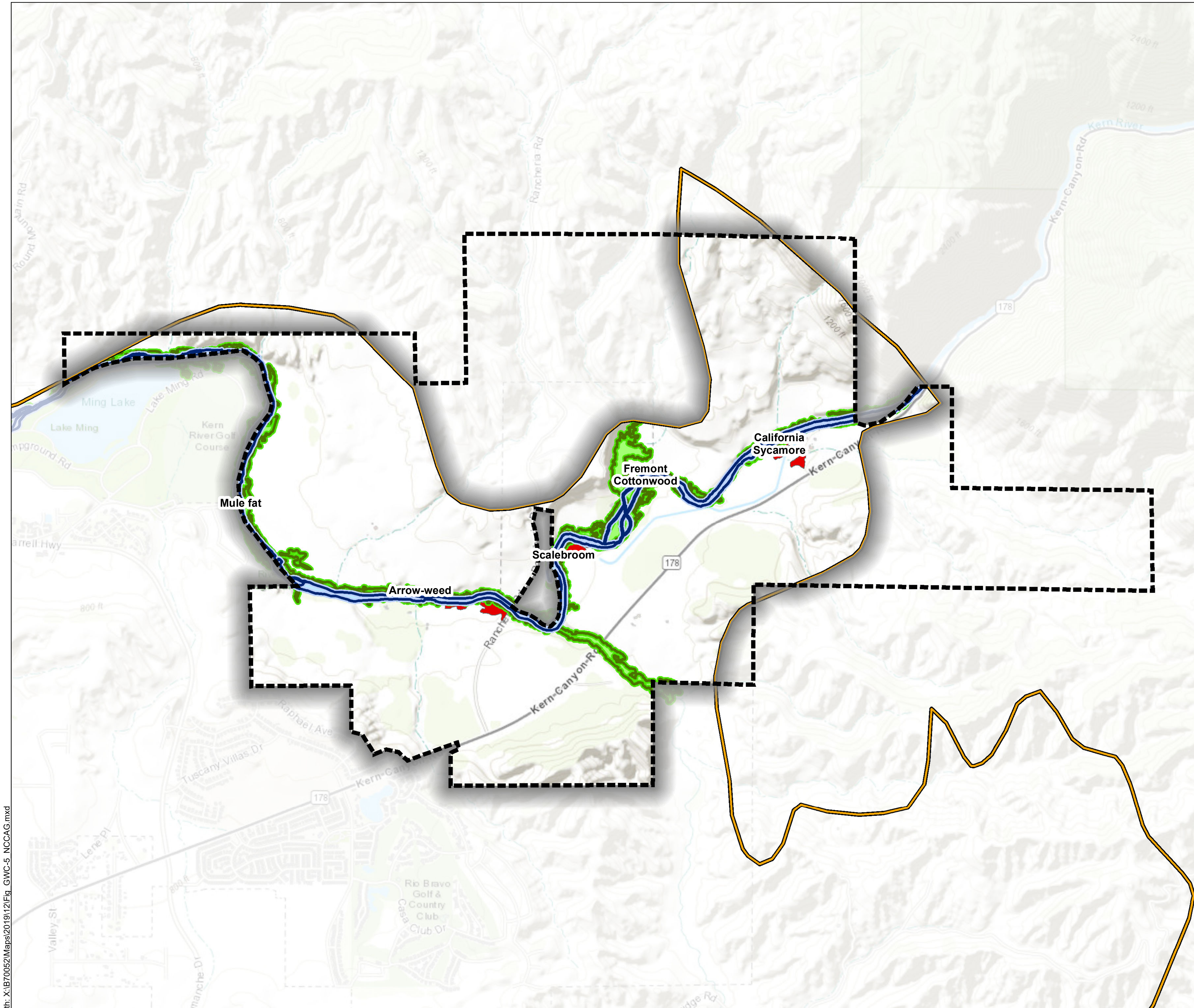
GEI Consultants

SUBSIDENCE AND POTENTIALLY IMPACTED MAJOR INFRASTRUCTURE

APR 2022

DRAFT

18-Apr-2022 Z:\Projects\2104829_KGA_DWR_GSP_Assess\Subsidence_Affected_Infrastructure_20220418.mxd SI



Legend

- Olcese Water District
- Kern County Subbasin (DWR 5-022.14)
- NCCAG Wetland

NCCAG Vegetation

- Kept
- Removed

Abbreviations

DWR	= California Department of Water Resources
GSA	= Groundwater Sustainability Agency
NC	= Natural Communities
NCCAG	= Natural Communities Commonly Associated with Groundwater
OWD	= Olcese Water District

Notes

1. All locations are approximate.
2. All wetland defined polygons within the Olcese GSA were kept.
3. The removed groundwater dependent vegetation polygons are due to change in land use, or there is no permanent vegetation.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. DWR NCCAG dataset was obtained from NC Dataset Viewer: (https://gis.water.ca.gov/app/NCDatasetViewer/)

N 0 0.5 1 Miles

Natural Communities Commonly Associated with Groundwater (DWR)

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Olcese Water District
Kern County, California
December 2019
B70052.03

Figure GWC-6

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9. WATER BUDGET INFORMATION

☑ 23 CCR § 354.18(a)
☑ 23 CCR § 354.18(f)

The Olcese GSA and the other Kern Subbasin GSAs participated in multiple coordinated, Kern Subbasin-scale water budgeting efforts, including:

1) Development of a **numerical groundwater flow model** for the Kern Subbasin based on DWR's California Central Valley Groundwater-Surface Water Simulation beta fine-grid model (C2VSim-FG); and
2) Creation of a **"checkbook" water accounting approach** that attempts to quantify a Basin-wide "natural safe yield" and document GSA-specific contributions to groundwater recharge within the Basin.

These two basin-level water budgeting efforts (i.e., the numerical model and the water accounting approach) are described in the Coordination Agreement and Appendices thereto (see **Appendix J**). These basin-level efforts are supplemented by the local water budget information presented in this section for the Olcese GSA Area. Consistent with DWR's GSP Emergency Regulations and DWR's Water Budget BMP (DWR, 2016b), this local water budget information provides an accounting of the total annual volume of water entering and leaving the Olcese GSA Area, for historical, current, and projected future conditions.

The two Basin-level water budgeting efforts and the local water budget assessment discussed in detail in this section provide a range of results. **Table WB-1** below shows a comparison of results for change in groundwater storage from the three water budget approaches for several relevant time periods. Change in groundwater storage is considered an appropriate term for comparison, as it amounts to an integration of all of the other inflow and outflow terms and represents the overall quantitative balance of the system.

The range of change in groundwater storage results shown in **Table WB-1** is due to several reasons. These include:

- Differences in the spatial area considered by the numerical model and the other two approaches (i.e., due to the fact that the model's grid cells/elements do not align with or completely cover the boundaries of the Olcese GSA Area);
- Inherently different levels of spatial resolution between methods, affecting the parameterization and subsequent calculation of subsurface flow across boundaries;
- Slight differences in the way in which land surface processes are treated (i.e., evapotranspiration demand, precipitation);
- Differences in the apportionment of native/natural water supplies stemming from the different perspectives and objectives of the multiple methods (i.e., the numerical model and local [analytical spreadsheet] model consider water supplies from a purely physical perspective whereas the "water accounting approach" uses a water rights perspective).[21]

Despite these differences, each approach provides valuable information that can support effective groundwater management within the Basin and the Olcese GSA Area.

[21] Nothing in this water budget information presented herein is meant to be viewed as a determination of water rights.

Table WB-1. Comparison of Change in Groundwater Storage Estimates from Three Water Budget Estimation Methods

Period / Scenario	Basin-wide Numerical Model	Local Analytical Spreadsheet Model	Basin-wide Water Accounting Approach
Historical Period (WY 1995 – 2014)	718 (a)	-47 (b)	NA
Current Period (WY 2015)	-416 (a)	-369 (b)	NA
Projected Period (50 years; 2021 – 2070) Baseline with no Projects	NA	-25 (c)	552 (d)
Projected Period (50 years; 2021 – 2070) 2030 Climate Change (2)	NA	-15 (c)	NA
Projected Period (50 years; 2021 – 2070) 2070 Climate Change	NA	-122 (c)	NA

Abbreviations
NA = not applicable / not available

Notes:
(1) All values are in AFY.
(2) The Projected Period is 50 years in length. For the 2030 Climate Change with Projects scenario, the Basin-wide numerical model approach includes a 20-year (2021-2040) "implementation period" and a 30-year (2041-2070) "sustainability period". The Analytical Spreadsheet Model results assumes projects and management actions are fully implemented for the entire 50-year projected period.

Sources:
(a) Table 1A of "FINAL_Olcese-Hist-WB.xlsx", received from Todd, 7 May 2019.
(b) Table WB-6
(c) Table WB-7
(d) "Kern Sub-Basin Water Budget Allocated 11-13-2019.xlsx", dated 6 December 2019. The 552 AFY surplus indicated by the "checkbook" water accounting method is based on supplies of 3,202 AFY and demands of 2,650 AFY.

9.1. Water Budget Methods and Data Sources

☑ 23 CCR § 354.18(d)
☑ 23 CCR § 354.18(e)

The detailed local water budget information presented herein is based on the use of an analytical spreadsheet model that quantifies each flow component of the water budget and enforces mass balance principles for each "subdomain" that collectively comprise the water budget domain (Olcese GSA Area).[22] This approach was warranted given that the existing regional-scale numerical groundwater flow model that is being used to develop a basin-scale water budget for the Kern Subbasin (i.e., DWR's C2VSim-FG model) does not fully cover the Olcese GSA Area.

The spreadsheet model approach described herein uses a variety of data and analytical methods to quantify each water budget flow component. Processes and groups of processes are grouped into "subdomains" and "flow components".

These water budget flow components are quantified on a monthly timestep for the period from January 1994 through September 2017. It should be noted that water budget information being developed by other GSAs within the Kern Subbasin is using the period from DWR WY 1995 through 2014 (i.e., October 1994 through September 2014) as the historical period and DWR WY 2015 (i.e., October 2014 through September 2015) as the "current" period.

Because Olcese Water District records of groundwater elevation are much more frequent for the period between 2015 and 2017 (compared to the period prior to 2015), using data from the 2015 to 2017 period was helpful for calibration of the spreadsheet model, and therefore the water budget spreadsheet model period was extended beyond the WY 1995 – 2015 period of interest to other GSAs within the Kern Subbasin. For consistency with those efforts, however, the historical water budget results presented herein align with the historical water budget period defined for the rest of the Kern Subbasin (i.e., WY 1995 – 2014). For the purposes of sustainable yield estimation (see **Section 9.2.5 *Sustainable Yield***) the full period of the spreadsheet model was used (i.e., WY 1995 – 2017).

9.1.1. Water Budget Subdomains

The water budget is divided into five internal subdomains, each influenced by a number of flow components and within which mass-balance is enforced (i.e., the sum of inflow components is balanced by the sum of outflow components and/or a change in storage component). **Figure WB-1** shows the water budget domain, and the following internal subdomains:

- Pipelines, Artificial Channels, and Reservoirs
- Natural Channels
- Agricultural Lands
- Urban Lands
- Groundwater system

In addition to the five internal subdomains, three external subdomains are incorporated into the analytical spreadsheet model. These include: (1) the watersheds that contribute streamflow to streams entering the Olcese GSA Area; (2) the atmosphere which is a source of precipitation and sink for evapotranspiration,

[22] The water budget component of this GSP is provided to comply with SGMA/GSP Emergency Regulations. The water budget, and the data used therein, is believed to be the best and most accurate available. However, it is acknowledged that new, additional, and/or more accurate information/data may be later obtained. Therefore, this water budget, and data in this GSP, may be updated or modified as the Olcese GSA deems necessary and as may be required to avoid Undesirable Results in the Olcese GSA portion of the Kern Subbasin.

and (3) adjacent groundwater (i.e., the hydraulically-connected portions of the regional groundwater system).

9.1.2. Water Budget Flow Components

Within and between each subdomain are 28 water budget flow components that route water through the Olcese GSA Area. **Figure WB-2** shows a conceptual diagram of the individual water budget flow components between subdomains as well as flow components that are external to the overall water budget domain (i.e., serve only as an inflow or outflow to the entire system, rather than a flow between subdomains).

Certain components are designated herein as "raw" components, which signifies that they are core input data that generally cannot be estimated but instead must come from actual data (e.g., Kern River streamflow, District diversions from the river, pumping volumes, and groundwater discharges back to the river). Certain other components are shown as "likely negligible"; these elements are shown for completeness, but due to their relatively small magnitudes, they are considered to be less crucial elements of the water budget. Details of the methods and data used in the analytical spreadsheet model approach are provided in **Appendix G**.

9.1.3. Data Sources

☑ **23 CCR § 354.18(d)**
☑ **23 CCR § 354.18(e)**

Per 23 CCR §354.18(e), the best-available data were used to evaluate the water budget for the Olcese GSA Area, including the following:

- Precipitation Records from California Irrigation Management Information System (CIMIS) station #125 – Arvin, *Monthly [March 1996 – December 2015];*
- Satellite Evapotranspiration (ET) Data from the Cal Poly Irrigation Training and Research Center's "Mapping Evapotranspiration at High Resolution with Internalized Calibration" (Irrigation Training & Research Center [ITRC]-METRIC) Study, funded by the Kern Groundwater Authority (KGA);[23] *Monthly [January 1993 – December 2015];*[24]
- Olcese Water District (Olcese WD) Land Use Survey from the Kern County GIS website; *Yearly [2018];*
- Olcese WD Kern River Diversions Records from the District's internal operations records; *Monthly [January 1995 – September 2017];*
- Olcese WD Well Pumping Records from the District's internal operations records, *Monthly [January 2010 – December 2015]; Yearly [1981 – 2017] (data availability varies by well);*

[23] Howes, D. 2017. 1993-2015 ITRC-METRIC ETc for Kern County. prepared for the Kern Groundwater Authority on behalf of the Cal Poly Irrigation Training and Research Center.
[24] There is no ITRC satellite ET data for calendar year 2012, as the LANDSAT satellite system employed in the ITRC-METRIC analysis was non-operational during this period. See **Appendix G** for further details.

- Historical Groundwater Level Records from District Wells #1, #2, and #3; *Yearly [1966 – 2017] (data availability varies by well); and*
- Streamflow Records for Kern River immediately upstream and downstream Olcese GSA (US Army Corps of Engineers stream gauge "KRI" and "KRB" respectively); *Monthly [January 1994 – September 2017] (data availability varies by gauge).*

9.1.4. Intended Purpose of Water Budget

The analytical spreadsheet model described herein (as well as the basin-wide numerical modelling approach to water budget estimation described in the Coordination Agreement and Appendices thereto) aims to assess the water budget from a purely quantitative, physical perspective, which is consistent with SGMA and the GSP Emergency Regulations (i.e., CWC § 10720.5 and 23 CCR § 354.18(a)). With the exception of continued use by Olcese Water District of its riparian Kern River water rights, the spreadsheet model does not aim to evaluate the water budget from the perspective of water rights. As discussed above, the "checkbook" water accounting approach described in the Coordination Agreement and Appendices thereto does attempt to evaluate the water budget with some consideration of water rights (e.g., a uniform "native yield" component applied to all lands within the Basin). However, no determination is made therein, or anywhere in this GSP, as to the actual legal water rights as they pertain to groundwater within the Olcese GSA Area.

9.2. Water Budget Results

This section presents results of the water budget analytical spreadsheet model. Results are presented below in terms of annual values during the historical water budget period (WY 1995 – 2014; consistent with the period being used by other GSAs in the Kern Subbasin). As such, some information presented here aligns with the requirements of the historical water budget described under **Section 9.3 *Current and Historical Water Budget*** below and is not repeated there.

9.2.1. Surface Water Inflows and Outflows

☑ 23 CCR § 354.18(b)(1)

Table WB-1 presents an annual summary of the total surface water inflows to and outflows from the Olcese GSA Area between WY 1995 – 2015. Inflows include Kern River streamflow into the Olcese GSA Area, run-off from surrounding watersheds, direct precipitation, and surface water imports from the California Water Service Company.[25] **Figure WB-3** shows the total surface water inflows by source. Surface water inflows to the GSA average approximately 657,800 AFY during this period but have varied widely from year to year. Surface water inflows are dominated by the Kern River inflow accounting for 99.65% of total long-term inflows, with the remainder being met by direct precipitation (0.17%) and streamflow from surrounding watersheds (0.18%). Most of the District's water supply comes from surface water diversions from the Kern River which average approximately 3,400 AFY (80% of their long-term supply). These

[25] Imports from the California Water Service Company are delivered to the Rio Bravo neighborhood, which is not part of the Olcese GSA Area, but are accounted in the water budget for completeness.

diversions are conducted pursuant to both riparian and non-riparian water rights held the District and its primary landowner, Nickel Family LLC.[26]

As shown in **Table WB-1** and **Figure WB-4**, surface water outflows from the Olcese GSA Area average 658,100 AFY. The Kern River streamflow dominates surface water outflows as well, representing 99.34% of the total long-term outflows. The remaining 0.13% of surface water outflows is due to surface water exports to the Rio Bravo Country Club Golf Course and sales from the District to other water suppliers.

9.2.2. Groundwater Inflows and Outflows

☑ **23 CCR § 354.18(b)(2)**
☑ **23 CCR § 354.18(b)(3)**

Table WB-2, **Figure WB-5**, and **Figure WB-6** provide a summary of annual inflows to and outflows from the groundwater system by water source type for WY 1995 – 2014.

Inflows

As discussed previously in **Section 7.1.4 *Principal Aquifers and Aquitards***, analysis of water quality and stable isotope data suggests that recharge to the Olcese Sand Aquifer Unit is sourced predominantly (i.e., approximately 70% to 80%) from local precipitation, with the remainder likely coming from the waters of the Kern River and/or the overlying Shallow Alluvium at the eastern edge of the basin. The water budget model therefore considers these two mechanisms as the only sources of inflows to the groundwater system and strives to achieve the same balance of sources over the long-term water budgeting period. To the extent that some recharge from local precipitation occurs to the north outside of the Olcese GSA Area (and outside of the Kern Subbasin) and enters the Olcese GSA Area through subsurface inflow from the north, this water is included within the “recharge of local precipitation” component. Given the substantial thickness of Round Mountain Silt above the Olcese Sand Aquifer Unit throughout the irrigated portion of the Olcese GSA Area, no inflows from infiltration of applied irrigation water are considered.

Inflows to groundwater from the Kern River and/or Shallow Alluvium are assumed to be constant, whereas inflows originating from precipitation on Olcese Sand outcrops within and to the north of the Olcese GSA Area are treated as a calibrated fraction of time-varying precipitation.

Through calibration, a seepage rate from the Kern River/Shallow Alluvium of approximately 730 AFY was determined. Recharge originating from local precipitation was estimated to average approximately 2,300 AFY over the WY 1995 – 2014 period (see **Figure WB-6**). Total inflows were therefore approximately 3,000 AFY. Based on these average values, 24% of total inflows to the groundwater system came from seepage from the Kern River/Shallow Alluvium, with the remaining 76% coming from infiltration of precipitation on Olcese Sand outcrops. These fractions are generally consistent with the recharge fractions estimated from the stable isotope data.

[26] The surface water numbers used throughout this GSP and specifically in the Kern Subbasin water budget under “Other Kern River Water” are for current supplies only. Other water rights of the Olcese Water District or landowners within the District may be applied to beneficial uses inside the District boundaries at a future date. These rights may include additional surface or riparian rights, Kern River flood rights or other additional sources to be determined in the future.

Outflows

Outflows from the Olcese Sand Aquifer Unit from the Olcese GSA Area consist of subsurface outflows to downgradient locations to the southwest and pumping from District wells. Two important points regarding groundwater outflows are relatively unique to the Olcese GSA Area and bear mentioning. First, subsurface groundwater outflows within the Olcese Sand Aquifer Unit do not contribute to the available groundwater in the main portion of the Kern Subbasin to the southwest due to the unit's westward dip and resultant great depth in that area; these outflows are essentially "lost" to the zone beneath the "bottom of the basin" in Kern Subbasin. Second, all groundwater pumped from the Olcese Sand Aquifer Unit is either consumptively used by crops or percolates into the Shallow Alluvium which is believed to be hydraulically separated from the Olcese Sand Aquifer Unit by the intervening Round Mountain Silt (see **Section 8.6 *Interconnected Surface Water Systems***). This water budget therefore does not count any "return flows" from applied irrigation water to the Olcese Sand Aquifer Unit.

Based on District operations data, groundwater pumping from the Olcese Sand Aquifer Unit from the District's production wells averaged approximately 857 AFY between WY 1995 – 2014.

Subsurface outflows were estimated using a Darcy's Law calculation as follows:

$$Outflow = Aquifer\ Transmissivity * Hydraulic\ Head\ Gradient * Boundary\ Width$$

Boundary width was set to 14,000 feet, based on the approximate Olcese GSA Area projected onto a plane perpendicular to the presumed direction of groundwater flow to the southwest (i.e., in the direction of dip of the principal aquifer). Lacking information on the temporal variability in down-gradient hydraulic head, the hydraulic head gradient was set to a constant value of 0.005 feet per foot (ft/ft) (see **Section 8.1 *Groundwater Elevations and Flow Direction*** for discussion on gradients). Transmissivity was set to 3,750 feet squared per day (ft^2/day), based on the representative value from aquifer pumping test data (see **Section 7.1.4 *Principal Aquifers and Aquitards***) and reduced by 25% to account for faulting to the southwest of the Olcese GSA Area which reduces the cross-sectional area of the aquifer (see **Figure HCM-11**).

Total groundwater outflows averaged approximately 3,000 AFY over WY 1995 – 2014. On average, total outflows were comprised of approximately 72% of subsurface groundwater outflows and approximately 28% of groundwater pumping (see **Figure WB-6** and **Table WB-2**). There are no outflows to surface water bodies nor evapotranspiration from the Olcese Sand Aquifer Unit.

9.2.3. Change in Groundwater Storage

☑ **23 CCR § 354.18(b)(4)**

Table WB-3, **Figure WB-7**, and **Figure WB-8** present the annual and cumulative change in groundwater storage between seasonal high conditions, which are defined herein to be April through March of the following year. Note that this annual time window is distinct from the DWR definition of a "Water Year", which extends from October of the previous year to September of the current year; thus the values presented in **Table WB-3** are slightly different than the annual and cumulative change in storage estimates provided for on a water year basis for WY 1995 – 2014 in **Table WB-2**, **Table WB-4**, and **Table WB-5**. The value for storage coefficient (storativity) used in the water budget calculations is 0.01, based on the results of aquifer testing of District wells (Schmidt, 2002).

Annual change in storage within the Olcese GSA Area between seasonal high conditions over the 20-year period from April 1994 through March 2014 has varied widely between years, as seen in **Figure WB-7** and **Table WB-3**. The cumulative change in storage from April 1994 through March 2014 was an increase of approximately 187 AF, equating to an annual average of +9 AFY (see **Figure WB-8**), indicating equilibrium within the Olcese GSA portion of the Kern Subbasin.

Figure WB-9, **Figure WB-10**, and **Table WB-4** compare the annual and cumulative change in storage in the Olcese GSA Area associated with each water year between WY 1995 – 2014 to the water year "type" based on DWR's San Joaquin Valley Water Year Index. These exhibits depict a clear relationship between change in groundwater storage to water year type, whereby change in storage becomes more positive with an increasing "wet" condition and more negative with an increasing "dry" condition. The net benefit of a "wet" period on groundwater conditions is especially evident in WY 1996 – 1999, whereas the impact of a severe multi-year drought is evident in WY 2012 – 2014.

Section 8.2 ***Change in Groundwater Storage*** reported values for change in storage based on observed groundwater levels and the storativity obtained from the calibration of the water budget model.[27] Calibration of the water budget model was achieved by comparing observed groundwater levels to levels calculated based on the modeled change in storage multiplied by the storage coefficient and adjusting selected parameters controlling inflows and outflows to achieve an acceptable match to water levels and the observed isotopic signature of groundwater. Parameters adjusted included the "area" of recharge for precipitation, the seepage rate from Kern River sources, and the groundwater outflow gradient. Recognizing the scarcity of groundwater elevation data and the relative simplicity of the water budget model (i.e., conceptualizing the entire system as being represented by water levels in only a few wells), the calibration was performed qualitatively. The objective was that the calculated groundwater level fell between the range of observations. **Figure WB-11** shows a comparison between observed and the model-estimated transient groundwater levels. Considering the objective, the calibration was successful. Particularly, when data points become denser, the model is able to reasonably capture the short-term behavior of groundwater levels within the principal aquifer (see **Figure WB-12**).

Even though the analytical spreadsheet model shows reasonable performance in predicting groundwater levels, uncertainty exists regarding the magnitude of groundwater inflows and outflows due to data gaps identified in **Section 7.4** ***Data Gaps***. Specifically, for the calculation of groundwater outflow there is no information about groundwater gradients near the Olcese GSA boundary. For this reason, a range of gradients was considered, and the parameters related to inflows were adjusted until a reasonable match between observed and modeled groundwater elevations was achieved. Through this process, it was determined that different combinations and equally reasonable values for inflows and outflows yield the similarly reasonable predictions for groundwater elevations. Future monitoring of gradients near the boundary of the Subbasin would be beneficial to reduce this source of uncertainty and refine this water budget component.

[27] The time frame of data used for the water budget model calibration was from January 1994 to September 2017.

9.2.4. Overdraft Conditions

☑ 23 CCR § 354.18(b)(5)

The Kern Subbasin is designated by DWR in its latest version of *Bulletin 118 – California's Groundwater* as being in a condition of critical overdraft (DWR, 2016d). With respect to overdraft conditions and basins subject to those conditions, DWR has made the following statements:

- "A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts." (DWR, 1980)
- Groundwater overdraft is "... the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. If overdraft continues for a number of years, significant adverse impacts may occur, including increased extraction costs, costs of well deepening or replacement, land subsidence, water quality degradation, and environmental impacts." (DWR, 2003)
- "Overdraft occurs where the average annual amount of groundwater extraction exceeds the long-term average annual supply of water to the basin. Effects of overdraft result can include seawater intrusion, land subsidence, groundwater depletion, and/or chronic lowering of groundwater levels".[28]

In evaluating basins for critical overdraft conditions in its most recent Bulletin 118 update, DWR considered the time period from WY 1989 – 2009. This period excludes the recent drought which began in 2012, includes both wet and dry periods, is at least 10 years in length, and includes precipitation close to the long-term average; these were all criteria used in selecting the time period.

As discussed in **Section 9.1 *Water Budget Methods and Data Sources***, the analytical spreadsheet model covers the period from January 1994 through September 2017 (i.e., it does not cover the entire period used in DWR's evaluation, missing the first five years). However, within the period covered by this water budget model, the timeframe between WY 1997 – 2009 meets all the same criteria. During this 13-year period, the cumulative departure in statewide average precipitation increased by approximately 9% (DWR, 2016d Figure 1), indicating that, on average, each year was less than 1% wetter than the long-term average.

Over this time period, the calculated cumulative change in storage within the Olcese GSA Area was an <u>increase</u> of approximately 1,930 AF, an average annual increase of 148 AFY. Therefore, by this metric, and DWR's description of overdraft on their website (see footnote 28), the Olcese GSA Area is not in a condition of critical overdraft.[29] As discussed in **Section 9** above, significant uncertainty exists regarding

[28] https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118/Critically-Overdrafted-Basins, accessed 1 July 2018.

[29] It should be noted that groundwater conditions vary spatially through the Kern County Subbasin and broad generalizations over large areas can lead to mischaracterization of conditions on a local scale, especially since Olcese Water District does not pump from the same water-bearing unit as the rest of the districts within the Kern County Subbasin. For this reason, it is imperative (and SGMA requires) that conditions be evaluated locally on a management area or representative monitoring location basis.

the actual magnitude of projected water budgets, and the local and basin-wide water budgets will be refined over time as additional data are collected.

9.2.5. Water Year Types

☑ 23 CCR § 354.18(b)(6)

Table WB-5 presents the annual total supplies, total demands, and change in groundwater storage in the Olcese GSA Area along with the DWR Water Year type (October – September) for the period from WY 1995 through 2015. Also shown on **Table WB-5** are the averages for total supplies, total demands and change in groundwater storage for each of the five Water Year types. **Figure WB-9** and **Figure WB-10** present the change in groundwater storage versus Water Year type on an annual and cumulative basis, respectively. The Water Year type is based on DWR's San Joaquin Valley Water Year Index. These exhibits depict a clear relationship between Water Year type and change in groundwater storage, whereby change in storage tends to be more positive during wet and above normal Water Years and more negative during below normal, dry and critical Water Years. The net benefit of a "wet" period on groundwater conditions is especially evident in Water Years 1995 – 2000, whereas the impact of a severe multi-year drought becomes increasingly evident in Water Years 2012 – 2015.

9.2.6. Sustainable Yield

☑ 23 CCR § 354.18(b)(7)

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" (California Water Code [CWC], §10721(w)). Inherent to the codified definition and the BMP statement is the avoidance of Undesirable Results, which include significant and unreasonable effects for any of the six SGMA sustainability indicators. Therefore, determination of the sustainable yield for the Olcese GSA Area depends upon how the Undesirable Results are defined.

While no exact method for defining the sustainable yield is required by SGMA, DWR's Water Budget BMP (DWR, 2016b) states that "[w]ater budget accounting information should directly support the estimate of sustainable yield for the basin and include an explanation of how the estimate of sustainable yield will allow the basin to be operated to avoid locally defined undesirable results." It follows that an estimate of the sustainable yield of the groundwater system underlying the Olcese GSA Area can be made by adding the average annual change in storage, to the average annual groundwater extraction, based on historical data for a representative period. This simplified approach provides a sustainable yield number corresponding to the volume of water that, if pumped over the water budget period of interest, would have resulted in a zero decline in groundwater levels and storage.

Over the 23-year period of WY 1995 – 2017, annual groundwater extraction was 872 AFY and change in storage was 18 AFY. Therefore, the sustainable yield estimated by the method described above is 890 AFY. This sustainable yield number is also inherently conservative in that it is based on a pumping rate that, under similar hydrologic conditions as the historical period, would result in no decrease in storage. As discussed in **Section 13.1 *Undesirable Results for Chronic Lowering of Groundwater Levels*** and **Section 13.2 *Undesirable Results for Reduction of Groundwater Storage***, the locally defined criteria for what constitutes an Undesirable Result for groundwater levels and change in storage is not strictly limited to a zero net decrease; rather, those criteria allow for some operation of the basin at groundwater levels and storage levels below current conditions. For the other relevant sustainability indicators (i.e., water quality degradation and land subsidence), a sustainable yield value that amounts to a zero change in storage would also be expected to avoid undesirable results. Therefore, this sustainable yield estimate takes into account Undesirable Results, as required by CWC § 10721(w).

As noted previously, the Olcese GSA Area principal aquifer appears to be in a stable condition under the current land use and pumping regime, with groundwater levels fluctuating in response to pumping and climate within a consistent range and no long-term downward trend.

Another study conducted in the Olcese Water District (Schmidt, 2002) estimates a sustainable yield of 900 gallons per minute (gpm) for Well #1 and 1,380 gpm for Well #2 (the only two active wells at the time), assuming a pumping schedule of six months per year. This translates into <u>a combined sustainable yield of 1,840 AFY</u>. This estimate for a sustainable yield is based on the recovery measurements of pump tests for these two wells and it is defined as the maximum extraction rate over six months that allows the total recovery of groundwater elevation over the following six months. It is important to note that this estimate does not take into account that the recovery rate would be smaller with simultaneous pumping.

Each of these sustainable yield estimation approaches has inherent limitations due to uncertainty regarding the mechanisms of recharge and discharge in the Olcese GSA Area. Therefore, monitoring will be crucial to track groundwater level trends relative to pumping rates and climate to better understand and refine the sustainable yield estimate.

9.3. Historical and Current Water Budget

9.3.1. <u>Historical Water Budget</u>

☑ **23 CCR § 354.18(c)(2)**

Water budget results for the historical water budget period being used throughout the Kern Subbasin (WY 1995 – 2014) are presented in **Section 9.2 *Water Budget Results***, including associated figures and tables, and are not repeated here. Rather, this section focuses on providing: (a) a quantitative evaluation of historical surface water availability and reliability (23 CCR §354.18(c)(2)(A)), (b) a quantitative assessment of the historical water budget (23 CCR §354.18(c)(2)(B)), and (c) a description of how historical conditions have impacted the ability of the Olcese GSA Area to be operated within its sustainable yield (23 CCR §354.18(c)(2)(C)).

<u>Historical Surface Water Availability and Reliability</u>

☑ **23 CCR § 354.18(c)(2)(A)**

Kern River diversions into the District represent a very small fraction of Kern River streamflow in this area, and thus any potential future changes in Kern River flows are not expected to have a significant impact on the ability of the District's primary landowner to exercise their riparian Kern River water rights. As mentioned above, Kern River inflow into the District averaged approximately 657,800 AFY during the historical time frame (WY 1995 – 2014), and the District's diversions averaged 3,400 AFY, or approximately 0.5% of total Kern River flows. Of this 3,400 AFY, approximately 2,500 AFY (75%) comes from riparian water rights on the Kern River, and 800 AFY (25%) comes from non-riparian rights.

Quantitative Assessment of Historical Water Budget

☑ **23 CCR § 354.18(c)(2)(B)**

Based on the DWR San Joaquin Valley Water Year Index for the 20-year period from WY 1995 – 2014, this period included four "critical" (dry) years, four dry years, two below normal years, three above normal year, and seven wet years. The first third of this period was relatively wet, the middle third was a mix of wet and dry years, and the last third of the period was extremely dry. This climatic factor is clearly reflected in the water budget for the Olcese GSA Area, whereby the groundwater system shows consistent increases in storage with "wetter" conditions and decreases in storage under "drier" conditions (see **Figure WB-9**, **Figure WB-10**, and **Table WB-4**).

Table WB-5 and **Figure WB-14** provide a summary of total inflows and outflows to the Olcese GSA Area for WY 1995 – 2014 and **Table WB-2** and **Figure WB-5** provide a summary of inflows and outflows to the groundwater system underlying the Olcese GSA Area for the same period. A summary of average annual groundwater inflows and outflows is provided in **Figure WB-6**.

Total inflows to the Olcese GSA Area amounted to an average of approximately 660,000 AFY for WY 1995 – 2014, comprised of 99.31% of Kern River streamflow, 0.18% of streamflow from surrounding watersheds, 0.17% of precipitation, and 0.35% of infiltration through Olcese Sand outcrops. This resulted in an average inflow to the groundwater system of 3,000 AFY, comprised of 76% of infiltration of precipitation on Olcese Sand outcrops and 24% from seepage from the Kern River/Shallow Alluvium.

Total annual outflows from the Olcese GSA Area amounted to 659,700 AFY for WY 1995 – 2014, comprised of 99.11% from the Kern River streamflow, 0.43% of evapotranspiration, 0.33% of subsurface groundwater outflow, and 0.13% of surface water exports. This resulted in an outflow from the groundwater system of 3,050 AFY, from which 72% was from subsurface outflows and 28% from groundwater pumping.

Operation within Sustainable Yield

☑ **23 CCR § 354.18(c)(2)(C)**

Average annual change in groundwater storage under the Olcese GSA Area amounted to approximately +18 AFY between WY 1995 – 2017, resulting in a cumulative change in groundwater storage of 419 AF within this period. This cumulative storage change over a 23-year historical record, that includes the recent severe drought, indicates that the groundwater system is in a state of balance, and NOT a state of significant overdraft. As discussed in previous sections (**Section 8.2 *Change in Groundwater Storage*** and **Section 9.2.3 *Change in Groundwater Storage***), the annual change in storage varies significantly depending on the selected period of analysis, having both, positive and negative values. Furthermore, the water levels measured in wells within the Olcese GSA Area (see **Figure WB-11** and **Figure GWC-1**) demonstrate that the groundwater system is sensitive to climatic variability, with decreases in storage during drought followed by increases in storage during wet periods, resulting in a long-term balance.

9.3.2. Current Water Budget

☑ 23 CCR § 354.18(c)(1)

This section presents results for the "current" water budget, based on values extracted from the analytical spreadsheet model for WY 2015. This definition of "current" is consistent with what other GSAs within the Kern Subbasin are using.

WY 2015 was classified as the third consecutive "Critical" (dry) Water Year and fourth consecutive "Dry" or "Critical" Water Year within the San Joaquin Valley and is thus representative of perhaps the worst drought condition in recent history within the region. Per 23 CCR §354.18(d)(1), **Table WB-5** provides a summary of total inflows and outflows to the Olcese GSA Area, including WY 2015, while **Table WB-2** and **Figure WB-13** provide a summary of groundwater inflows and outflows.

Total inflows to the Olcese GSA Area amounted to approximately 150,400 AF in WY 2015, comprised of 97.20% Kern River streamflow, 0.67% of direct precipitation, 0.60% streamflow from surrounding watersheds, and 1.53% of infiltration through Olcese Sand outcrops. This resulted in a total inflow to the groundwater system of approximately 3,000 AF, comprised of 76% infiltrated precipitation through Olcese Sand outcrops, and 24% infiltration from the Kern River/Shallow Alluvium.

Total outflows from the Olcese GSA Area amounted to approximately 150,400 AF in WY 2015, comprised of 95.84% Kern River streamflow, 2.27% of evapotranspiration, 1.46% of subsurface groundwater outflow, and 0.43% of surface water exports. This resulted in a total outflow from the groundwater system of approximately 3,400 AF, 65% of which is due to subsurface outflow, and 35% groundwater extraction.

As evident from these water budget values, the Olcese GSA Area (like nearly all areas in the Kern Subbasin and San Joaquin Valley as a whole) was impacted significantly by the extreme drought condition of WY 2015, resulting in a net loss of -369 AF of groundwater storage during this water year, preceded by an even more significant loss of -2,631 AF in WY 2014, -667 AF in WY 2013 and -756 AF in WY 2012 (see **Table WB-2**). However, as evidenced by the recovery of water levels and storage following previous dry periods, the groundwater system is resilient, and the "current" (WY 2015) conditions are not indicative of a normal condition but rather represent the late stages of a major drought period from which the groundwater system has already started to recover (see **Figure GWC-1**).

9.4. Projected Water Budget

☑ 23 CCR § 354.18(c)(3)

In accordance with the *Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development* (DWR, 2018), this section presents the results of the projected water budget analysis. A total of four future scenarios, in addition to a "Baseline" scenario, are considered. The first scenario uses the "central tendency" climate variables for 2030 and is considered a near future scenario representative of conditions during the 20-year GSP implementation phase. The next three scenarios represent conditions in the far future (2070) and include a "central tendency" scenario, a wetter scenario (Wetter with Moderate Warming) and a drier scenario (Drier with Extreme Warming). All scenarios utilize a monthly historical hydrology record from January 1960 to December 2011.

9.4.1. Future Baseline Conditions

The Projected Water Budget was developed by adapting the historical analytical spreadsheet model to hydrology, surface water supply, and water demand future conditions. These conditions were estimated as follows.

- **Projected hydrology** (i.e., precipitation and evapotranspiration) was estimated by applying the DWR Climate Change Dataset, obtained from the SGMA Data Viewer (DWR, 2018), to the historical time series of precipitation and evapotranspiration within the analytical spreadsheet model. This climate change dataset includes time-series representing monthly change factors over a 6 kilometer (km) by 6 km grid over the simulation period of January 1915 to December 2011 for each scenario. As shown in **Figure WB-14**, the model has several precipitation and evapotranspiration components throughout different regions. To make the spatial distribution of these regions compatible with the gridded climate change factors, Geographic Information System (GIS) analysis was used to extract the grid cells within each region and calculate a weighted average. The resulting averaged factors where then applied to (i.e., multiplied by) the corresponding time-series of precipitation and evapotranspiration within the spreadsheet model (i.e., January 1960 to December 2011). This process was applied for change factors associated with each of the four climate change scenarios.

  The historical hydrology used in the current and historical water budget does not cover the required 50-year timespan. Therefore, other sources of precipitation and evapotranspiration records were used. For precipitation, since there is not an available climatological station near the District that has a 50-year record, the PRISM Climate Group's precipitation dataset was used. This dataset contains spatially gridded monthly total precipitation at a 4 km grid cell resolution. A similar procedure was used as with the climate change factors dataset to make the PRISM precipitation dataset spatially compatible with the components of the Olcese GSA analytical spreadsheet model. For evapotranspiration, the dataset used in the historical water budget was classified by DWR water year types (Critical, Dry, Below Normal, Above Normal, and Wet) and then the average values for each month were calculated. Then, for the missing years (1960 to 1994) the averaged-monthly ET values were applied according to the DWR water year type of each missing year.

- **Surface Water Supply**. Olcese Water District's surface water supply comes almost entirely from riparian Kern River water rights held by its primary landowner, Nickel Family LLC, and managed by the District.[30] The District's average annual surface water diversion rate represents less than 0.1% of the long-term average annual flow rate of the river. Because of the relatively miniscule amount of surface water used by the District and the fact that the water used is pursuant to high-reliability riparian water rights, it was assumed that the District's surface water supply would not be affected under future climate change conditions, despite potential changes in the overall flow rate of the river. This is reflected in the analytical spreadsheet model by scaling surface water and groundwater supply to satisfy the new demand and using the same factor to preserve the observed historical ratio of applied surface water/groundwater.

- **Future Demand**. Given that the primary beneficial use of groundwater in the Olcese GSA Area is for irrigated agriculture and is not expected to change, the objective of this projected water budget

[30] Agreement dated 18 March 1981.

is to assess how current land use would impact the principal aquifer under each scenario. In other words, assuming a constant land use, the objective is to determine how water demand is affected by climate change and how this new demand affects the principal aquifer. To be able to understand the impacts of climate change, a "Baseline Scenario" was developed where all climate change factors were set to one and the average groundwater extraction over the period for the historical water budget (857 AFY) was used.

9.4.2. Results

Table WB-7 shows the water balance of the main water budget subdomains (i.e., the Agricultural Lands subdomain and the Groundwater subdomain) for the historical water budget period, the projected Baseline scenario and the four projected climate change scenarios.[31] As shown in **Table WB-7**, the average change in storage for the Baseline scenario is -25 AFY, representing an estimated decrease of -0.7 feet/year (ft/yr) in the groundwater level. For the 2030 scenario, the average change in storage is -15 AFY, representing a smaller annual groundwater level decrease of -0.3 ft/yr. The 2070 scenario shows significantly drier conditions with a change in storage of -122 AFY or a decrease in groundwater levels of 3.5 ft/yr. Although a decrease of 3.5 ft/yr over the SGMA time frame is not desirable, considering that the groundwater elevation in December of 2014 was 349 ft, the groundwater elevation in December of 2070 would be 151 feet (ft), a level that is well above the defined Minimum Threshold described in **Section 14.1** ***Minimum Threshold for Chronic Lowering of Groundwater Levels***.

The extreme scenarios "Wetter with Moderate Warming" (WMW) and a "Drier with Extreme Warming" (DEW) results illustrate the uncertainty in the projected water budget related to long-term climate change projections. The change in storage for the 2070 DEW scenario is -640 AFY, which translates to a decline in groundwater levels of -19 ft/yr, while the change in storage for the 2070 WMW is 325 AFY, or an increase in groundwater levels of 10 ft/yr. This wide range of results, from -19 ft/yr to +10 ft/yr, suggests that climate change could have significant effects on groundwater level conditions in the principal aquifer. However, this wide range of uncertainty limits the use of this future water budget as a predictive tool. To overcome this uncertainty, continuous monitoring of pumping rates, precipitation and groundwater levels will be crucial for the sustainable management of the Olcese GSA Area, and land management will require flexibility to adapt to changes in the availability of water supplies.

The limitations of the water budget model, primarily due to uncertainties in the assumptions regarding mechanisms of recharge and discharge of the principal aquifer, constrain the applicability of this model to extreme scenarios. While the assumptions of a constant recharge from the Kern River, and constant outflow from the principal aquifer are reasonable under the current and historical conditions of the aquifer and yield adequate results on the estimation of groundwater levels, they might not hold for a drastic change in such conditions. For example, if an abnormally wet period happens in the future, the substantial increase in groundwater levels water levels could results in greater groundwater outflows. On the other hand, if a prolonged dry period were to occur, a substantial decrease of groundwater levels in the principal aquifer could reduce groundwater outflows from the Olcese Sand Aquifer Unit.

[31] The water budget component of this GSP is provided to comply with SGMA/GSP Emergency Regulations. The water budget, and the data used therein, is believed to be the best and most accurate available. However, it is acknowledged that new, additional, and/or more accurate information/data may be later obtained. Therefore, this water budget, and data in this GSP, may be updated or modified as the Olcese GSA deems necessary and as may be required to avoid Undesirable Results in the Olcese GSA portion of the Kern Subbasin.

9.4.3. Basin-wide Projected Water Budget Efforts

As mentioned previously, in addition to the detailed local analytical spreadsheet model that forms the basis for the historical, current, and projected water budget information presented above, the Olcese GSA participated in two basin-wide water budget efforts including:

1) Development of a numerical groundwater flow model for the Kern Subbasin based on DWR's C2VSim-FG; and
2) Creation of a "checkbook" accounting approach that attempts to quantify the water budget based on consumptive demands and supplies from imported water, precipitation, and "native yield".

These efforts were undertaken by all Kern Subbasin GSAs in order to fulfill the requirements for a coordinated water budget. However, as discussed below, these approaches have limited value in the Olcese GSA Area due to the relatively unique hydrogeologic conditions.

C2VSim Numerical Model

The C2VSim model grid does not cover the entire Olcese GSA Area; the model grid boundary aligns with the Kern River in this area, and therefore cuts off the portion of the Olcese GSA Area that is north of the river. Furthermore, the C2VSim model does not accurately capture the pumping from the Olcese Sand Aquifer Unit, as its model layers are designed to capture the pumping occurring in the shallower formations that comprise the principal aquifer in the main valley floor area (e.g., the Kern River Formation). For this reason, water budget results from the C2VSim model on a local Olcese GSA Area-scale are not considered representative of local conditions.

"Checkbook" Water Accounting Approach

The "checkbook" water accounting approach assumes values for precipitation (0.42 AFY per acre) and native yield (0.15 AFY per acre) [32] that are not necessarily applicable to the local conditions in the Olcese GSA Area. Specifically, due to the relatively higher elevation of the Olcese GSA Area compared to most of the Kern Subbasin and the orographic effect, precipitation is likely higher in this area than the 0.42 AFY per acre value assumed. Likewise, the uniform "native yield" value of 0.15 AFY per acre likely underestimates the contributing recharge to the Olcese Sand Aquifer Unit which comprises the principal aquifer in this area. Nevertheless, results from the "checkbook" approach for the Olcese GSA Area suggest a local surplus of approximately 552 AFY under Baseline conditions, which is similar to the values determined through the calibrated spreadsheet model, suggesting the Olcese GSA Area is very close to balanced conditions.

[32] The use of acreage-normalized "native yield" values in the "checkbook" water accounting approach should not be viewed as an "allocation" of groundwater pumping to lands in the Kern Subbasin, but rather is used to facilitate comparisons to commonly-used agronomic quantities (e.g., crop water demands in AFY/ac).

TABLE WB-2
Annual Surface Water Inflows and Outflows by Source Type
Olcese Groundwater Sustainability Agency
Kern Subbasin

DWR Water Year (Oct - Sept)	INFLOWS [AFY]				OUTFLOWS [AFY]		
	Natural Inflows			TOTAL SURFACE WATER INFLOWS	*Surface Water Exports*	*Natural Outflows*	TOTAL SURFACE WATER OUTFLOWS
	Kern River Streamflow into District	Streamflow from Surrounding Watersheds	Direct Precipitation		Golf Course/ Water Sales (a)	Kern River Outflow	
Historical Water Budget (WY 1995 - 2014)							
1995	614,883	1,302	1,113	**617,298**	759	612,369	**613,128**
1996	930,243	1,177	1,007	**932,427**	721	928,448	**929,169**
1997	1,177,033	1,483	1,115	**1,179,631**	588	1,175,634	**1,176,221**
1998	1,555,670	3,237	2,502	**1,561,410**	679	1,557,083	**1,557,762**
1999	482,372	1,104	982	**484,459**	748	481,489	**482,237**
2000	469,790	645	608	**471,044**	756	467,569	**468,325**
2001	492,942	1,152	860	**494,953**	775	491,501	**492,276**
2002	348,612	615	531	**349,758**	793	345,645	**346,438**
2003	462,918	1,390	1,100	**465,407**	778	461,574	**462,352**
2004	443,428	958	900	**445,285**	979	440,894	**441,873**
2005	850,197	1,429	1,148	**852,774**	802	848,668	**849,470**
2006	1,072,429	1,231	977	**1,074,637**	775	1,070,109	**1,070,884**
2007	365,987	1,104	954	**368,045**	821	364,072	**364,893**
2008	462,701	551	530	**463,781**	910	459,626	**460,536**
2009	449,209	878	855	**450,942**	824	447,213	**448,036**
2010	704,315	1,775	1,359	**707,448**	715	703,872	**704,587**
2011	1,318,218	1,682	1,482	**1,321,382**	654	1,318,260	**1,318,914**
2012	495,559	858	682	**497,099**	788	493,133	**493,920**
2013	241,492	831	840	**243,164**	820	239,542	**240,362**
2014	171,212	647	615	**172,473**	1,836	168,682	**170,518**
TOTAL	13,109,209	24,049	20,161	**13,153,418**	16,521	13,075,382	**13,091,902**
AVERAGE	*655,460*	*1,202*	*1,008*	***657,671***	*826*	*653,769*	***654,595***
%	*99.66%*	*0.18%*	*0.15%*	-	*0.13%*	*99.87%*	-
Current Water Budget (WY 1995)							
2015	146,179	912	925	**148,016**	649	144,086	**144,735**
%	*98.76%*	*0.62%*	*0.62%*	-	*0.45%*	*99.55%*	-

Abbreviations

AFY = acre-feet per year
CalWater = California Water Service Company
DWR = California Department of Water Resources

Notes

(a) Olcese Water District sold 1,050 AF of water to Kern County Water Agency between March 2014 and July 2014.

TABLE WB-3

Annual Inflows to and Outflows from the Groundwater System, and Change in Groundwater Storage

Olcese Groundwater Sustainability Agency

Kern Subbasin

DWR Water Year (Oct - Sept)	**INFLOWS [AFY]**			**OUTFLOWS [AFY]**			**CHANGE IN STORAGE**	
	Infiltration from Kern River-Shallow Alluvium	Infiltration of Precipitation through Olcese Sand Outcrops	**TOTAL INFLOWS TO GROUND-WATER SYSTEM**	Groundwater Pumping	Subsurface Groundwater Outflow	**TOTAL OUTFLOWS FROM GROUND-WATER SYSTEM**	**Annual Change in Groundwater Storage [AFY]**	*Cumulative Change in Groundwater Storage Since WY 1995 [AF]*
Historical Water Budget (WY 1995 - 2014)								
1995	730	2,705	**3,435**	433	2,201	**2,634**	**801**	*801*
1996	730	2,207	**2,937**	1,363	2,201	**3,564**	**-628**	*173*
1997	730	2,812	**3,542**	995	2,201	**3,196**	**346**	*518*
1998	730	4,487	**5,217**	178	2,201	**2,379**	**2,838**	*3,356*
1999	730	2,454	**3,184**	1,019	2,201	**3,220**	**-36**	*3,320*
2000	730	1,426	**2,156**	568	2,201	**2,769**	**-613**	*2,707*
2001	730	2,059	**2,789**	541	2,201	**2,742**	**47**	*2,754*
2002	730	1,261	**1,990**	543	2,201	**2,744**	**-754**	*2,000*
2003	730	2,610	**3,340**	383	2,201	**2,584**	**756**	*2,756*
2004	730	2,136	**2,866**	709	2,201	**2,910**	**-44**	*2,712*
2005	730	2,725	**3,455**	226	2,201	**2,427**	**1,028**	*3,740*
2006	730	2,302	**3,032**	77	2,201	**2,278**	**754**	*4,494*
2007	730	2,237	**2,967**	1,009	2,201	**3,211**	**-244**	*4,251*
2008	730	1,296	**2,026**	955	2,201	**3,156**	**-1,130**	*3,120*
2009	730	2,000	**2,730**	1,548	2,201	**3,749**	**-1,019**	*2,102*
2010	730	3,255	**3,985**	1,070	2,201	**3,271**	**713**	*2,815*
2011	730	2,845	**3,575**	1,083	2,201	**3,284**	**292**	*3,107*
2012	730	1,642	**2,371**	927	2,201	**3,128**	**-756**	*2,350*
2013	730	1,959	**2,689**	1,154	2,201	**3,356**	**-667**	*1,684*
2014	730	1,197	**1,927**	2,357	2,201	**4,558**	**-2,631**	*-948*
TOTAL	14,598	45,615	**60,213**	17,140	44,021	**61,161**	**-948**	-
AVERAGE	730	2,281	**3,011**	857	2,201	**3,058**	**-47**	-
%	24%	76%	-	28%	72%	-	-	-

TABLE WB-3

Annual Inflows to and Outflows from the Groundwater System, and Change in Groundwater Storage

Olcese Groundwater Sustainability Agency

Kern Subbasin

DWR Water Year (Oct - Sept)	**INFLOWS [AFY]**			**OUTFLOWS [AFY]**			**CHANGE IN STORAGE**	
	Infiltration from Kern River-Shallow Alluvium	Infiltration of Precipitation through Olcese Sand Outcrops	**TOTAL INFLOWS TO GROUND-WATER SYSTEM**	Groundwater Pumping	Subsurface Groundwater Outflow	**TOTAL OUTFLOWS FROM GROUND-WATER SYSTEM**	**Annual Change in Groundwater Storage [AFY]**	*Cumulative Change in Groundwater Storage Since WY 1995 [AF]*
Current Water Budget (WY 1995)								
2015	730	2,300	**3,030**	1,198	2,201	**3,399**	**-369**	*-1,317*
%	24%	76%		35%	65%	**-**	**-**	-
Additional Water Budget Years (WY 2016 and 2017)								
2016	730	2,756	**3,485**	1,192	2,201	**3,393**	**93**	*-1,224*
2017	730	3,643	**4,373**	529	2,201	**2,730**	**1,643**	*419*
TOTAL (WY 1995 - 2017)	16,788	54,313	**71,101**	20,058	50,624	**70,682**	**419**	
AVERAGE (WY 1995 - 2017)	*730*	*2,361*	***3,091***	*872*	*2,201*	***3,073***	**18**	-
%	*24%*	*76%*	-	*28%*	*72%*	**-**	-	-

Abbreviations

AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
WY = Water Year

Notes

(a) All values reported in acre-feet per year (AFY), except cumulative change in storage (reported in acre-feet).

(b) The area of Olcese Sand outcrops through which precipitation recharges the groundwater systems was estimated by GIS analysis and water balance calibration to be 15,000 acres, and includes some areas outside of the Olcese GSA Area.

TABLE WB-4

Annual and Cumulative Change in Groundwater Storage between Seasonal Highs (Apr - Mar)

Olcese Groundwater Sustainability Agency

Kern Subbasin

Period of Reference [m/yy]	Annual Change in Groundwater Storage [AFY]	Cumulative Change in Groundwater Storage [AF]
4/94 - 3/95	-307	-307
4/95 - 3/96	756	449
4/96 - 3/97	174	623
4/97 - 3/98	75	698
4/98 - 3/99	2,961	3,658
4/99 - 3/00	-1,450	2,208
4/00 - 3/01	136	2,344
4/01 - 3/02	-306	2,038
4/02 - 3/03	-31	2,006
4/03 - 3/04	715	2,722
4/04 - 3/05	-126	2,596
4/05 - 3/06	1,150	3,746
4/06 - 3/07	311	4,057
4/07 - 3/08	-650	3,407
4/08 - 3/09	-713	2,694
4/09 - 3/10	-749	1,945
4/10 - 3/11	1,096	3,041
4/11 - 3/12	-729	2,312
4/12 - 3/13	-320	1,992
4/13 - 3/14	-1,805	187
TOTAL	187	-
AVERAGE	9	-

Abbreviations

AF = acre-feet

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

(a) The change in groundwater storage values shown here are for annual periods between seasonal high groundwater levels, i.e., April through March of the following year.

TABLE WB-5

Supplies, Demands, and Change in Groundwater Storage vs. DWR Water Year Type

Olcese Groundwater Sustainability Agency

Kern Subbasin

DWR Water Year (Oct - Sept)	DWR Water Year Type (a)	Total Supplies [AFY] (b)	Total Demands [AFY] (c)	Annual Change in Groundwater Storage [AFY]
1995	W	620,003	618,744	801
1996	W	934,634	934,638	-628
1997	W	1,182,443	1,181,521	346
1998	W	1,565,897	1,562,958	2,838
1999	AN	486,913	486,693	-36
2000	AN	472,470	472,773	-613
2001	D	497,013	496,627	47
2002	D	351,018	351,434	-754
2003	BN	468,017	466,929	756
2004	D	447,422	447,139	-44
2005	W	855,500	854,185	1,028
2006	W	1,076,940	1,075,885	754
2007	C	370,282	370,182	-244
2008	C	465,077	465,834	-1,130
2009	BN	452,942	453,521	-1,019
2010	AN	710,703	709,634	713
2011	W	1,324,227	1,323,621	292
2012	D	498,741	499,125	-756
2013	C	245,122	245,369	-667
2014	C	173,670	175,864	-2,631
2015	C	150,316	150,345	-369

Water Year Type (a)	Number of Years During WY 1995 - 2015 Period	Average Total Supplies [AFY] (b)	Average Total Demands [AFY] (c)	Average Annual Change in Groundwater Storage [AFY]
C	5	280,893	281,519	-1,008
D	4	448,548	448,581	-377
BN	2	460,480	460,225	-131
AN	3	556,695	556,366	21
W	7	1,079,949	1,078,793	776

Abbreviations

AFY = acre-feet per year
DWR = California Department of Water Resources
WY = Water Year

Notes:

(a) DWR Water Year Types are as follows: W = wet, AN = above normal, BN = below normal, D = dry, C = critical
(b) Total supplies equal the sum of inflow terms (see Table WB-6 for individual inflow components).
(c) Total demands equal the sum of outflow terms (see Table WB-6 for individual outflow components).
(d) The apparent residual of water-budget calculated change in groundwater storage to [Total Inflows - Total Outflows] can be attributed to the deep percolation lag effect in the water budget spreadsheet model, which serves to delay infiltration from reaching the groundwater system. See "Appendix E - Methods & Data Used in the Water Budget Spreadsheet Model Approach" for further details on how monthly storage change is calculated within the water budget spreadsheet model.

Sources:

(1) DWR Water Year Type is from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley <http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>.

TABLE WB-6
Annual Total Inflows, Outflows, and Change in Groundwater Storage
Olcese Groundwater Sustainability Agency
Kern Subbasin

	INFLOWS [AFY]						OUTFLOWS [AFY]					CHANGE IN STORAGE	
DWR Water Year (Oct - Sept)	Subsurface Groudwater Inflow	Infiltration of Precipitation through Olcese Sand Outcrops	Direct Precipitation	Streamflow from Surrounding Watersheds	Kern River Inflow	**TOTAL INFLOWS**	Evapo-transpiration (b)	Surface Water Exports	Kern River Outflow	Subsurface Groundwater Outflow	**TOTAL OUTFLOWS**	**Annual Change in Groundwater Storage [AFY] (c)**	*Cumulative Change in Groundwater Storage Since WY 1995 [AF]*
Historical Water Budget (WY 1995 - 2014)													
1995	0	2,705	1,113	1,302	614,883	**620,003**	3,414	759	612,369	2,201	**618,744**	**801**	*801*
1996	0	2,207	1,007	1,177	930,243	**934,634**	3,268	721	928,448	2,201	**934,638**	**-628**	*173*
1997	0	2,812	1,115	1,483	1,177,033	**1,182,443**	3,098	588	1,175,634	2,201	**1,181,521**	**346**	*518*
1998	0	4,487	2,502	3,237	1,555,670	**1,565,897**	2,995	679	1,557,083	2,201	**1,562,958**	**2,838**	*3,356*
1999	0	2,454	982	1,104	482,372	**486,913**	2,255	748	481,489	2,201	**486,693**	**-36**	*3,320*
2000	0	1,426	608	645	469,790	**472,470**	2,247	756	467,569	2,201	**472,773**	**-613**	*2,707*
2001	0	2,059	860	1,152	492,942	**497,013**	2,150	775	491,501	2,201	**496,627**	**47**	*2,754*
2002	0	1,261	531	615	348,612	**351,018**	2,794	793	345,645	2,201	**351,434**	**-754**	*2,000*
2003	0	2,610	1,100	1,390	462,918	**468,017**	2,376	778	461,574	2,201	**466,929**	**756**	*2,756*
2004	0	2,136	900	958	443,428	**447,422**	3,065	979	440,894	2,201	**447,139**	**-44**	*2,712*
2005	0	2,725	1,148	1,429	850,197	**855,500**	2,514	802	848,668	2,201	**854,185**	**1,028**	*3,740*
2006	0	2,302	977	1,231	1,072,429	**1,076,940**	2,800	775	1,070,109	2,201	**1,075,885**	**754**	*4,494*
2007	0	2,237	954	1,104	365,987	**370,282**	3,088	821	364,072	2,201	**370,182**	**-244**	*4,251*
2008	0	1,296	530	551	462,701	**465,077**	3,097	910	459,626	2,201	**465,834**	**-1,130**	*3,120*
2009	0	2,000	855	878	449,209	**452,942**	3,283	824	447,213	2,201	**453,521**	**-1,019**	*2,102*
2010	0	3,255	1,359	1,775	704,315	**710,703**	2,846	715	703,872	2,201	**709,634**	**713**	*2,815*
2011	0	2,845	1,482	1,682	1,318,218	**1,324,227**	2,506	654	1,318,260	2,201	**1,323,621**	**292**	*3,107*
2012	0	1,642	682	858	495,559	**498,741**	3,003	788	493,133	2,201	**499,125**	**-756**	*2,350*
2013	0	1,959	840	831	241,492	**245,122**	2,806	820	239,542	2,201	**245,369**	**-667**	*1,684*
2014	0	1,197	615	647	171,212	**173,670**	3,145	1,836	168,682	2,201	**175,864**	**-2,631**	*-948*
TOTAL	0	45,615	20,161	24,049	13,109,209	**13,199,033**	56,750	16,521	13,075,382	44,021	**13,192,673**	**-948**	-
AVERAGE	0	2,281	1,008	1,202	655,460	**659,952**	2,838	826	653,769	2,201	**659,634**	**-47**	-
%	0.00%	0.35%	0.15%	0.18%	99.32%	-	0.43%	0.13%	99.11%	0.33%	**-**	-	-
Current Water Budget (WY 2015)													
2015	0	2,300	925	912	146,179	**150,316**	3,409	649	144,086	2,201	**150,345**	**-369**	*-1,317*
%	0.00%	1.53%	0.62%	0.61%	97.25%	-	2.27%	0.43%	95.84%	1.46%	**-**	-	-

Abbreviations
AF = acre-feet
AFY = acre-feet per year
DWR = California Department of Water Resources
M&I = municipal & industrial
WY = Water Year

Notes
(a) All values reported in acre-feet per year (AFY), except cumulative change in storage (reported in acre-feet).
(b) "Evapotranspiration" includes all estimated crop and vegetative evapotranspirative demands as well as evaporation of excess rainfall and from open water bodies within the District.
(c) Apparent residual of water-budget calculated change in groundwater storage as [Total Inflows - Total Outflows] can be attributed to the uncertainty of: (1) Kern River water diversions between the GSA boundary and the nearest streamflow gauge, (2) recharge from the Kern River to the Shallow Alluvium.
(d) The water budget component of this GSP is provided to comply with SGMA/GSP regulations. The water budget, and the data used therein, is believed to be the best and most accurate available. However, it is acknowledged that new, additional, and/or more accurate information/data may be later obtained. Therefore, this water budget, and data in this GSP, may be updated or modified as the Olcese GSA deems necessary and as may be required to avoid Undesirable Results in the Olcese GSA portion of the Kern Subbasin.

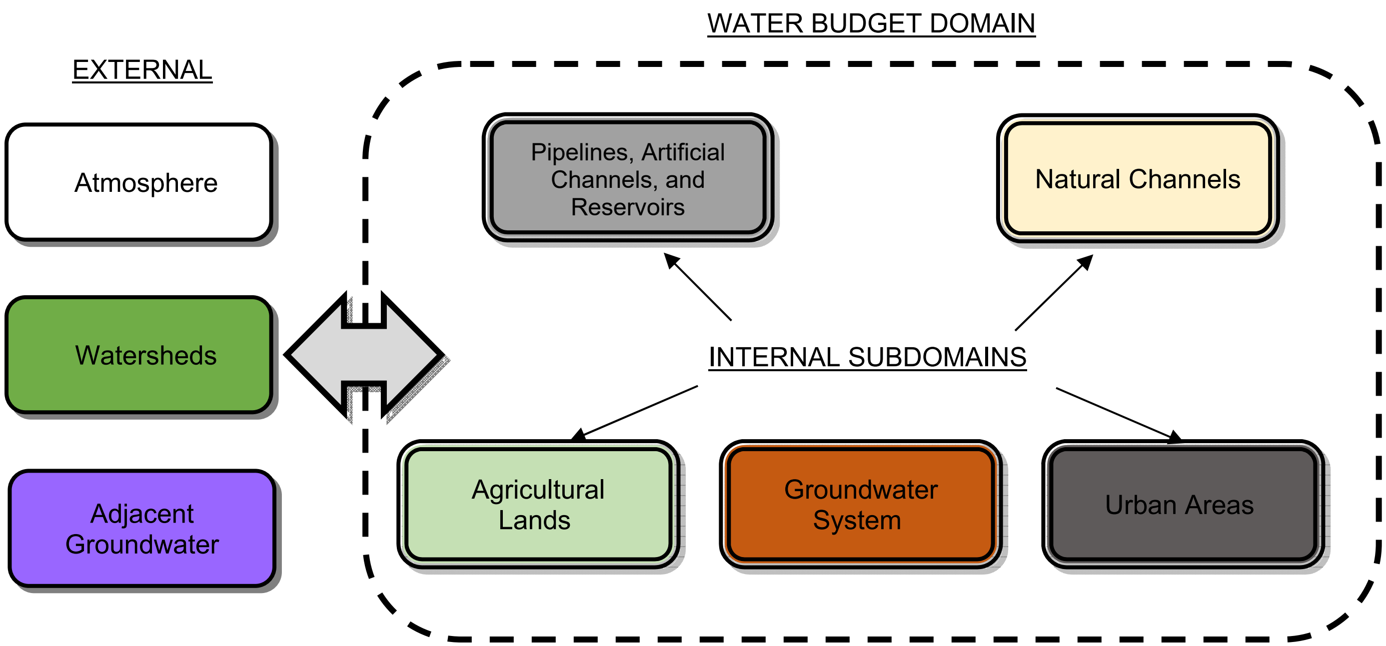
TABLE WB-7
Water Budget Summary - Historical and Projected Scenarios
Olcese Groundwater Sustainability Agency
Kern Subbasin

	Historical (WY 1995-2014)	Extended Historical (WY 1995-2017)	Projected Future Scenarios				
			Baseline	2030 Climate Change	2070 Climate Change	2070 Climate Change (WMW)	2070 Climate Change (DEW)
Surface Water / Shallow Alluvium Subdomain							
Inflows							
Smaller Streamflow into District Area	1,202	1,224	1,441	1,469	1,431	1,712	1,225
Seepage from Artificial Channels	55	55	55	55	55	55	55
Infiltration of Rainfall and Applied Water	1,411	1,410	1,325	1,362	1,423	1,353	1,514
Kern River Flow into District Area	655,460	661,120	646,353	646,054	639,573	774,536	638,369
Rainfall onto Natural Channels	51	53	51	52	51	61	42
Infiltration of M&I Water	45	46	48	49	48	55	42
Total Inflows	**658,225**	**663,907**	**649,273**	**649,039**	**642,579**	**777,771**	**641,246**
Outflows							
Kern River Diversions	3,379	3,359	3,299	3,378	3,538	3,222	3,850
Recharge from Natural Channels	730	730	730	730	730	730	730
Evaporation from Natural Channels	348	348	135	138	144	137	151
Kern River Flow out of District Area	653,769	659,470	645,110	644,793	638,167	773,682	636,515
Total Outflows	**658,225**	**663,907**	**649,273**	**649,039**	**642,579**	**777,771**	**641,246**
Balance (Inflows - Outflows)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Agricultural Lands Subdomain (within Olcese GSA Area)							
Inflows							
District Deliveries to Ag Lands	2,877	2,890	2,849	2,943	3,133	2,758	3,504
Rainfall onto Agricultural Lands	945	967	945	957	931	1,116	776
Total Inflows	**3,822**	**3,857**	**3,794**	**3,900**	**4,064**	**3,874**	**4,280**
Outflows							
Infiltration of Rainfall and Applied Water	1,411	1,410	1,325	1,362	1,423	1,353	1,514
Evapotranspiration of Rainfall and Applied Water	2,410	2,447	2,469	2,538	2,641	2,521	2,767
Total Outflows	**3,822**	**3,857**	**3,794**	**3,900**	**4,064**	**3,874**	**4,280**
Balance (Inflows - Outflows)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Groundwater Subdomain (Olcese Sand Aquifer Unit)							
Inflows							
Recharge from Natural Channels	730	730	730	730	730	730	730
Groundwater Inflow (subsurface)	0	0	0	0	0	0	0
Infiltration of Precipitation on Olcese Sand Outcrops	2,281	2,361	2,303	2,339	2,287	2,627	1,875
Total Inflows	**3,011**	**3,091**	**3,033**	**3,069**	**3,017**	**3,357**	**2,604**
Outflows							
Groundwater Pumping from District Wells	857	872	857	884	938	831	1,044
Subsurface Groundwater Outflow	2,201	2,201	2,201	2,201	2,201	2,201	2,201
Total Outflows	**3,058**	**3,073**	**3,058**	**3,085**	**3,139**	**3,032**	**3,245**
Balance (Inflows - Outflows)	**-47**	**18**	**-25**	**-15**	**-122**	**325**	**-640**

TABLE WB-7
Water Budget Summary - Historical and Projected Scenarios
Olcese Groundwater Sustainability Agency
Kern Subbasin

	Historical (WY 1995-2014)	Extended Historical (WY 1995-2017)	Projected Future Scenarios				
			Baseline	**2030 Climate Change**	**2070 Climate Change**	**2070 Climate Change (WMW)**	**2070 Climate Change (DEW)**
Artificial Channels Subdomain							
Inflows							
Kern River Diversions	3,379	3,359	3,299	3,378	3,538	3,222	3,850
Groundwater Pumping from District Wells	857	872	857	884	938	831	1,044
Rainfall onto Artificial Channels and Reservoirs	12	12	12	12	12	14	10
Total Inflows	**4,248**	**4,243**	**4,168**	**4,274**	**4,487**	**4,067**	**4,904**
Outflows							
District Deliveries to Ag Lands	2,877	2,890	2,849	2,943	3,133	2,758	3,504
Seepage from Artificial Channels	55	55	55	55	55	55	55
M&I Deliveries (Anne Sippi)	76	75	103	103	103	103	103
Evaporation from Artificial Channels	80	80	32	33	35	33	36
Surface Water Exports	1,161	1,144	1,129	1,140	1,162	1,119	1,206
Total Outflows	**4,248**	**4,243**	**4,168**	**4,274**	**4,487**	**4,067**	**4,904**
Balance (Inflows - Outflows)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Urban Lands Subdomain (Anne Sippi Clinic and Rio Bravo Area) [2]							
Inflows							
M&I Deliveries (Anne Sippi)	76	75	103	103	103	103	103
Cal Water Deliveries to Rio Bravo Area	29	29	29	29	29	29	29
Rainfall on Urban Lands	35	36	35	35	34	41	29
Total Inflows	**140**	**140**	**167**	**168**	**167**	**173**	**161**
Outflows							
Consumptive Use of M&I Water	94	94	119	119	119	119	119
Infiltration of M&I Water	45	46	48	49	48	55	42
Total Outflows	**140**	**140**	**167**	**168**	**167**	**173**	**161**
Balance (Inflows - Outflows)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Entire Water Budget Domain							
Inflows							
Subsurface Groudwater Inflow	0	0	0	0	0	0	0
Infiltration of Precipitation through Olcese Sand Outcrops	2,281	2,361	2,303	2,339	2,287	2,627	1,875
Direct Precipitation	1,043	1,067	1,043	1,056	1,027	1,232	857
Streamflow from Surrounding Watersheds	1,202	1,224	1,441	1,469	1,431	1,712	1,225
Cal Water Deliveries to Rio Bravo Area	29	29	29	29	29	29	29
Kern River Inflow	655,460	661,120	646,353	646,054	639,573	774,536	638,369
Total Inflows	**660,016**	**665,802**	**651,170**	**650,947**	**644,347**	**780,137**	**642,354**
Outflows							
Evaporation & Evapotranspiration	2,838	2,875	2,635	2,709	2,820	2,691	2,954
Surface Water Exports	1,161	1,144	1,129	1,140	1,162	1,119	1,206
Kern River Outflow	653,769	659,470	645,110	644,793	638,167	773,682	636,515
Subsurface Groundwater Outflow	2,201	2,201	2,201	2,201	2,201	2,201	2,201
Consumptive Use of M&I Water	94	94	119	119	119	119	119
Total Outflows	**660,063**	**665,784**	**651,195**	**650,963**	**644,469**	**779,812**	**642,995**
Balance (Inflows - Outflows)	**-47**	**18**	**-25**	**-15**	**-122**	**325**	**-640**

Notes
(a) Units are acre-feet per year (AFY) unless indicated otherwise
(b) The Rio Bravo Area is the small (44-acre) neighborhood in the center of the Olcese GSA Area. Though technically not part of the Olcese GSA Area, it is included herein for completeness.
(c) The water budget component of this GSP is provided to comply with SGMA/GSP regulations. The water budget, and the data used therein, is believed to be the best and most accurate available. However, it is acknowledged that new, additional, and/or more accurate information/data may be later obtained. Therefore, this water budget, and data in this GSP, may be updated or modified as the Olcese GSA deems necessary and as may be required to avoid Undesirable Results in the Olcese GSA portion of the Kern Subbasin.



Notes

1. The Natural Channels subdomain includes the Kern River and the hydraulically-connected Shallow Alluvium.
2. The Groundwater System subdomain includes the Olcese Sand Aquifer Unit.
3. Non-agricultural lands are not included in the water budget domain.

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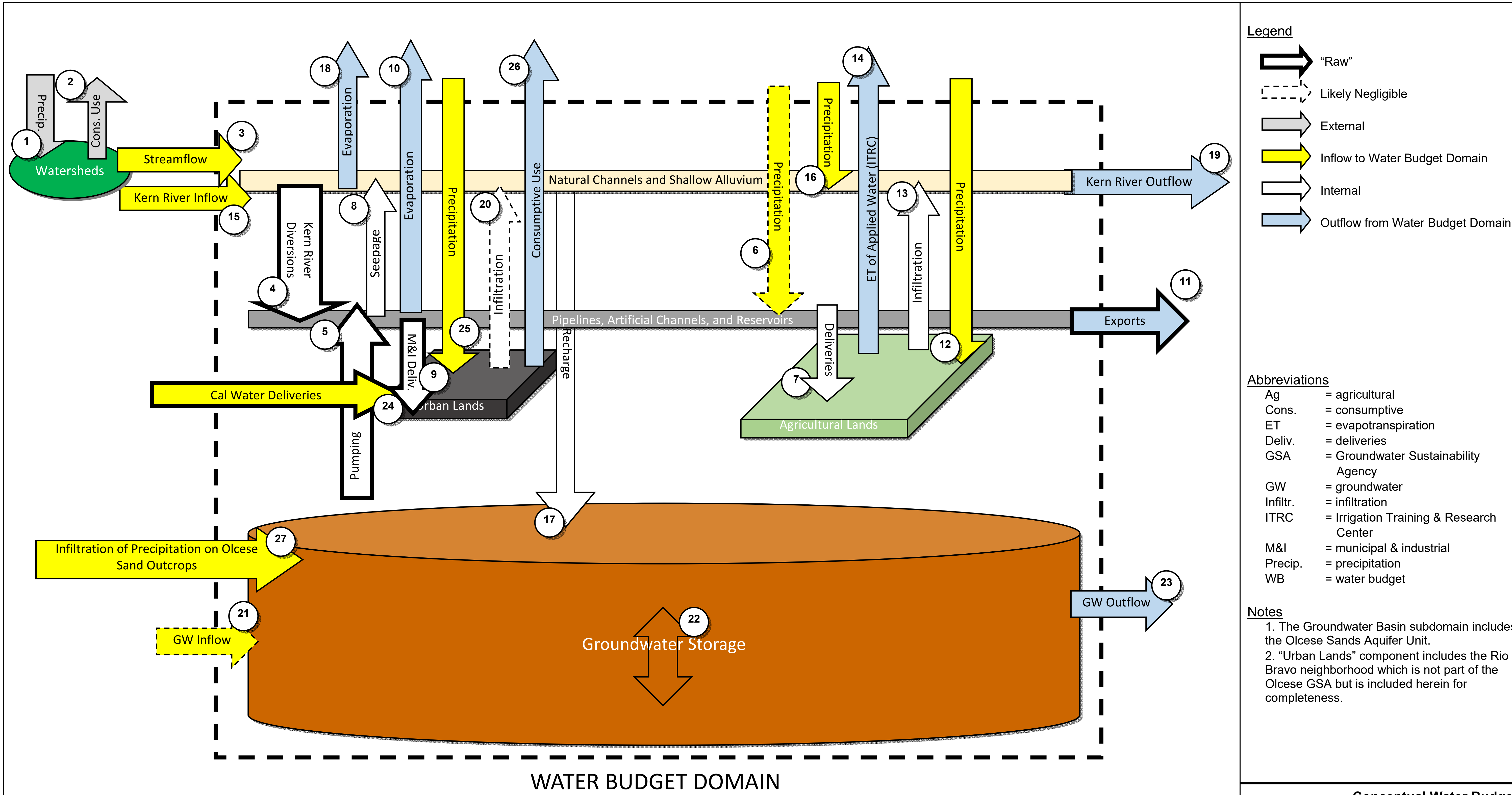
Conceptual Water Budget Domain and Subdomains

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-1



Conceptual Water Budget Components/Linkages

Olcese Water District
Kern County, California
December 2019
B70052.03

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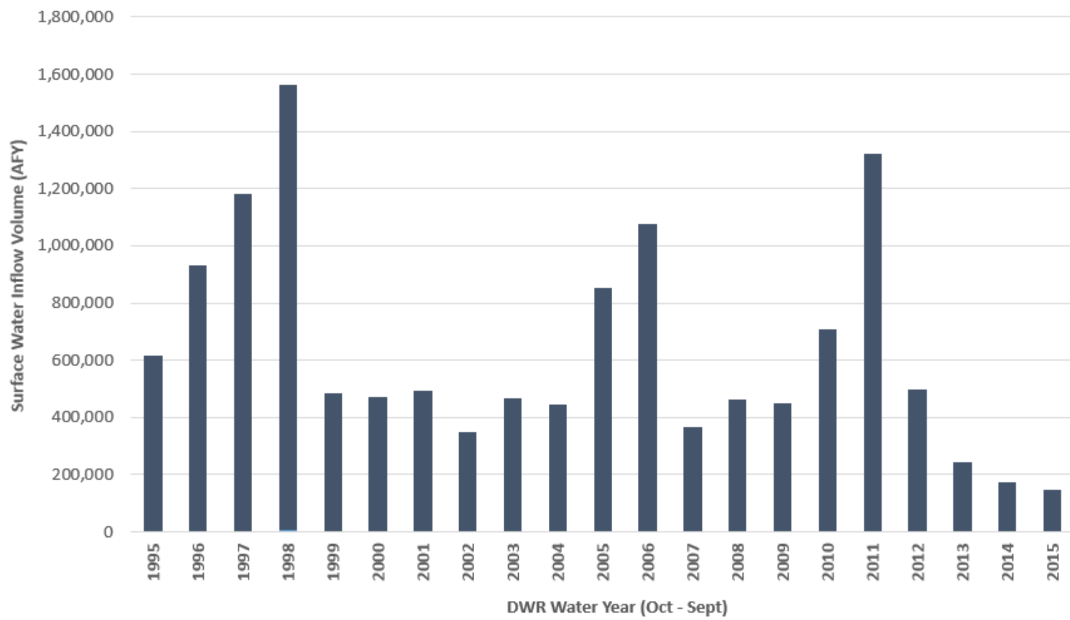
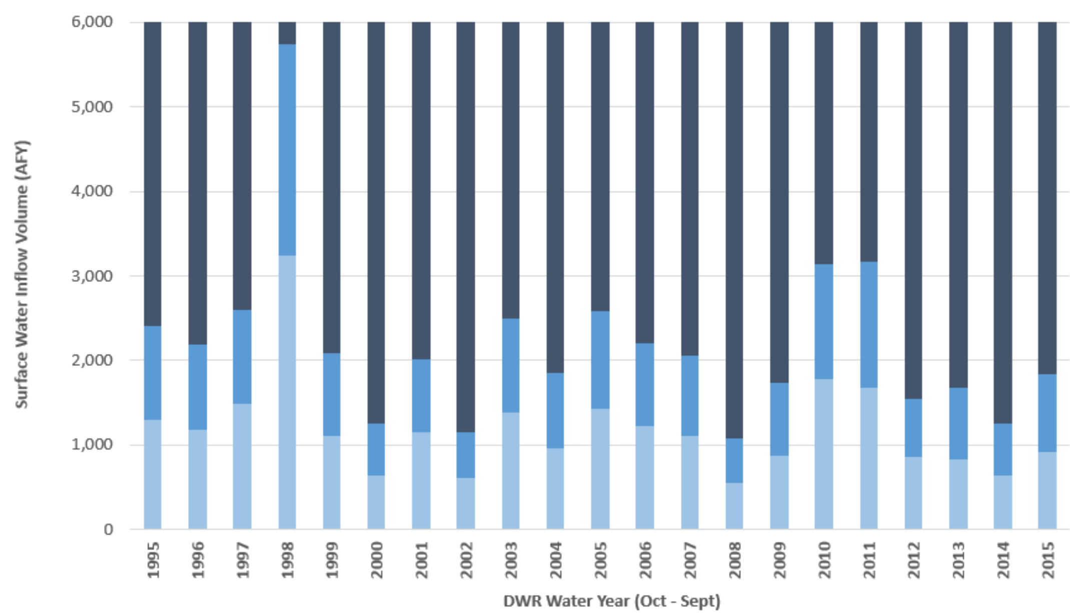
Figure WB-2





Legend

= Streamflow from Surrounding Watersheds

= Direct Precipitation

= Kern River Inflow

Abbreviations

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

1. The vertical scale on the lower chart has been expanded to show the smaller surface water inflow components.

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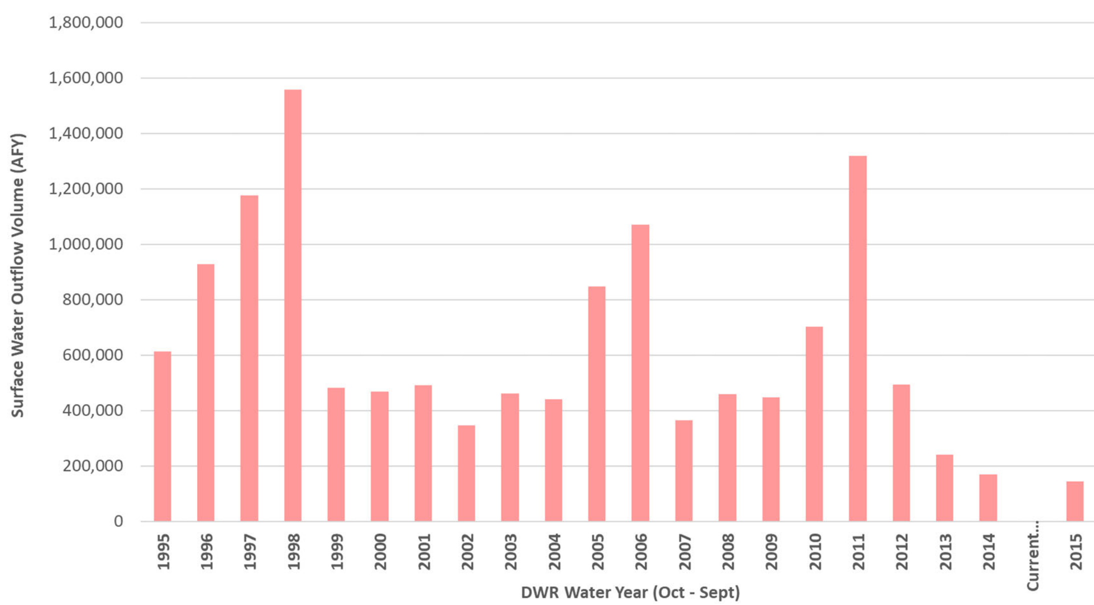
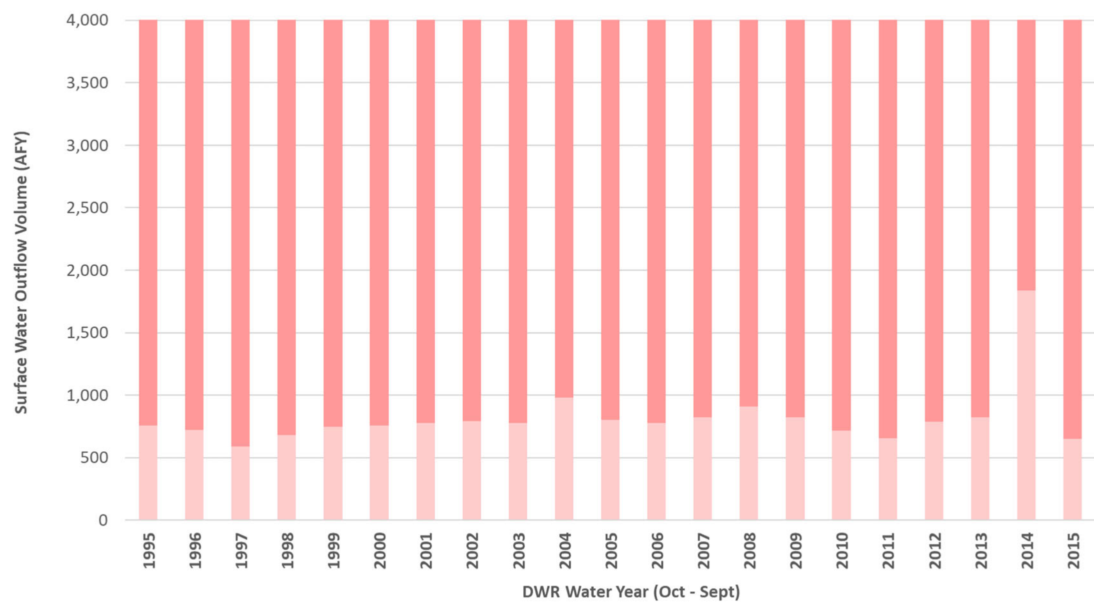
Annual Surface Water Inflows by Source

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-3





Legend

= Surface Water Exports

= Kern River Outflow

Abbreviations

AFY = acre-feet per year

DWR = California Department of Water Resources

Notes

1. The vertical scale on the lower chart has been expanded to show the smaller surface water outflow components.
2. Surface water exports include deliveries to the Rio Bravo Country Club and water sales to other districts.

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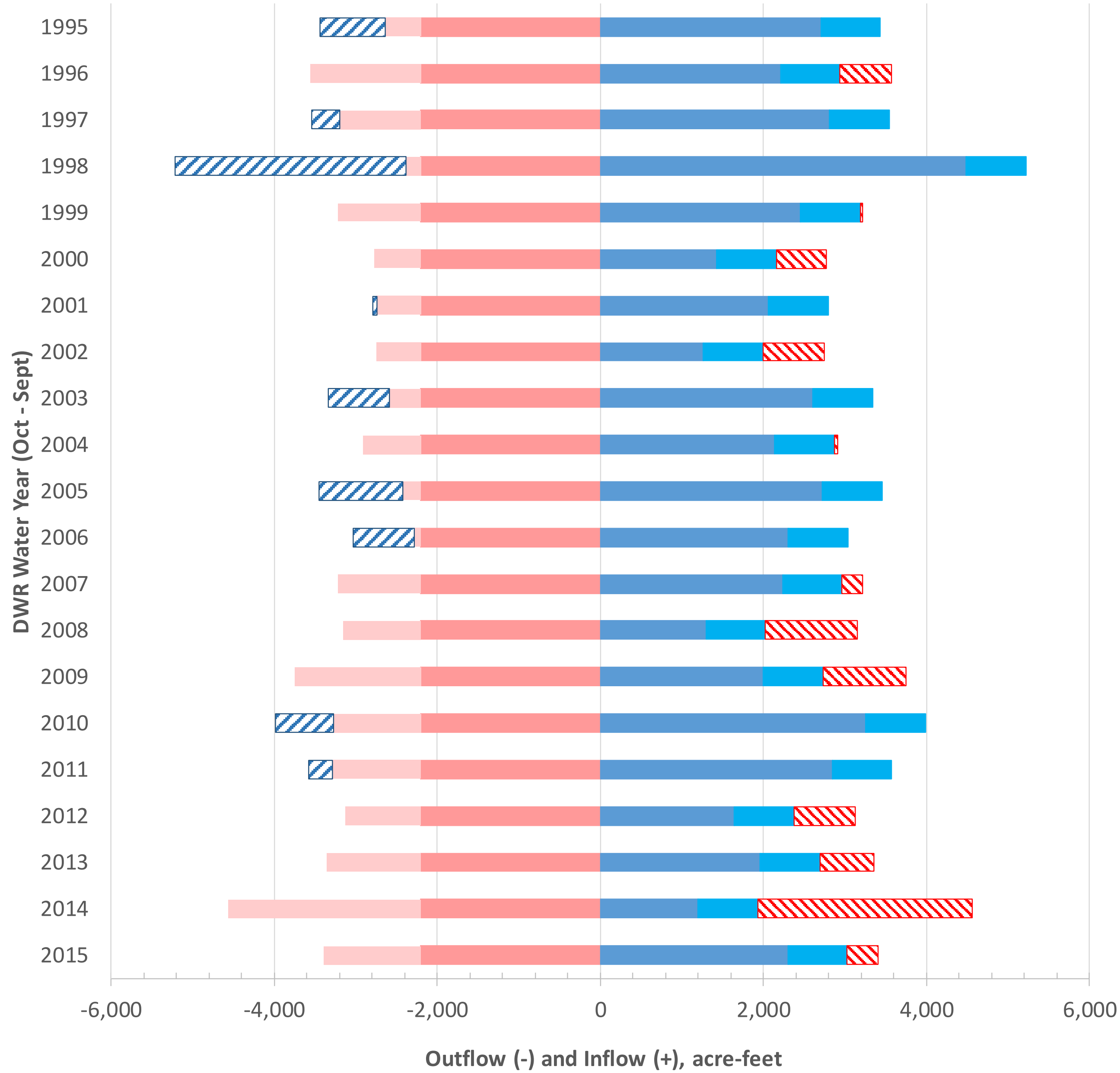
Annual Surface Water Outflows by Source

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-4



Legend

Groundwater Inflows

= Infiltration of Precipitation Through Olcese Sand Outcrops

= Infiltration from the Kern River-Shallow Alluvium

Groundwater Outflows

= Subsurface Groundwater Outflow

= Groundwater Extraction

Change in Groundwater Storage

= Gain in GW Storage

= Reduction in GW Storage

Abbreviations

DWR = California Department of Water Resources

GW = groundwater

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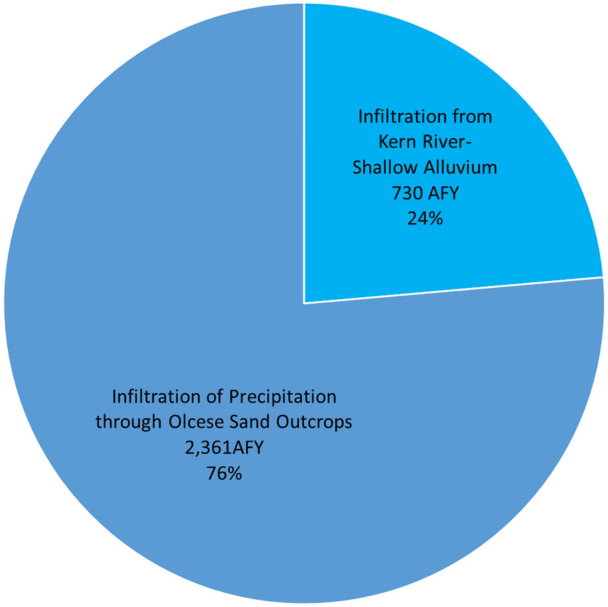
Annual Groundwater Inflows and Outflows

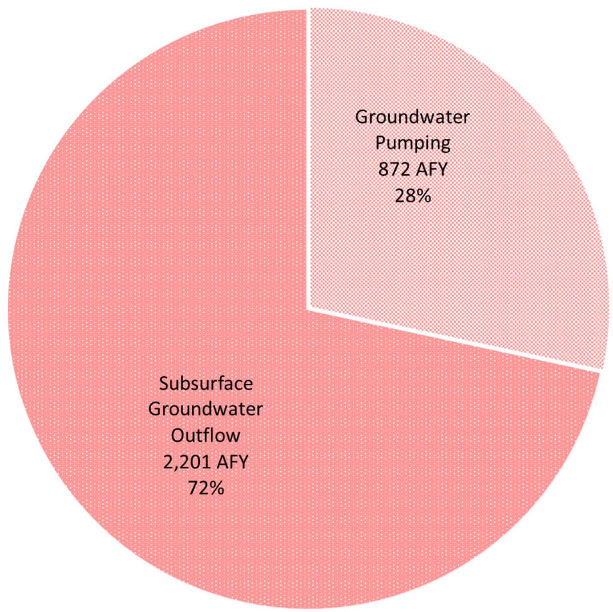
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-5

Total Average Annual Inflows: ***3,091 AFY***



Total Average Annual Outflows: ***3,073 AFY***



Legend

Groundwater Inflows

= Subsurface GW Inflow

= Infiltration of Applied Water

= Infiltration of Precipitation

= Infiltration from Surface Water Systems

Groundwater Outflows

= Subsurface Groundwater Outflow

= Groundwater Pumping

Abbreviations

AFY = acre-feet per year

GW = groundwater

WY = Water Year

Notes

1. All values reported in acre-feet per year (AFY).

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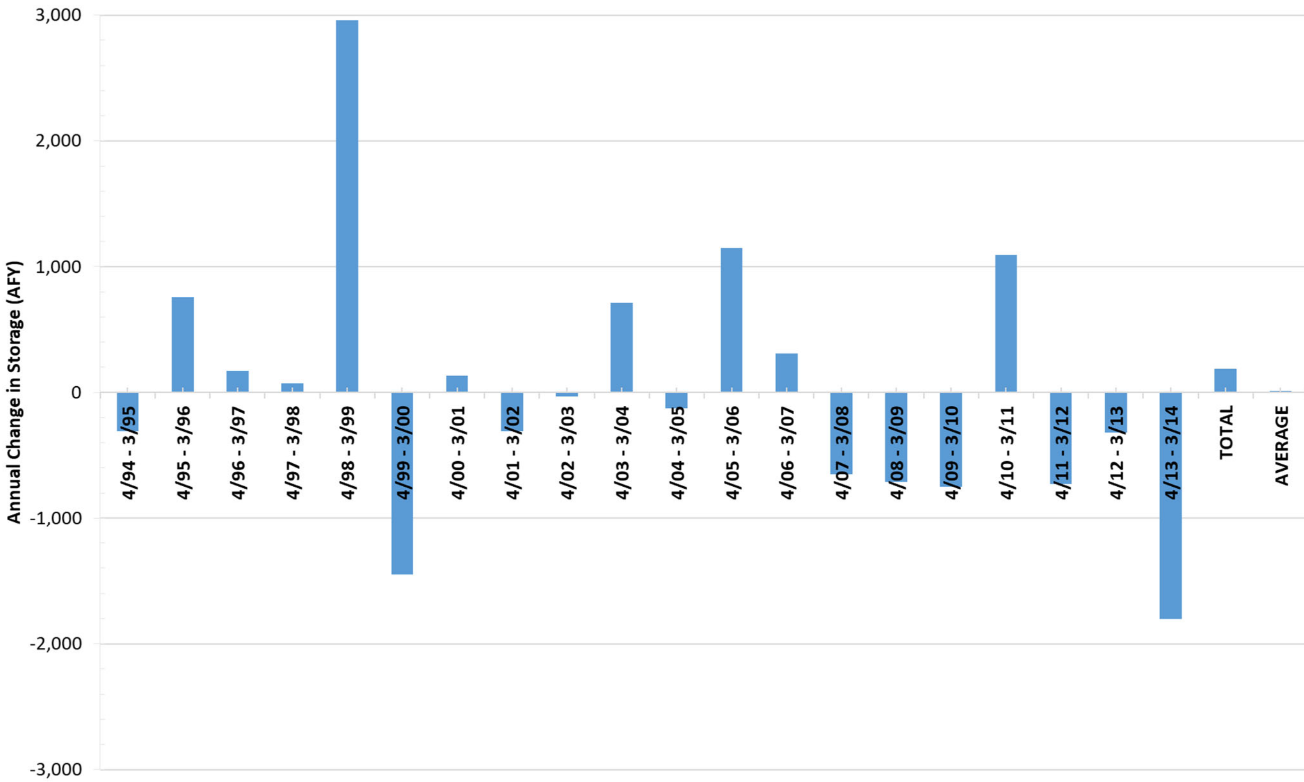
Average Annual Groundwater Inflows & Outflows, WY 1995 - 2015

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-6



Abbreviations

AFY = acre-feet per year

Notes

1. "Seasonal high" condition is defined as April – March of the following year.

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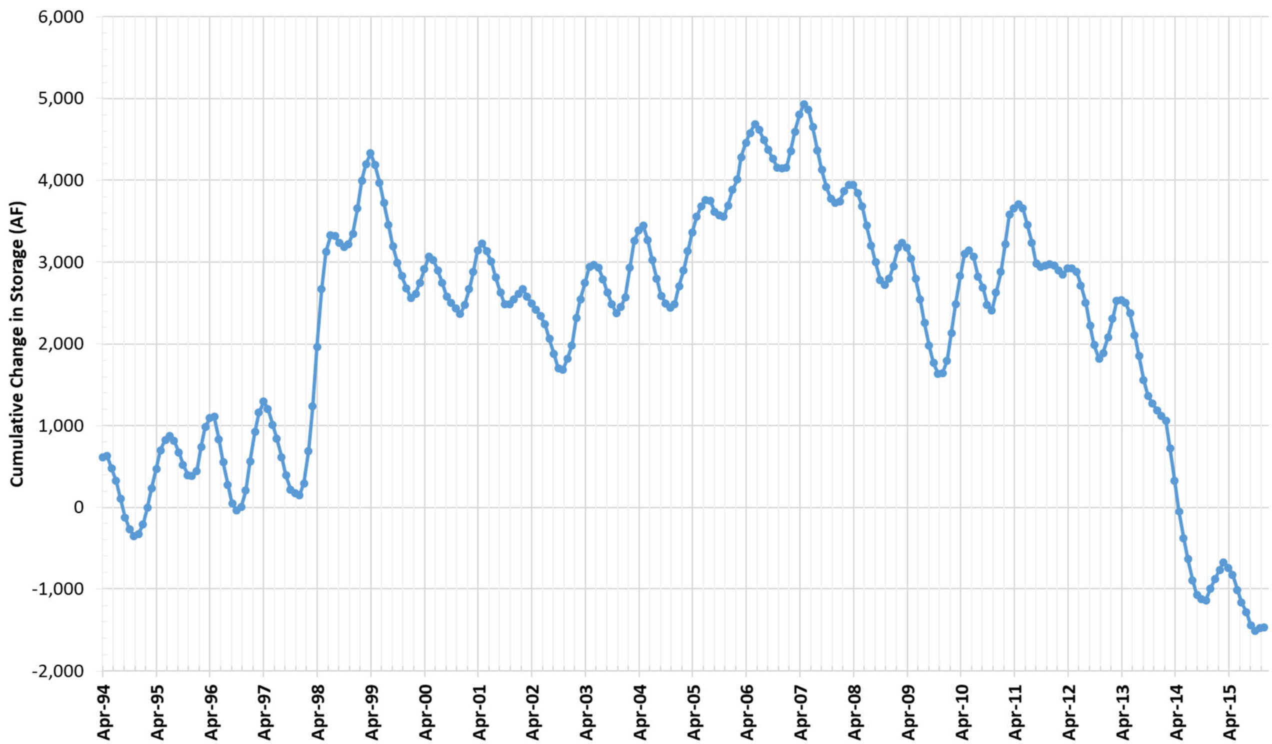
Annual Change in Storage Between Seasonal Highs

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-7



Abbreviations

AF = acre-feet

Notes

1. Values represent cumulative change in storage since the “seasonal high” condition of April 1994.

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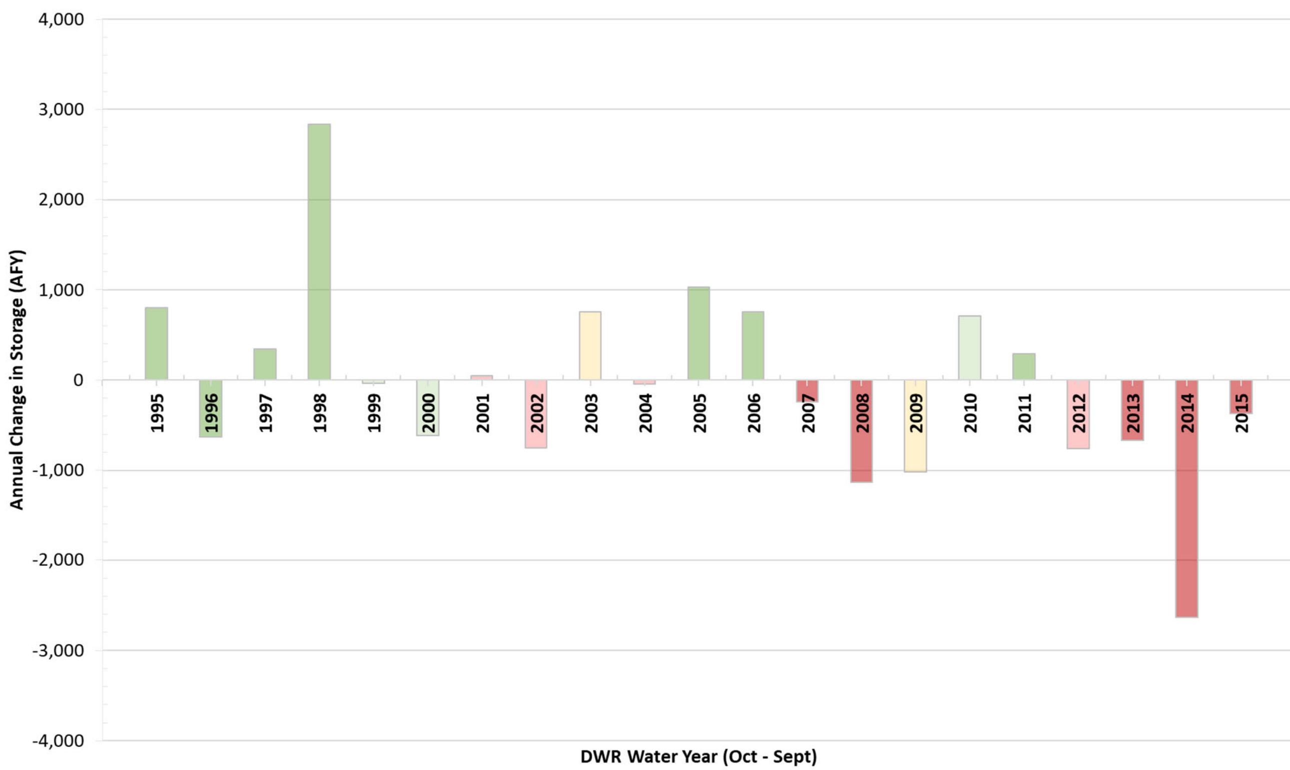
Cumulative Change in Storage, April 1994 - December 2015

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-8



Legend

DWR Water Year Type

= Wet

= Above Normal

= Below Normal

= Dry

= Critical

Abbreviations

AFY = acre-feet per year

DWR = California Department of Water Resources

Sources

1. DWR Water Year Type is from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley <http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>.

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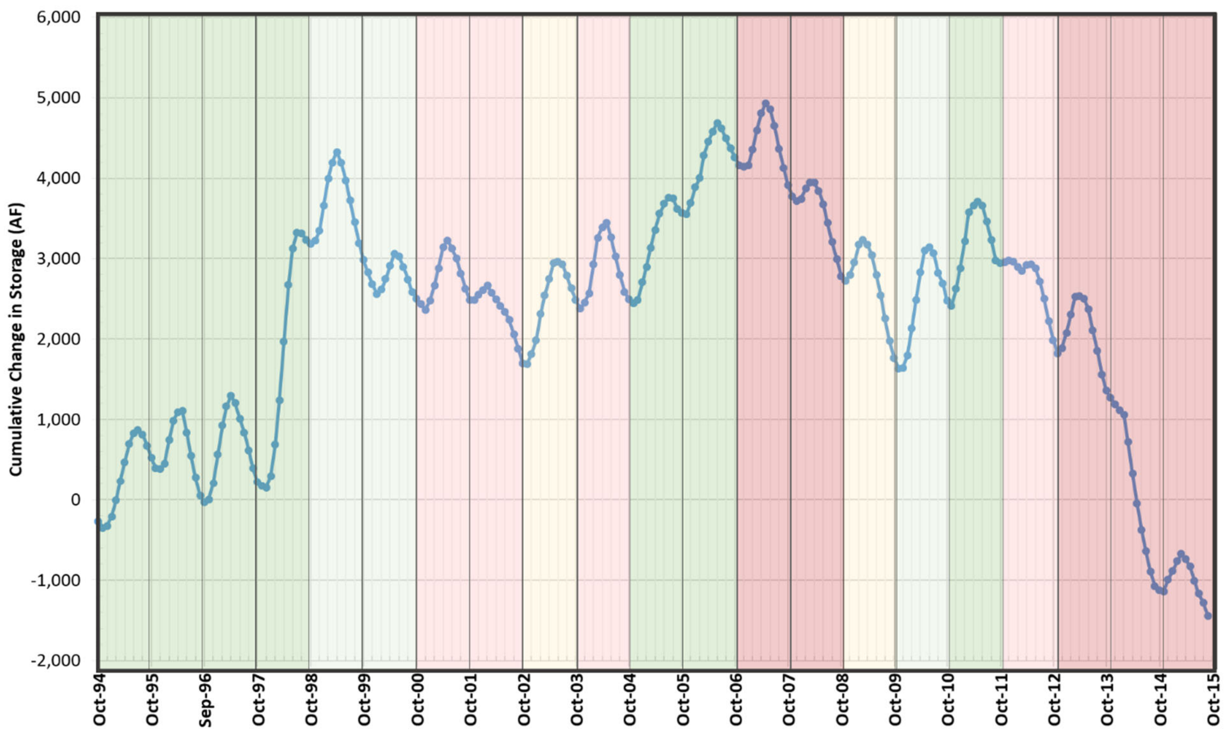
Annual Change in Storage vs. DWR Water Year Type

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-9



Legend

DWR Water Year Type

- = Wet
- = Above Normal
- = Below Normal
- = Dry
- = Critical

Abbreviations

AF = acre-feet

DWR = California Department of Water Resources

Sources

1. DWR Water Year Type is from DWR's Water Year Hydrologic Classification Indices for the San Joaquin Valley <http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST>.

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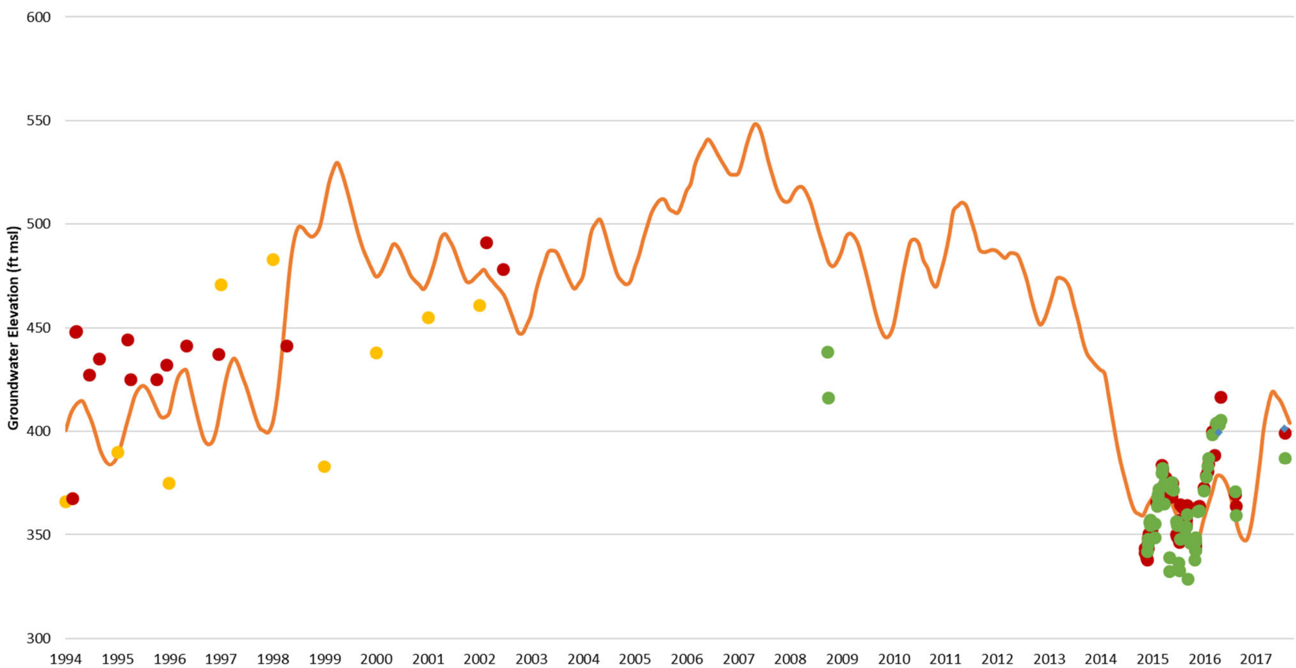
Cumulative Change in Storage vs. DWR Water Year Type

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-10



Legend

= Water Budget Spreadsheet Model-Calculated Groundwater Elevation (ft msl)

= Well #1
= Well #2
= Well #3
= Well #4

Abbreviations

ft msl = feet above mean sea level

Notes

1. Calibration of the water budget spreadsheet model was performed by comparing measured groundwater elevations on District's wells with an estimate of the average groundwater elevation throughout the District based on change in groundwater storage.

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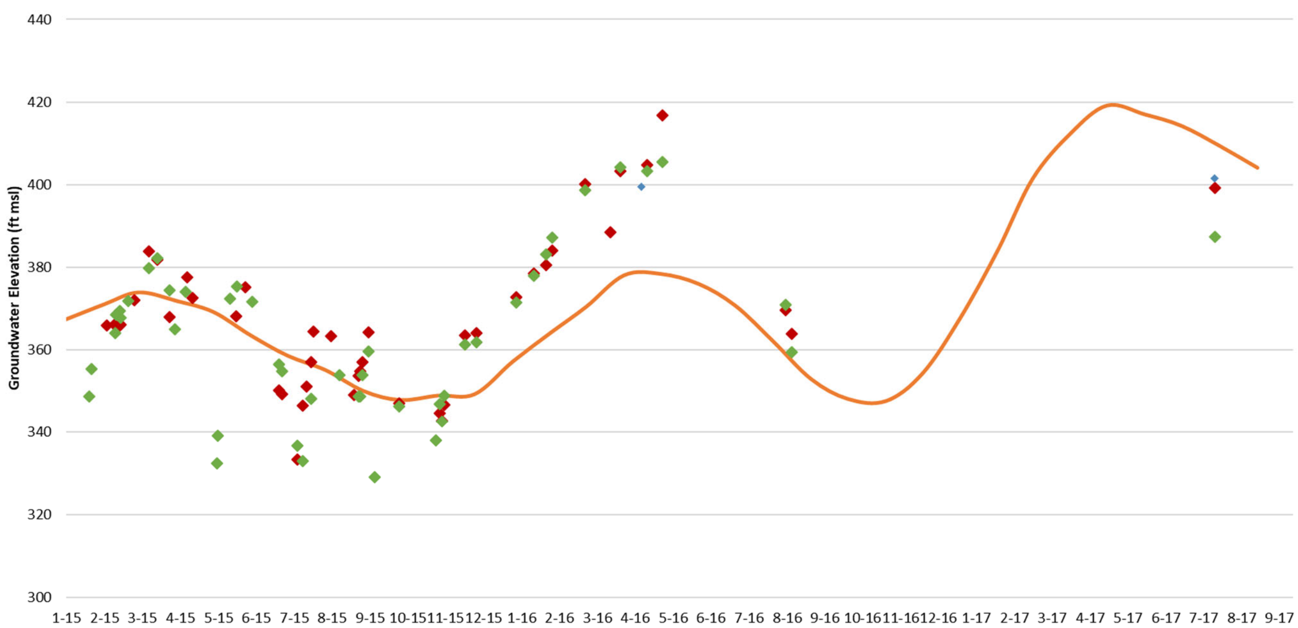
Comparison of Modeled & Observed Groundwater Elevation

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-11



Legend

= Water Budget Spreadsheet Model-Calculated Change In Storage (AF)

= Well #2

= Well #3

= Well #4

Abbreviations

AF = acre-feet

ft msl = feet above mean sea level

Notes

1. Calibration of the water budget spreadsheet model was performed by comparing measured groundwater elevations on District's wells with an estimate of the average groundwater elevation throughout the District based on storage change.

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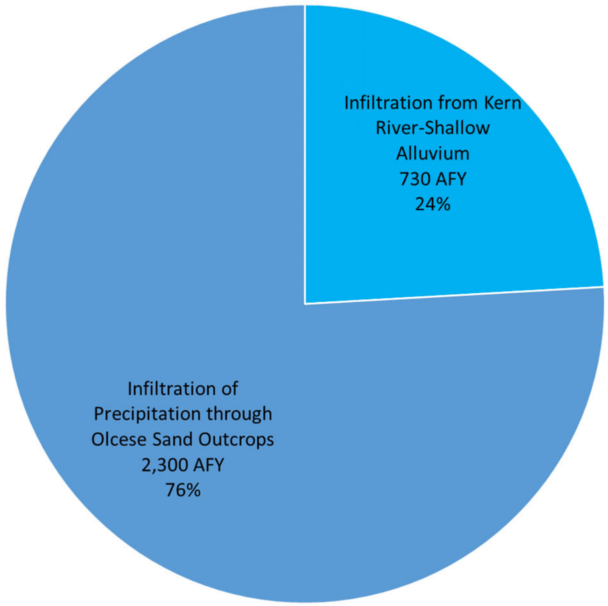
Comparison of Modeled & Observed Groundwater Elevation, 2015 (Period of High Density Data)

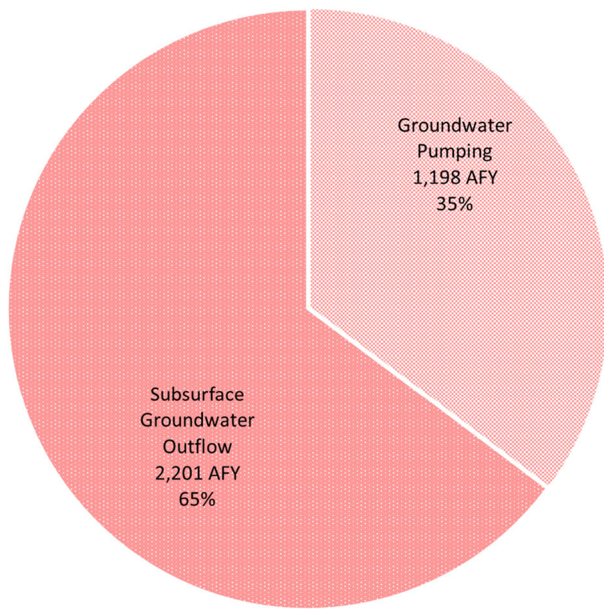
Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-12

WY 2015 Total Inflows: 3,030 *AFY*



WY 2015 Outflows: 3,399 *AFY*



Legend

Groundwater Inflows

= Infiltration of Precipitation through Olcese Sand Outcrops

= Infiltration from Surface Water Systems

Groundwater Outflows

= Subsurface Groundwater Outflow

= Groundwater Pumping

Abbreviations

AFY = acre-feet per year
GW = groundwater
WY = water year

Notes

1. All values reported in AFY.

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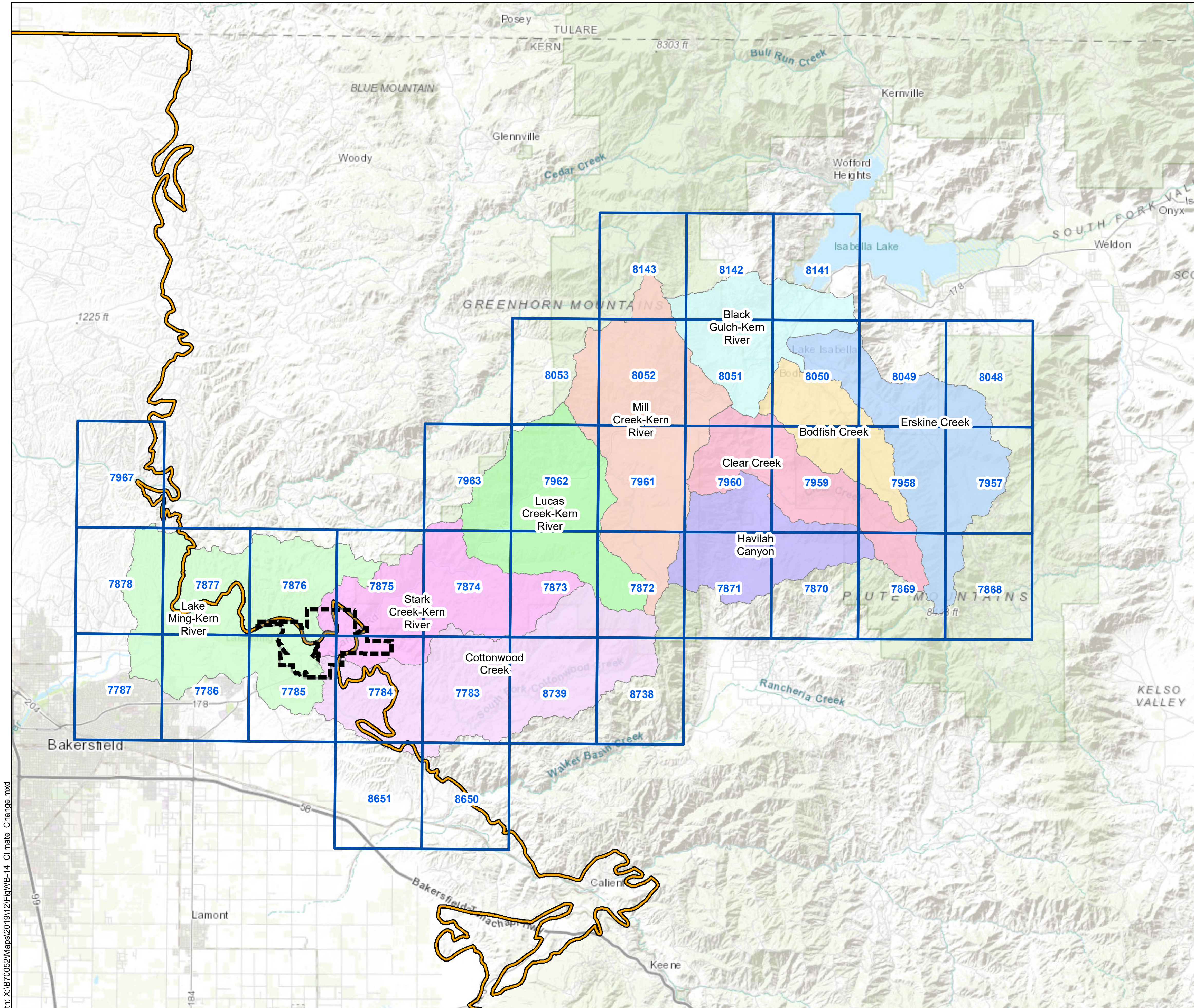
Summary of Groundwater Inflows & Outflows, WY 2015

Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-13



Legend

- Kern County Subbasin (DWR 5-022.14)
- Olcese Water District
- VIC Model Grid

Abbreviations

DWR = California Department of Water Resources
GSA = Groundwater Sustainability Agency
VIC = Variable Infiltration Capacity Macroscale Hydrologic Model

Notes

1. All locations are approximate.
2. Watersheds shown are those that contribute to the Olcese GSA Area and are included in the Olcese GSA Water Budget Model.
3. Only VIC Grid cells that overlap watersheds that contribute to the Olcese GSA Area are shown.
4. Each VIC grid cell grid is associated with a monthly climate change factor time-series for each scneario. These factors are then multiplied by a corresponding precipitation and evapotranspiration time-series to obtain projected climatological data.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.
2. VIC Model Grid obtained from the University of Washington website, on 29 August 2018. (http://www.hydro.washington.edu/Lettenmaier/Models/VIC/SouceCode/Download.shtml)

N 0 4 8 Miles

Climate Change Factors (VIC Model Grid)

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Olcese Water District
Kern County, California
December 2019
B70052.03

Figure WB-14

Path: X:\B70052\Maps\2019\12\FigWB-14_Climate_Change.mxd

10. MANAGEMENT AREAS

☑ 23 CCR § 354.20(a)

The information presented in the Basin Setting sections of this GSP is specific to and describes conditions within the Olcese GSA Area. As discussed in **Section 5.1.6 *Lands Outside of District Covered by the GSP***, information regarding the undistricted lands (i.e., "White Lands") covered by this GSP is presented in **Appendix C**.

The entire Olcese GSA Area is being managed as a single Management Area within the Kern Subbasin, and therefore no other divisions into other Management Areas are proposed herein.

10.1. Description and Justification

☑ 23 CCR § 354.20(b)(1)
☑ 23 CCR § 354.20(c)

As discussed previously in **Section 5 *Description of the Plan Area***, the Kern Subbasin is overlain by a large number of entities with water or land use management authority. The Olcese GSA is locally responsible for SGMA compliance within the Olcese GSA Area, which can be considered a Management Area of the greater Kern Subbasin. One significant reason that the Olcese Water District decided to form the Olcese GSA in 2016 and to develop its own GSP was to ensure that it would maximum flexibility and control over sustainable groundwater management within its service area.

10.2. Minimum Thresholds and Measurable Objectives

☑ 23 CCR § 354.20(b)(2)
☑ 23 CCR § 354.20(b)(4)

The Sustainable Management Criteria developed for the Olcese GSA Area, including the rationale for their selection, are described in detail in **Section 14 *Minimum Thresholds*** and **Section 15 *Measurable Objectives***.

10.3. Monitoring

☑ 23 CCR § 354.20(b)(3)

Monitoring networks for each applicable Sustainability Indicator, including a discussion of the level of monitoring an analysis appropriate for the Olcese GSA Area, are described in detail in **Section 16 *Monitoring Network***.

SUSTAINABLE MANAGEMENT CRITERIA

11. INTRODUCTION TO SUSTAINABLE MANAGEMENT CRITERIA

☑ 23 CCR § 354.22

Sustainable Groundwater Management Act (SGMA) legislation defines "Sustainability Goal" as "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield" (California Water Code [CWC] § 10721(u)). SGMA requires Groundwater Sustainable Plans (GSPs) to develop and implement plans to meet the Sustainability Goal (CWC § 10727(a)) and requires that the plans include Measurable Objectives as well as Interim Milestones in increments of five years to achieve the Sustainability Goal within 20 years of the implementation of the plan (CWC § 10727.2(b)(1)).

The GSP Emergency Regulations further define terms related to achievement of the Sustainability Goal, including:

- Interim Milestone - a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan (23 CCR § 351(q))
- Measurable Objective - specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin (23 CCR § 351(s))
- Minimum Threshold - a numeric value for each sustainability indicator used to define undesirable results (23 CCR § 351(t))

Collectively, the Sustainability Goal, Interim Milestones, Measurable Objectives, and Minimum Thresholds are referred to herein as Sustainable Management Criteria (SMCs).

The GSP Emergency Regulations specify how Groundwater Sustainability Agencies (GSAs) must establish SMCs for each applicable Sustainability Indicator. **Sections 12**, **13**, **14**, and **15** of this GSP describe the **Sustainability Goal**, **Undesirable Results**, **Minimum Thresholds**, and **Measurable Objectives**, respectively, developed as part of this GSP in coordination with the other GSPs for the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin") (i.e., collectively the Kern Subbasin Plan).

11.1. Demonstration of Sustainability

Table SMC-1 below presents as summary of the current status (i.e., as of the end of Water Year [WY] 2021) of groundwater conditions relative to the criteria used to identify Undesirable Results within the Olcese GSP, and describes any actions taken to address the potential occurrence of Undesirable Results, demonstrating how the Olcese GSA has continued to sustainably manage its portion of the Basin to avoid Undesirable Results throughout the SGMA implementation period to date.

Table SMC-1. Current Status of Relevant Sustainability Indicators

Sustainability Indicator	Local Undesirable Results (UR) Criteria	Current Status (Water Year 2021)	Action Taken
Chronic Lowering of Groundwater Levels	It is considered a local UR for Chronic Lowering of Groundwater Levels when groundwater levels decline below established Minimum Thresholds (MTs) in 40% or more of any water level representative monitoring sites (RMS) within the management area over four consecutive bi-annual SGMA required monitoring events. The number of exceedances that equates to at least 40% of RMS in the Olcese GSA Area is 1 of 2 RMS.	MTs have never been exceeded at either of the two RMS since adoption of the Olcese GSP.	Continue to monitor and implement the Olcese GSP.
Reduction of Groundwater Storage	It is considered a local UR for Reduction of Groundwater Storage when groundwater levels decline below established MTs in 40% or more of any water level RMS within the management area over four consecutive bi-annual SGMA required monitoring events. It is considered a local UR if groundwater storage were to be reduced by an amount that would cause the groundwater levels in one or both representative monitoring sites to exceed their MT for Chronic Lowering of Groundwater Levels; the criteria set for Chronic Lowering of Groundwater Levels are considered a reasonable proxy.	Groundwater levels are used as a proxy for monitoring Reduction of Groundwater Storage. As stated above, MTs for Chronic Lowering of Groundwater Levels have never been exceeded at either of the two RMS since adoption of the Olcese GSP.	Continue to monitor and implement the Olcese GSP.
Seawater Intrusion	Groundwater conditions in the basin show that Seawater Intrusion is not present within the Basin and is not anticipated to be present in the future, and therefore the Sustainability Indicator is not applicable to the Basin.		
Degraded Water Quality	There are no URs for Degraded Water Quality defined for the Olcese GSA Area.	Not applicable.	Continue to monitor and implement the Olcese GSP.
Land Subsidence	It is considered a local UR if the capacity of the District's canal is reduced by 25% as a result of inelastic land subsidence caused by groundwater extraction.	Based on available data, no land subsidence has occurred within the Olcese GSA Area.	Continue to monitor and implement the Olcese GSP.
Depletions of Interconnected Surface Waters	Groundwater conditions in the Basin show that Depletion of Interconnected Surface Waters is not present within the Basin and is not anticipated to be present in the future, and therefore the Sustainability Indicator is not applicable to the Basin.		

12. SUSTAINABILITY GOAL

☑ **23 CCR § 354.24**

The Basin-wide Sustainability Goal adopted by all Basin GSAs, is as follows:

> “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 and beyond
> - 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 uses for municipal and domestic drinking water supply wells”

The Olcese GSA has developed a local sustainability goal for the Olcese GSA Area which is consistent with and in addition to the above Basin-wide sustainability goal being adopted by all GSAs in the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; “Kern Subbasin”). The Olcese GSA’s local sustainability goal is as follows:

> “to maintain an economically-viable groundwater resource that supports the current and future beneficial uses of groundwater by utilizing the area’s groundwater resources within the local sustainable yield. Long-term groundwater sustainability will be evaluated and maintained in compliance with locally-defined sustainability criteria, including through active monitoring and the conjunctive use of groundwater and Kern River surface water supplies.”

13. UNDESIRABLE RESULTS

☑ 23 CCR § 354.26(a)

This section describes the Undesirable Results (URs) defined for the Olcese GSA Area. Pursuant to the GSP Emergency Regulations, URs are to be defined consistently throughout the basin (23 CCR § 354.20), and the definitions shown below are those that have been adopted by all GSAs within the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin") through a coordinated effort, and are contained within the Kern County Subbasin Coordination Agreement (see **Appendix J**). However, as stated in **Section 7.1.4 *Principal Aquifers and Aquitards***, the progressive thinning, dipping, and displacement via faulting of the Olcese Sand Aquifer Unit (i.e., the principal aquifer within the Olcese GSA Area) to the north and southwest serves to bound usable groundwater resources of this unit to within the vicinity of the Olcese GSA Area and limits its connectivity to other principal aquifers in the Kern Subbasin. Therefore, the causes, criteria, and effects of URs are described herein to reflect the particular hydrogeologic and groundwater conditions of the Olcese GSA Area.

As discussed below for each Sustainability Indicator, the UR definitions for the Basin refer to and rely on Minimum Thresholds (MTs) established at the local management area/GSP level. Specifically, URs for the Basin occur if and when local Management Area Exceedances are triggered by MT exceedances for a certain percentage (by acreage) of management areas. Each management area determines what the local MT values are, but uses a consistent trigger to assess whether a local Management Area Exceedance is occurring. If a local Management Area Exceedance manifests in a management area, that area begins to count towards the Basin-wide UR definition.

In the following sections, the UR definitions adopted by the Olcese GSA and other Basin GSAs for each Sustainability Indicator are presented (i.e., what combination of MT exceedances, if any, constitutes a local Management Area Exceedance). Based on the available historical and recent data, groundwater conditions within the Olcese GSA Area have been maintained in compliance with (i.e., not exceeding) their respective SMCs, indicating sustainable management and avoidance of Undesirable Results.

13.1. Undesirable Results for Chronic Lowering of Groundwater Levels

The basin-wide definition of URs 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 Groundwater Sustainability Plans."

The above basin-wide definition allows for local definition, within each Management Area of the Kern Subbasin, of the MTs that constitute a significant and unreasonable impact to the reasonable and beneficial use of groundwater by overlying users (i.e., a Management Area Exceedance). As such, it is necessary to consider local conditions and beneficial uses and users within each management area.

13.1.1. Identification of Beneficial Users

Beneficial users that could be impacted by Chronic Lowering of Groundwater Levels in the Olcese GSA Area include:

- Agricultural and Industrial Users: The primary use and user of groundwater within the Olcese GSA Area is for irrigation of agricultural lands owned by the Nickel Family LLC and served by the Olcese Water District. There is minor use of groundwater for stock water.
- Domestic and Small Community Users: There are no private domestic wells or commercial/industrial uses of groundwater in the Olcese GSA Area. The Anne Sippi Clinic uses groundwater pumped from the Canyon View Well for potable supply. In March 2022, the Anne Sippi Clinic drilled a second well to serve as a backup in case of interruption of supply from the Canyon View Well.
- Municipal Users: There are no municipal users of groundwater within the Olcese GSA Area.

Critical infrastructure is not defined as a beneficial user in California Water Code (CWC) §10723.2, but is still considered as a land use and property interest in the development of SMCs for Chronic Lowering of Groundwater Levels (and Land Subsidence).

Per CWC §106.3(a), all drinking water users of groundwater within the Management Area are considered beneficial users with a human "right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."

13.1.2. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(1)), potential causes of URs due to Chronic Lowering of Groundwater Levels in the Olcese GSA Area include increased pumping and/or reduced recharge. Because the primary use of groundwater from the principal aquifer in the Olcese GSA Area (the Olcese Sand Aquifer Unit) is for agricultural purposes, increased pumping from the Olcese Sand Aquifer Unit could occur if new land is put into agricultural production or if water use per acre on existing irrigated land increases. Pumping from the Olcese Sand Aquifer Unit for domestic use is limited to the Anne Sippi Clinic, and based on the size of the population served (35), this volume is relatively small and unlikely to substantially increase. To the extent that new residential development occurs in the Olcese GSA Area, it would be conditioned on securing a water supply other than groundwater from the Olcese Sand Aquifer Unit (i.e., connection to the existing Cal Water Bakersfield division water supply). Reduced recharge could occur due to increased agricultural irrigation efficiency or due to climate change that results in decreased precipitation and increased evapotranspiration (ET), as discussed in **Section 9.4** ***Projected Water Budget***.

13.1.3. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**
☑ **23 CCR § 354.26(c)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(2)), the description of URs must include a quantitative description of the number of MT exceedances that constitute an UR. In a similar manner to how URs are defined at the Basin level, it is considered a local Management Area Exceedance for Chronic

Lowering of Groundwater Levels when groundwater levels decline below established MTs in 40% or more of any water level representative monitoring sites (RMS) within the management area over four consecutive bi-annual Sustainable Groundwater Management At (SGMA) required monitoring events. As discussed further below in **Section 14 *Minimum Thresholds*** and **Section 16 *Monitoring Network***, within the Olcese GSA Area, MTs for groundwater levels are set at two representative monitoring sites by considering the elevations of screens of existing groundwater wells (i.e., beneficial users). Each of the two RMS represents an approximately equal size portion of the Olcese GSA Area, and therefore neither site is more important than the other. Therefore, effects from groundwater conditions constitute a local Management Area Exceedance for Chronic Lowering of Groundwater Levels if the MT is exceeded at either one of the RMS (i.e., one or more of the two sites).

13.1.4. Potential Effects of Undesirable Results

☑ **23 CCR § 354.26(b)(3)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(3)), the primary potential effects of URs caused by Chronic Lowering of Groundwater Levels on beneficial uses and users of groundwater in the Olcese GSA Area may include groundwater well dewatering, increased pumping lift, and potential impacts to interconnected surface water and groundwater dependent ecosystems (GDEs), if present. Excessive well dewatering is detrimental to wells as it can lead to increased maintenance costs (i.e., well rehabilitation/redevelopment, pump lowering) and reduced well lifespan due to corrosion of well casing and screen. Increased pumping lift results in more energy use per unit volume of groundwater pumped and greater pumping costs and can cause increased wear and tear on well pumps/motors. While potential impacts on interconnected surface water and GDEs have not been observed to date in the Olcese GSA Area, and such a connection is considered unlikely given that the principal aquifer appears to be hydraulically separated from the near-surface groundwater and surface water systems, the issue does warrant further study. For this reason, development of monitoring infrastructure to address this issue is included in **Section 18 *Projects and Management Actions***.

13.2. Undesirable Results for Reduction of Groundwater Storage

The basin-wide definition of URs 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 drought period.
>
> This is determined when the volume of storage (above the groundwater level minimum thresholds) 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 Area).
>
> Minimum thresholds shall be set by each of the management areas through their respective Groundwater Sustainability Plans."

The above Basin-wide definition ties the UR for Reduction of Groundwater Storage directly to the MTs for Chronic Lowering of Groundwater Levels which, as stated above, are defined locally within each management area.

13.2.1. Identification of Beneficial Users

Reduction of Groundwater Storage is directly correlated to Chronic Lowering of Groundwater Levels. Therefore, the beneficial users are the same as those defined in **Section 13.1.1** above.

13.2.2. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(1)), Reduction of Groundwater Storage is generally correlated to Chronic Lowering of Groundwater Levels. Therefore, the potential causes of URs due to Reduction in Groundwater Storage are generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels (i.e., increased groundwater pumping and reduced recharge).

13.2.3. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**
☑ **23 CCR § 354.26(c)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(2)), the criteria used to define URs for Reduction of Groundwater Storage in the basin-wide definition above are the MTs established at a local management area level for Chronic Lowering of Groundwater Levels. Put simply, it is considered a local Management Area Exceedance for Reduction of Groundwater Storage when groundwater levels decline below established MTs in 40% or more of any water level RMS within the management area over four consecutive bi-annual SGMA required monitoring events. In the Olcese GSA Area, this amounts to a Management Area Exceedance if MTs for Chronic Lowering of Groundwater Levels are exceeded over four consecutive bi-annual SGMA required monitoring events in one or more of the two RMS.

13.2.4. Potential Effects of Undesirable Results

☑ **23 CCR § 354.26(b)(3)**

The primary potential effect of URs caused by Reduction of Groundwater Storage on beneficial uses and users of groundwater in the Olcese GSA Area include reduced groundwater supply reliability. The effect of reduced groundwater reliability would be most significant during periods of reduced surface water supply availability due to, for example, natural drought conditions, regulatory restrictions, natural disasters, or other causes.

13.3. Undesirable Results for Seawater Intrusion

☑ **23 CCR § 354.26(d)**

The GSP Emergency Regulations state that "An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators" (23 CCR § 354.26(d)). Because the Kern Subbasin is not located near any saline water bodies, seawater intrusion is not present and not likely to occur, the Seawater Intrusion Sustainability Indicator is not applicable to the Kern Subbasin, and therefore no URs for this Sustainability Indicator are defined in the Kern Subbasin.

13.4. Undesirable Results for Degraded Water Quality

The basin-wide definition of URs 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 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 Kern Subbasin, of the MTs that constitute a significant and unreasonable impact to the reasonable and beneficial use of groundwater by overlying users (i.e., a Management Area Exceedance). Key to the basin-wide definition is the phrase "as caused by water management actions". This phrase rightfully distinguishes between water quality impacts that are due to GSA-related water management activities and those that are the result of natural conditions or that pre-date SGMA. Because impacts that were present prior to 2015 or that are due to natural conditions are not caused by (and in some cases, cannot be remedied by) GSA action, those impacts are not considered to be URs subject to SGMA compliance.[33,34]

The definition also draws a distinction between localized or isolated (e.g., well specific) effects, that are not necessarily under the purview of GSAs to manage (especially if related to well location and design relative to naturally-occurring or anthropogenically-caused impacts that pre-date SGMA), and broader, groundwater management-related regional effects which can fall under a GSA's purview. This approach is both consistent with the SGMA's definition of URs meaning "…effects caused by groundwater conditions occurring throughout the basin" (emphasis added) (CWC § 10721(x)) and reflects the fact that SGMA does not require GSPs to address URs that occurred before, and have not been corrected by, January 1, 2015.

13.4.1. Identification of Beneficial Users

As described in **Section 8.4 Groundwater Quality**, agricultural use is the dominant beneficial use of groundwater within the Olcese GSA Area, and groundwater quality is generally suitable for agricultural

[33] "SGMA and the GSP Regulations do not require a GSP to address undesirable results associated with degraded water quality that occurred before, and have not been corrected by, January 1, 2015." (DWR Consultation Letter, Cuyama Valley 2020 Groundwater Sustainability Plan, 3 June 2021).

[34] "Department staff recognize that GSAs are not responsible for improving existing degraded water quality conditions. GSAs are required; however, to manage future groundwater extraction to ensure that groundwater use subject to its jurisdiction does not significantly and unreasonably exacerbate existing degraded water quality conditions." (DWR Determination Letter, 180/400 Foot Aquifer Subbasin GSP, 3 June 2021).

use. Further, water quality issues related to deep percolation of agricultural chemicals such as nitrate are regulated separately under the Irrigated Lands Regulatory Program (ILRP) and Central Valley-Salinity Alternatives for Long-term Sustainability (CV-SALTS).

The most sensitive beneficial use of groundwater is for potable supply. Groundwater served by public water systems such as the Anne Sippi Clinic must meet water quality regulatory standards (i.e., Maximum Contaminant Levels; MCLs) in the water they serve, and these systems are regulated by the State Water Resources Control Board (SWRCB). Per CWC §106.3(a), all drinking water users of groundwater within the Management Area are considered beneficial users with a human "right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." Within the Olcese GSA Area, there are no private domestic wells, and therefore no drinking water beneficial users that are not covered by other superseding regulatory frameworks.

13.4.2. Potential Causes of Undesirable Results

☑ **23 CCR § 354.26(b)(1)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(1)), potential causes of URs due to Degraded Water Quality within the Olcese GSA Area include the addition of constituents of concern (COCs) to groundwater in the principal aquifer through processes that are causatively related to water management or land use activities. Fortunately, due to hydrogeological conditions in the Olcese GSA Area, the mechanisms for this addition of COCs to the principal aquifer are quite limited due to the confined nature of the Olcese Sand Aquifer Unit. Also, owing to its location on the margin of the Kern Subbasin, the Olcese GSA Area is not vulnerable to inflows of poor-quality water from adjacent basins or areas. Direct injection of "produced water" generated from oil field operations may occur in areas outside of the Olcese GSA Area (e.g., in the Ant Hill oil field), but those areas are generally downgradient from the Olcese GSA Area and separated from the Olcese GSA Area by several fault systems. Furthermore, such injection is regulated under the Underground Injection Control (UIC) program.[35] Therefore, URs for Degraded Water Quality are unlikely to occur within the Olcese GSA Area.

13.4.3. Criteria Used to Define Undesirable Results

☑ **23 CCR § 354.26(b)(2)**

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(2)), the definition of URs provides for local definition of the combination of Minimum Threshold exceedances that constitute a significant and unreasonable effect (i.e., a Management Area Exceedance) in a management area. As discussed above, due to the location of and hydrogeologic conditions within the Olcese GSA Area, there are no water management-related mechanisms in this area that have caused or have the potential to cause an UR for this sustainability indicator. The State Water Resources Control Board's (SWRCB) Division of Drinking Water regulates the quality of water served by the single public water system in the Olcese GSA Area (the Anne Sippi Clinic), and the water quality criteria under which that program operates (i.e., Maximum Contaminant Levels [MCLs]) is not superseded by SGMA. Groundwater quality is generally suitable for agricultural uses, and no other existing regulatory program governs groundwater quality for agricultural

[35] Direct injection of fluids associated with oil and natural gas production via Class II wells under the UIC program is regulated under the Safe Drinking Water Act and is limited to occur only in strata that are not designated as Underground Sources of Drinking Water (USDWs), but injection infrastructure can leak, resulting in addition of potential COCs to USDWs.

uses. Therefore, based on the existing and potential beneficial uses and users of groundwater within the Olcese GSA Area, no Management Area Exceedance for Degraded Water Quality is defined.

13.4.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(3)), potential effects of URs must be identified. As discussed above, because of the confined nature of the principal aquifer (Olcese Sand Aquifer Unit) within the Olcese GSA Area, there are no realistically likely causes of URs and therefore URs are not defined for this sustainability indicator.

The above notwithstanding, more generally the potential effects of URs caused by Degraded Water Quality on beneficial uses and users of groundwater may include: increased costs to treat groundwater to drinking water standards if it is to be used as a potable supply source; increased costs to blend relatively poor-quality groundwater with higher quality sources for agricultural and non-agricultural uses; limitations on viable crop types depending on crop sensitivity and tolerance to COCs in groundwater used for irrigation; and potential reduction in "usable storage" volume of groundwater in the basin if large areas of aquifer are impacted to the point that they cannot be used to support beneficial uses and users.

As discussed in **Section 5.2.1 *Existing Monitoring Programs in the Olcese GSA Area***, the District conducts groundwater quality sampling and monitoring for its own agricultural water management program, and the Anne Sippi Clinic conducts source water quality monitoring as part of its compliance with its public water system permit. These groundwater quality monitoring programs are expected to continue during the SMGA implementation horizon and will be incorporated into future SGMA reporting and analysis.

13.5. Undesirable Results for Land Subsidence

The original 2020 basin-wide definition of URs 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."

As part of the basin-wide coordinated efforts to address the comments in DWR's 2022 determination letter on the Kern Subbasin GSPs, additional language regarding Undesirable Results has been developed, including the following:

> "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."

Furthermore:

> "The Kern Subbasin 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."

The basin-wide definitions of Undesirable Results for Land Subsidence are also found in Coordination Agreement and appendices thereto (**Appendix J**).

13.5.1. <u>Identification of Beneficial Users</u>

Within the Olcese GSA Area, the only beneficial user potentially affected by URs for Land Subsidence is the Olcese Water District that relies on its gravity-driven canal to convey water to its Rio Bravo Hydroelectric Plant and for irrigation purposes. The canal is thus considered Management Area Critical Infrastructure, although it should be noted that Olcese Water District could still obtain water from the Kern River for irrigation purposes even without the canal, and there have been no known occurrences of land subsidence causing any significant impacts in the Olcese GSA Area (see **Section 8.5 *Land Subsidence***). The District conducts periodic monitoring of the elevation of survey benchmarks along its canal and at the Rio Bravo Hydroelectric Plant as part of its compliance with its license from the Federal Energy Regulatory Commission (FERC).

13.5.2. <u>Potential Causes of Undesirable Results</u>

☑ 23 CCR § 354.26(b)(1)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(1)), land subsidence can be caused by several mechanisms, but the only mechanism relevant to sustainable groundwater management is the depressurization of aquifers and aquitards due to lowering of groundwater levels, which can lead to compaction of compressible strata and lowering of the ground surface. Therefore, the potential causes of URs due to Land Subsidence are generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels. As discussed in **Section 8.5 *Land Subsidence,*** there have been no known occurrences of land subsidence causing any significant impacts within the Olcese GSA Area.

13.5.3. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(2)), the basin-wide definition of URs refers to significant and unreasonable impacts to critical infrastructure. As discussed above, the Olcese Water District canal is considered Management Area Critical Infrastructure, and a loss of significant functionality of the canal due to inelastic subsidence, if caused by groundwater extractions, would constitute an Undesirable Result. For purposes of this Olcese GSP, the loss of significant functionality is determined to be a reduction in capacity of 25%. As discussed further in **Section 14.5 *Minimum Threshold for Land Subsidence***, the reduction in capacity is translated for SMC development purposes into a change in differential elevation between monitoring points based on the relationship between capacity and channel slope.

13.5.4. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(3)), potential effects of URs caused by land subsidence within the Olcese GSA Area may include damage to gravity-driven water conveyance infrastructure (i.e., District canals). Land subsidence could also affect non-critical infrastructure such as transportation infrastructure; utility infrastructure (i.e., gas pipelines); and water storage infrastructure, including shallow ponds used for temporary storage of imported water supplies. Potential effects could also include damage to below-ground infrastructure including groundwater well casings. As noted above and in **Section 8.5 *Land Subsidence,*** available data from regional and local monitoring indicate that there has been no known significant land subsidence within the OIcese GSA Area.

13.6. Undesirable Results for Depletions of Interconnected Surface Water

No basin-wide definition of URs for Depletions of Interconnected Surface Water has been developed by the Kern Subbasin GSAs, nor has a local definition of a Management Area Exceedance for this sustainability indicator been developed for the Olcese GSA Area.

Based on available data and information, depletion of interconnected surface water has not been observed within the Olcese GSA Area. As described in **Section 7.1.4 *Principal Aquifers and Aquitards*** and **Section 8.6 *Interconnected Surface Water Systems***, multiple lines of evidence (i.e., water quality data, hydrostratigraphy, and water levels) suggest that the principal aquifer is hydraulically separated from the Shallow Alluvium and surface water bodies interconnected thereto. However, as described in **Section 18 *Projects and Management Actions***, a study to monitor groundwater levels in the Shallow Alluvium zone during regular seasonal pumping from the Olcese Sand Aquifer Unit will allow the District to further evaluate the degree of hydraulic connection between the principal aquifer and the Shallow Alluvium and surface water bodies interconnected thereto.

13.6.1. Potential Causes of Undesirable Results

☑ 23 CCR § 354.26(b)(1)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(1)), Depletion of Interconnected Surface Water is generally correlated to Chronic Lowering of Groundwater Levels in an interconnected groundwater aquifer system. Therefore, the potential causes of URs due to Depletion of Interconnected Surface Water would be generally the same as the potential causes listed above for URs due to Chronic Lowering of Groundwater Levels (i.e., increased groundwater pumping and reduced recharge). However, as discussed above, the degree of hydraulic connection between the principal aquifer from which pumping occurs (Olcese Sand Aquifer Unit) and the Shallow Alluvium and interconnected surface water is unknown but suspected to be small based on available information on water quality, water levels and hydrostratigraphy. Because there is no known pumping from the Shallow Alluvium, there does not appear to be any active potential causes for URs due to Depletion of Interconnected Surface Water.

13.6.2. Criteria Used to Define Undesirable Results

☑ 23 CCR § 354.26(b)(2)

Per the GSP Emergency Regulations (23 CCR §354.26(b)(2)), the description of URs must include a quantitative description of the combination of Minimum Threshold exceedances that constitute and UR. Because no historical data exist to support definition of MTs for this sustainability indicator, there is no quantitative definition of URs presented herein. A project to install a shallow groundwater monitoring well to assess the degree of hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and Shallow Alluvium is included in **Section 18 *Projects and Management Actions***. If results from that project indicate a hydraulic connection between the two zones does exist, and that changes to groundwater level conditions in the Olcese Sand Aquifer Unit are likely to have an effect on Shallow Alluvium groundwater levels and interconnected surface water, the criteria necessary for definition of URs for Depletion of Interconnected Surface Water will be revisited.

13.6.3. Potential Effects of Undesirable Results

☑ 23 CCR § 354.26(b)(3)

Per the GSP Emergency Regulations (23 CCR § 354.26(b)(3)), potential effects of URs of Depletion of Interconnected Surface Water may include reduced surface water flows to support downstream or in-stream uses. As discussed above, URs for this indicator have not been observed within the Olcese GSA Area.

14. MINIMUM THRESHOLDS

☑ 23 CCR § 354.28(a)

Minimum Thresholds (MTs) are the numeric criteria for each Sustainability Indicator that, if exceeded, may cause Undesirable Results (URs). Like **Measurable Objectives and Interim Milestones**, discussed in **Section 15** below, this section describes the MTs that have been developed to avoid URs for each applicable Sustainability Indicator in the Olcese GSA Area.

As shown in **Table SMC-2**, MTs within the Olcese GSA Area are defined at different spatial scales and locations, or not at all, depending on the Sustainability Indicator. Where appropriate, the MTs for the Sustainability Indicators have been set using groundwater levels as a proxy, based on the demonstration "that there is a significant correlation between groundwater levels and the other metrics" (Department of Water Resources [DWR] Sustainable Management Criteria Best Management Practices [BMP]; DWR, 2017).

Table SMC-2. Spatial Scale of Minimum Threshold Definition

Sustainability Indicator	Spatial Scale of Minimum Threshold Definition	Notes
Chronic Lowering of Groundwater Levels	Representative Monitoring Site (RMS, i.e., well)	Two RMS are used to define MTs for this sustainability indicator
Reduction of Groundwater Storage	Olcese GSA Area	MTs are based on groundwater level data from the two RMS for Chronic Lowering of Groundwater Levels
Seawater Intrusion	Not applicable	Sustainability indicator not applicable within the Kern Subbasin
Degraded Water Quality	No MTs defined for this indicator	Monitoring for groundwater quality at selected locations will continue as part of State Water Resources Control Board (SWRCB) regulatory compliance and District agricultural water management
Land Subsidence	Two survey benchmark locations	Land surface elevation is monitored at a network of benchmarks along the District's canal and at the Rio Bravo Hydroelectric Plant
Depletion of Interconnected Surface Water	No MTs defined for this indicator	Monitoring of groundwater levels in a shallow well installed as part of GSP implementation will be used to evaluate connection between Shallow Alluvium and principal aquifer (Olcese Sand Aquifer Unit)

14.1. Minimum Threshold for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.28(c)(1)

Chronic Lowering of Groundwater Levels is arguably the most fundamental Sustainability Indicator, as it influences several other key Sustainability Indicators, including Reduction of Groundwater Storage and possibly Land Subsidence and Depletions of Interconnected Surface Water. Consistent with the GSP Emergency Regulations (23 CCR § 354.28(c)), the definition of MTs for Chronic Lowering of Groundwater Levels in Olcese GSA Area is based on consideration of URs. There are no state, federal, or local standards that relate to this Sustainability Indicator.

Given the potential effects of URs for Chronic Lowering of Groundwater Levels, discussed in **Section 13.1.3** above, the MTs consider the elevation of the top of well screens for wells within the Olcese Sand Aquifer Unit (i.e., for consideration of impacts to beneficial users). MTs for the two representative monitoring sites are defined as shown in **Table SMC-3** and **Figure SMC-1**.

Table SMC-3. Minimum Thresholds for Chronic Lowering of Groundwater Levels

Representative Monitoring Site	Minimum Threshold (ft msl)	Basis
Well #4	71.90	Elevation of top of screen of Well #2, the shallowest screened irrigation well in the principal aquifer in the Olcese GSA Area
Canyon View Ranch Well	532.80	Elevation of top of screen of the Canyon View Ranch Well, the only domestic water supply well in the Olcese GSA Area

The above MTs were developed with consideration of general historical groundwater level trends in wells screened within the Olcese Sand Aquifer Unit. As discussed in **Section 8.1** ***Groundwater Elevations and Flow Direction*** and **Section 8.2** ***Change in Groundwater Storage***, groundwater levels have varied over a range of approximately 118 feet and appear to be influenced by both groundwater pumping volumes and climatic variability. No long-term downwards trends in groundwater levels are apparent in the available data. Land use and groundwater use from the principal aquifer within the Olcese GSA Area are not expected to change significantly in the future, except possibly as a result of climate change which could increase ET from existing irrigated crop lands. Climate change could also result in reduced recharge of precipitation to Olcese Sand Aquifer Unit outcrops within and outside of the GSA area.

As discussed further below in **Section 18** ***Projects and Management Actions*** and in **Appendix I**, a new shallow monitoring well (MWS-1) has been installed in the vicinity of Wells #2 and #3 and will be monitored for a period of time during the irrigation pumping season to assess the degree of potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium. At this time, this shallow well monitoring location is not considered a Representative Monitoring Site for Chronic Lowering of Groundwater Levels, and no MT for this sustainability indicator is defined at this location. If monitoring indicates that there is a significant degree of hydraulic connection, and that pumping from the principal aquifer could lead to significant and unreasonable lowering of groundwater levels in the Shallow Alluvium, the criteria to define a MT at this shallow monitoring well location will be revisited.

14.2. Minimum Threshold for Reduction of Groundwater Storage

☑ **23 CCR § 354.28(c)(2)**

The MT for Reduction of Groundwater Storage is defined on a management area or basin-wide basis as the volume of water that can be withdrawn without causing conditions that may lead to URs. Because the amount of groundwater in storage is directly, if not linearly, related to groundwater levels, Reduction of Groundwater Storage is closely tied to Chronic Lowering of Groundwater Levels. It is therefore logical to define the MT for Reduction of Groundwater Storage based on the MTs for Chronic Lowering of Groundwater Levels. Because of the close relationship between these two Sustainability Indicators, definition of the MT for Reduction of Groundwater Storage implicitly considers the groundwater level trends, water year types, and projected water use. There are no state, federal, or local standards that relate to this Sustainability Indicator.

The MT for Reduction in Groundwater Storage for the Olcese GSA Area is defined as the available volume of "usable storage" above the MT for Chronic Lowering of Groundwater Levels. This volume is calculated based on the following data and assumptions:

- Area of Olcese GSA Area (approximately 3,206 acres)
- Storage coefficient (0.01)
- Groundwater levels in July 2017 in Well #4 and the Canyon View Ranch Well (i.e., the Representative Monitoring Sites for Chronic Lowering of Groundwater Levels)
- The MTs for Chronic Lowering of Groundwater Levels at each Representative Monitoring Site

The volume of usable storage, and thus <u>the MT for groundwater storage, is approximately 7,030 acre-feet (AF)</u>. This volume corresponds to the volume that would be pumped in roughly eight years of pumping at the long-term historical average rate of 873 AFY, assuming no inflow to the system. Measurement and monitoring of this indicator will be based on the measurement of groundwater levels as a proxy.

14.3. Minimum Threshold for Seawater Intrusion

☑ **23 CCR § 354.28(c)(3)**
☑ **23 CCR § 354.28(e)**

The GSP Emergency Regulations (23 CCR § 354.28(e)) state that "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 minimum thresholds related to those sustainability indicators". Because the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin") is not located near any saline water bodies, seawater intrusion is not present and not likely to occur, the Seawater Intrusion Sustainability Indicator is not applicable to the Kern Subbasin, and therefore no SMCs for this Sustainability Indicator are defined in the Olcese GSA Area.

14.4. Minimum Threshold for Degraded Water Quality

☑ 23 CCR § 354.28(c)(4)

Because there are no observable mechanisms by which water management actions by the Olcese GSA could affect groundwater quality conditions within the Olcese GSA Area, URs for Degraded Water Quality are not defined in the Olcese GSA Area, nor are MTs for Degraded Water Quality. As discussed above in **Section 13.4 *Undesirable Results for Degraded Water Quality***, activities already being undertaken as part of other regulatory compliance efforts (i.e., monitoring groundwater quality at the Anne Sippi Clinic, the only public water system in the Olcese GSA Area, and routine monitoring of groundwater quality in Olcese Water District irrigation wells as part of agricultural water management) will continue during the SGMA implementation timeframe. If a causal nexus between groundwater quality and water management activities is discovered, the criteria for development of URs and MTs for Degraded Water Quality will be revisited.

14.5. Minimum Threshold for Land Subsidence

☑ 23 CCR § 354.28(c)(5)

As discussed in **Section 8.5 *Land Subsidence***, no significant subsidence has been observed within the Olcese GSA Area based on available data. However, for purposes of this Olcese GSP, the Olcese Water District canal is considered to be Management Area Critical Infrastructure, and therefore MTs are established based on the criteria for URs described in **Section 13.5 *Undesirable Results for Land Subsidence***.

Flow velocity and discharge in an open channel such as the Olcese Water District canal is proportional to the square root of slope, per Manning's equation. The slope of the canal as constructed is 0.0005 feet per foot (ft/ft) along its entirety. A given percentage reduction in canal capacity due to differential subsidence would occur if the square root of the slope between two points on the canal were to be reduced by that same percentage. The criterion for URs is defined as a 25% reduction in canal capacity (if due to land subsidence caused by groundwater extractions)[36] which in turn equates to a 25% reduction in the square root of slope, or a 43.75% reduction in actual slope to 0.000281 ft/ft. To define the MT, this reduction in slope is applied to a set of two monitoring locations a known distance apart along the canal centerline to determine the change in relative elevation difference corresponding to the MT.

The two monitoring points selected (see **Section 16.1.5 *Monitoring Network for Land Subsidence***) are approximately 3,416 ft apart along the canal centerline, and therefore the difference in elevation based on the design slope (0.0005 ft/ft) is 1.71 ft. At the reduced slope corresponding to the MT (0.000281 ft/ft), the elevation difference would be 0.96 ft. Therefore, <u>the MT for subsidence is determined to be a change in relative elevation difference of 0.75 ft (i.e., 1.71 ft - 0.96 ft) between the two selected monitoring points</u>. In other words, an MT exceedance would occur if the upstream location experienced 0.75 ft more subsidence than the downstream location (which would result in a reduction in slope of 43.75% and a reduction in channel capacity of 25% which is the UR criterion).

[36] Reduction in canal capacity due to causes other than inelastic subsidence due to groundwater extraction (e.g., sedimentation, tectonic activity, etc.) is not considered a UR for Land Subsidence.

14.6. Minimum Threshold for Depletions of Interconnected Surface Water

☑ **23 CCR § 354.28(c)(6)**
☑ **23 CCR § 354.28(e)**

As discussed in **Section 13.6** ***Undesirable Results for Depletions of Interconnected Surface Water***, the potential for URs for this sustainability indicator is limited due to the hydrogeologic conditions in the Olcese GSA Area that limit hydraulic connectivity between groundwater in the Olcese Sand Aquifer and groundwater and interconnected surface water in the Shallow Alluvium. As described in **Section 7.1.4** ***Principal Aquifers and Aquitards*** and **Section 8.6** ***Interconnected Surface Water Systems***, multiple lines of evidence (i.e., water quality data, hydrostratigraphy, and water levels) suggest that the principal aquifer is hydraulically separated from the Shallow Alluvium For this reason, no MT for Depletion of Interconnected Surface Water is defined herein.

As discussed above in **Section 13.6** ***Undesirable Results for Depletions of Interconnected Surface Water***, a project to install a shallow groundwater monitoring well to assess the degree of hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and Shallow Alluvium is included in **Section 18** ***Projects and Management Actions***. If results from that project indicate a hydraulic connection between the two zones does exist, and that changes to groundwater level conditions in the Olcese Sand Aquifer Unit are likely to have an effect on Shallow Alluvium groundwater levels and interconnected surface water, the criteria for defining URs for Depletion of Interconnected Surface Water will be revisited, and MTs for Depletion of Interconnected Surface Water will be developed, as appropriate. It is likely that any MT for this sustainability indicator would use groundwater levels measured in the shallow groundwater monitoring well as a proxy, pursuant to GSP Emergency Regulations (23 CCR § 354.28(d)) and as further described in the DWR Sustainable Management Criteria BMP (DWR, 2017).

15. MEASURABLE OBJECTIVES AND INTERIM MILESTONES

☑ 23 CCR § 354.30(a)
☑ 23 CCR § 354.30(b)

This section discusses the development of Measurable Objectives (MOs) and Interim Milestones (IMs) for all relevant Sustainability Indicators in the Olcese GSA Area.

15.1. Measurable Objective and Interim Milestones for Chronic Lowering of Groundwater Levels

15.1.1. Measurable Objectives for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.30(c)

MOs for Chronic Lowering of Groundwater Levels are defined herein as the groundwater levels that are 40 feet below the levels that were observed in representative monitoring sites in July 2017. The rationale for this is as follows:

- Groundwater level data from prior to the Sustainable Groundwater Management Act (SGMA) effective date (1 January 2015) are not available for the two Representative Monitoring Sites (RMS), but data from July 2017 are available;
- Based on groundwater level data from Olcese Water District Wells #2 and #3, due to relatively wet conditions in 2016 and 2017, groundwater levels in July 2017 were higher than they were in 2016 and 2015, and also likely higher than they were in 2014, the year preceding the SGMA effective date.[37] This suggests that groundwater levels at the two RMS in 2014 would also have been lower than the measured levels in July 2017;
- Because Minimum Thresholds (MTs) for Chronic Lowering of Groundwater Levels are set based on the elevation of the top of the well screens in two representative wells (i.e., the Canyon View Ranch Well and Well #2 which is used to define the MT for Well #4), which are more than 40 feet below the July 2017 levels, setting MOs at 40 feet below the July 2017 levels will provide an adequate Margin of Operational Flexibility;
- Results from the projected water budget analysis (see **Section 9.4 *Projected Water Budget***) suggest that climate change may result in groundwater level decline rates of -0.3 feet per year (ft/yr) under the 2030 climate scenario and -3.5 ft/yr under the central tendency 2070 scenario. A MO set 40 feet below July 2017 levels translates to an average annual decline rate of approximately -1.8 ft/yr, and therefore is consistent with the range of potential effects of climate change; and
- Because the MOs are set at levels that are above historical lows, and no Undesirable Results (URs) for this sustainability indicator have been observed even at historical lows, setting the MO at these levels will ensure sustainable groundwater management within the Olcese GSA Area and will not interfere with achieving sustainable groundwater management in adjacent areas of the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin").

[37] Groundwater levels were approximately 40 feet lower in both Well #2 and Well # in July 2015 than they were in July 2017.

15.1.2. Interim Milestones for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.30(e)

IMs for Chronic Lowering of Groundwater Levels are defined herein based on a linear interpolation between the Fall 2017 groundwater levels and the MT. **Table SMC-4** below presents the MOs and IMs for Chronic Lowering of Groundwater Levels. **Figure SMC-1** also shows the MOs at the representative monitoring locations.

Table SMC-4. Measurable Objectives for Chronic Lowering of Groundwater Levels

Representative Monitoring Site	Interim Milestone #1 (2025) (ft msl)	Interim Milestone #2 (2030) (ft msl)	Interim Milestone #3 (2035) (ft msl)	Measurable Objective (ft msl)
Well #4	388.04	379.16	370.28	361.40
Canyon View Ranch Well	629.15	620.27	611.39	602.51

15.2. Measurable Objective for Reduction of Groundwater Storage

☑ 23 CCR § 354.30(c)
☑ 23 CCR § 354.30(d)

Because groundwater levels are used as a proxy for monitoring change in storage, the MO for Reduction of Groundwater Storage is defined as the change in groundwater storage over the SGMA implementation period that would occur if water levels in the RMS wells reached the MO for Chronic Lowering of Groundwater Levels discussed above. This volume of storage is calculated to be 1,280 AF, using the same calculation methods used in **Section 14.2 *Minimum Threshold for Reduction of Groundwater Storage***. Therefore, the MO for Reduction of Groundwater Storage is set at -1,280 AF.

15.3. Measurable Objective for Seawater Intrusion

This sustainability indicator is not applicable to the Kern Subbasin, and no URs, MTs, MOs, or IMs are defined for this indicator.

15.4. Measurable Objective for Degraded Water Quality

☑ 23 CCR § 354.30(c)

As discussed above in **Section 13.4 *Undesirable Results for Degraded Water Quality***, there are no significant and unreasonable effects of Degraded Water Quality on beneficial uses and users of groundwater in the Olcese GSA Area that are related to human-driven water management actions, as opposed to natural processes. For this reason, sustainable management criteria (SMCs) for this sustainability indicator are not applicable to this area, and no URs, MTs, MOs, or IMs are defined for this indicator. As discussed above in **Section 13.4 *Undesirable Results for Degraded Water Quality***, activities already being undertaken as part of other regulatory compliance efforts (i.e., monitoring groundwater quality at the Anne Sippi Clinic, the only public water system in the Olcese GSA Area, and routine monitoring of groundwater quality in Olcese Water District irrigation wells as part of agricultural water management) will continue during the SGMA implementation timeframe. If a causal nexus between groundwater quality and water management activities is discovered, the criteria for development of MOs for Degraded Water Quality will be revisited.

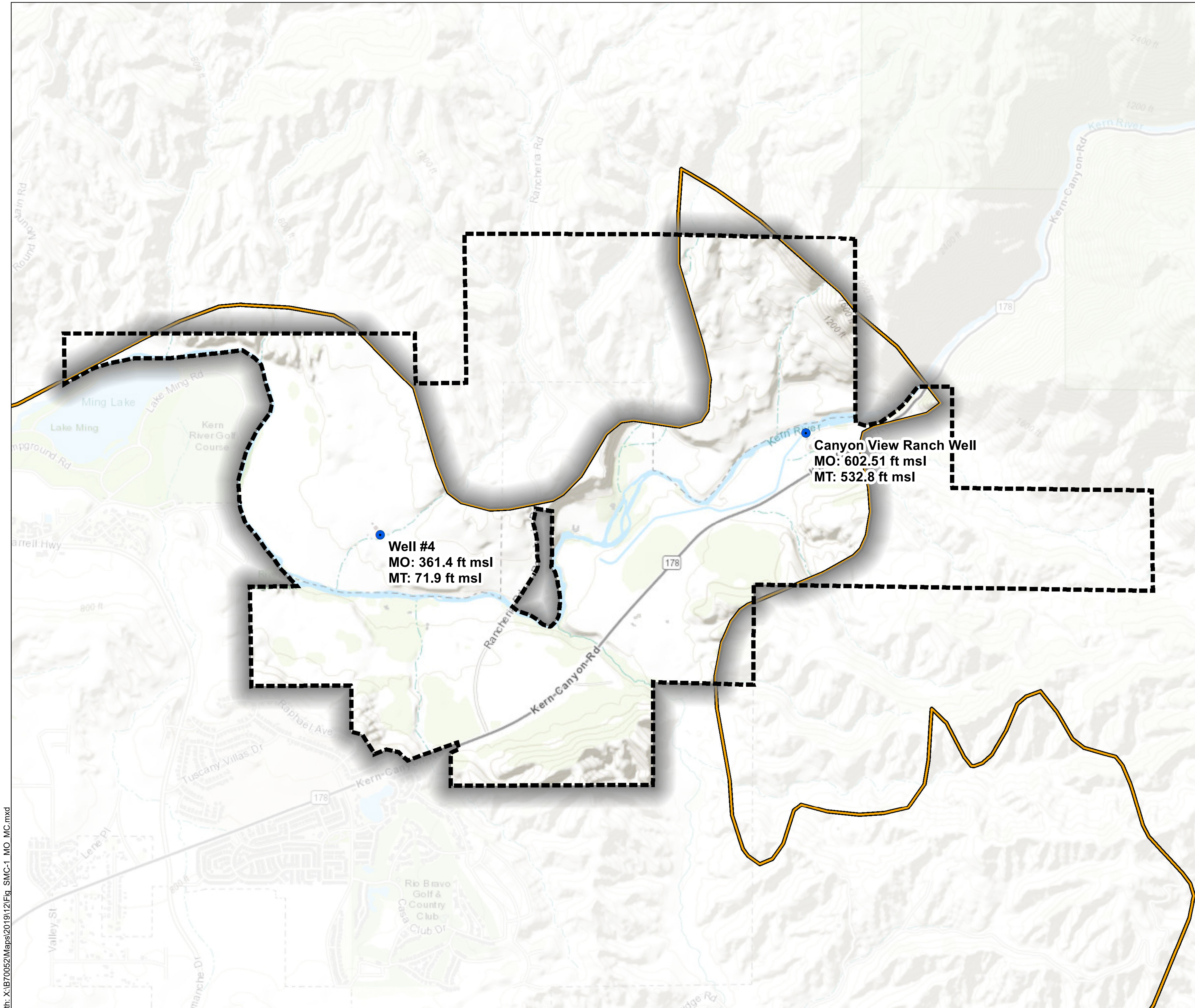
15.5. Measurable Objective for Land Subsidence

As discussed above in **Section 13.5 *Undesirable Results for Land Subsidence***, there has been no observed occurrence of significant and unreasonable effects of Land Subsidence on beneficial uses and users of groundwater in the Olcese GSA Area. However, the Olcese Water District's canal is considered to be Management Area Critical Infrastructure and therefore SMCs for land subsidence are defined. The criterion for URs for Land Subsidence are defined in terms of reduction in canal capacity, and an MT is defined based on the relationship between capacity and slope (see **Section 14.5 *Minimum Threshold for Land Subsidence***). Likewise, the MO for Land Subsidence is defined herein as a zero change in canal capacity (if caused by inelastic subsidence due to groundwater extraction). This corresponds to a zero change in the relative elevation difference between the two monitoring points established for Land Subsidence.

15.6. Measurable Objective for Depletion of Interconnected Surface Water

As discussed above in **Section 13.6 *Undesirable Results for Depletions of Interconnected Surface Water***, the potential for URs for this sustainability indicator is limited due to the hydrogeologic conditions in the Olcese GSA Area that limit hydraulic connectivity between groundwater in the Olcese Sand Aquifer and groundwater and interconnected surface water in the Shallow Alluvium. As described in **Section 7.1.4 *Principal Aquifers and Aquitards*** and **Section 8.6 *Interconnected Surface Water Systems***, multiple lines of evidence (i.e., water quality data, hydrostratigraphy, and water levels) suggest that the principal aquifer is hydraulically separated from the Shallow Alluvium. For this reason, no URs, MTs, MOs or IMs for Depletion of Interconnected Surface Water are defined herein.

As discussed above in **Section 13.6 *Undesirable Results for Depletions of Interconnected Surface Water***, a project to install a shallow groundwater monitoring well to assess the degree of hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and Shallow Alluvium is included in **Section 18 *Projects and Management Actions***. If results from that project indicate a hydraulic connection between the two zones does exist, and that changes to groundwater level conditions in the Olcese Sand Aquifer Unit are likely to have an effect on Shallow Alluvium groundwater levels and interconnected surface water, the criteria for defining URs for Depletion of Interconnected Surface Water will be revisited, and MOs for Depletion of Interconnected Surface Water will be developed, as appropriate. It is likely that any MO for this sustainability indicator would use groundwater levels measured in the shallow groundwater monitoring well as a proxy, pursuant to GSP Emergency Regulations (23 CCR § 354.28(d)) and as further described in the DWR Sustainable Management Criteria BMP (DWR, 2017).



Legend
- Olcese Water District
- Kern County Subbasin (DWR 5-022.14)
- Representative Monitoring Site

Abbreviations
DWR = California Department of Water Resources
ft msl = feet above mean sea level
MO = Measurable Objective
MT = Minimum Threshold

Notes
1. All locations are approximate.

Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 December 2019.

N 0 0.5 1 Miles

Measurable Objectives and Minimum Thresholds for Chronic Lowering of Groundwater Levels

Olcese Water District
Kern County, California
December 2019
B70052.03

eki environment & water

Figure SMC-1

Path: X:\B70052\Maps\2019\12\Fig_SMC-1_MO_MC.mxd

MONITORING NETWORK

16. MONITORING NETWORK

☑ 23 CCR § 354.32

This section describes the monitoring network designed for the Olcese Groundwater Sustainability Agency (Olcese GSA) Area, subsequently referred to as Monitoring Network. Pursuant to the Groundwater Sustainability Plan (GSP) Emergency Regulations, the Monitoring Network objective is to collect sufficient data for the correct assessment of the sustainability indicators relevant to the Olcese GSA Area (see **Section 13 *Undesirable Results***), and the impacts to the beneficial users of groundwater. Per the GSP Emergency Regulations (23 CCR § 354.32(e)), the Monitoring Network incorporates the Olcese GSA California Statewide Groundwater Elevation Monitoring (CASGEM) Monitoring Plan (included herein as **Appendix H**) and includes additional components to comply with the GSP Emergency Regulations.

16.1. Description of Monitoring Network

☑ 23 CCR § 354.34(a)
☑ 23 CCR § 354.34(b)
☑ 23 CCR § 354.34(d)
☑ 23 CCR § 354.34(f)

The Olcese GSA Monitoring Network for Sustainable Groundwater Management Act (SGMA) compliance purposes consists of two existing Olcese Water District (District) production wells that are part of the CASGEM Monitoring Network (Well #4 and Canyon View Ranch Well). Groundwater levels will be measured in these two wells at least bi-annually (spring and fall) to allow for characterization of groundwater conditions during seasonal highs and lows. Additionally, two other existing District productions wells, Well #2 and Well #3, and a new shallow monitoring well (MWS-1) that was recently installed (2019) as part of the Olcese GSA's planned Projects and Management Actions to monitor groundwater levels in the Shallow Alluvium, will be monitored to provide additional information to support management decisions in the Olcese GSA (see **Figure MN-1**). However, those wells are not considered part of the SGMA compliance Monitoring Network.[38] As discussed in **Section 18 *Projects and Management Actions***, if results from monitoring of well MWS-1 show that a hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium does exist, an additional shallow monitoring well will be installed and monitored. The Monitoring Network also includes two benchmark survey locations along the District's canal, data from which are used to assess Undesirable Results (URs) for Land Subsidence.

The objective of the Monitoring Network is to provide sufficient data to assess conditions relative to the established Minimum Thresholds (MTs) defined in **Section 14** and progress toward achieving the Measurable Objectives (MOs) defined in **Section 15**. The purpose of monitoring water levels in the new

[38] Well #2 and Well #3 have historically been monitored using an air-line measurement method and the wells do not have adequate space in the well head to employ a sounding wire, necessary to measure with an accuracy of at least 0.1 feet (Per § 352.4(a)(3) Data and Reporting Standards), therefore, these wells are not included in the SGMA compliance Monitoring Network.

shallow monitoring well MWS-1 is to provide information to assess the degree of hydraulic connection, if any, between the Olcese Sand Aquifer Unit and the Shallow Alluvium and associated interconnected surface water and Groundwater Dependent Ecosystems (GDEs) (see **Section 16.1.6**).

16.1.1. Monitoring Network for Chronic Lowering of Groundwater Levels

☑ 23 CCR § 354.34(c)(1)

Consistent with the Olcese GSA CASGEM Monitoring Plan, Well #4 was selected as a monitoring well due to its location on the western side of the Olcese GSA Area, and because it has the deepest screened interval of all District wells (i.e., screened from 860 to 2,000 feet below ground surface [ft bgs]). This will provide for adequate monitoring of groundwater conditions within the deeper portion of the Olcese Sands Aquifer Unit on the western side of the Olcese GSA Area. This well was recently installed in 2016 and contains a dedicated sounding tube for measuring water levels with an electric sounding tape.

The Canyon View Ranch well was selected as a monitoring well due to its location on the eastern side of the Olcese GSA Area, and because it has the shallowest screened interval of all District wells (i.e., from 140 to 340 ft bgs). This will provide for adequate monitoring of groundwater conditions within the shallow portion of the Olcese Sands Aquifer Unit on the eastern side of the Olcese GSA Area. Though this well has not historically been monitored for groundwater elevations, it is part of the approved CASGEM network, and the well head contains ample space to install a sounding tube for measuring water levels using an electric sounding tape.

Though District Wells #2 and #3 have historically been monitored, these wells do not have adequate space in the well head to employ a sounding wire required to collect data compliant with GSP Emergency Regulations (23 CCR § 352.4). However, these wells will serve as additional monitoring locations (not part of the SGMA compliance Monitoring Network) to provide groundwater level data to improve the estimate of flow directions, and hydraulic gradients[39] in the Olcese GSA Area.

The new shallow monitoring well (MWS-1) is installed in the Shallow Alluvium in close proximity to Well #2 and the Kern River (see **Figure MN-1**). Monitoring groundwater levels in the Shallow Alluvium, proximate to a well extracting from the Olcese Sand Aquifer, will serve to assess the connection and possible impacts on the Shallow Alluvium due to groundwater extraction from the Olcese Sand Aquifer Unit.

If results from monitoring of well MWS-1 indicate a possible hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium, an additional shallow monitoring well (MWS-2) for the Shallow Alluvium will be installed in the vicinity of the potential GDEs along Cottonwood Creek and regularly monitored for groundwater levels. The purpose of this well, if installed, will be to expand the understanding of the Shallow Alluvium, its relationship with potential GDEs in the Olcese GSA Area, and the possible impacts of extraction from the Olcese Sand Aquifer Unit on the Shallow Alluvium.

Details of the Monitoring Network for Chronic Lowering of Groundwater Levels, and additional monitoring sites, are provided in **Table MN-1**. MTs and MOs defined for the two Representative Monitoring Wells for the this sustainability indicator are described in **Section 14** and **15**, respectively. Monitoring Protocols are adopted from the Olcese GSA CASGEM Monitoring Plan, presented as an appendix in this GSP (see

[39] Groundwater outflows in the Olcese GSA Area have been identified as a data gap, a better estimation of hydraulic gradients would help to improve the Water Budget Model.

Appendix H).

Monitoring Well Density

According to DWR's Monitoring Network and Identification of Data Gaps Best Management Practices (BMP) (DWR, 2016c), monitoring well density should be between 0.2 and ten wells per 100 square miles. The Olcese GSA Monitoring Network is compliant with these criteria, having two wells per five square miles[40] in the principal aquifer, and one well per five square miles in the Shallow Alluvium.

Monitoring Schedule

Water levels will be measured bi-annually (spring and fall) to, among other things, document seasonal fluctuations in groundwater levels. Monitoring will be conducted consistent with the Monitoring Protocols included in the Kern County Subbasin Coordination Agreement and appendices thereto (see **Appendix J**). Specifically, spring levels will be measured in March to represent a seasonal high prior to summer irrigation demands. Fall levels will be measured in October to represent a seasonal low after the summer irrigation demands.

16.1.2. Monitoring Network for Reduction of Groundwater Storage

☑ **23 CCR § 354.34(c)(2)**

Groundwater level data obtained from Well #4 and Canyon View Ranch Well will be used to provide an estimate of the change in groundwater storage within the principal aquifer. This monitoring approach is appropriate, as the Chronic Lowering of Groundwater Levels Sustainability Indicator serves as a proxy for the Reduction in Groundwater Storage Sustainability Indicator (see **Section 14.2** ***Minimum Threshold for Reduction of Groundwater Storage*** and **Section 15.2** ***Measurable Objective for Reduction of Groundwater Storage***).

16.1.3. Monitoring Network for Seawater Intrusion

☑ **23 CCR § 354.34(c)(3)**
☑ **23 CCR § 354.34(j)**

Because the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin") is not located near any saline water bodies, seawater intrusion is not present and not likely to occur, the Seawater Intrusion sustainability indicator is not applicable to the Kern Subbasin, and therefore no monitoring locations for this sustainability indicator are defined in the Kern Subbasin.

16.1.4. Monitoring Network for Degraded Water Quality

☑ **23 CCR § 354.34(c)(4)**

Historical groundwater quality monitoring data in the Olcese GSA Area has not shown any occurrences of water quality issues that would have any significant or unreasonable effects on beneficial uses/users. Therefore, Degraded Water Quality is not considered a sustainability indicator of concern in the Olcese GSA Area. However, the District will continue monitoring water quality periodically as part of its own

[40] The Olcese GSA Area (3,206 acres) is equivalent to approximately 5 square miles.

agricultural water management activities, and the data will be used to identify if a change in the water quality trend occurs.

Canyon View Ranch Well, as a public water system supply well, is subject to water quality monitoring requirements under the State Water Resources Control Board (SWRCB) Drinking Water Program. Water quality analysis is reported on the California Drinking Water Watch along with the monitoring schedule.

16.1.5. Monitoring Network for Land Subsidence

☑ **23 CCR § 354.34(c)(5)**

There has been no evidence of land subsidence in the Olcese GSA Area portion of the Kern Subbasin. As discussed in **Section 8.5 *Land Subsidence***, the NASA JPL InSAR dataset shows very low values of change in ground surface elevation (inclusive of zero) suggesting that land subsidence in this area is negligible. Nevertheless, the Olcese GSA considers the Olcese Water District canal to be Management Area Critical Infrastructure and has established sustainable management criteria (SMCs) for Land Subsidence based on the canal's capacity and the relationship between capacity and channel slope. The SMCs are based on the change in relative elevation difference at two monitoring points along the canal.

The District conducts periodic surveys (approximately every five years) of ground surface elevation at benchmark locations along its canal and at its hydroelectric power plant facility as part of its compliance with its license from the Federal Energy Regulatory Commission. The Monitoring Network for Land Subsidence in this Olcese GSP leverages this existing monitoring program through the use of two of those benchmark survey locations. The two locations that comprise the Monitoring Network for Land Subsidence are identified as points 55 and 93 on the map included in **Appendix F**. Point 55 is located near the midpoint of the canal (at/near Station 55+11.13) close to Olcese Water District's Well #2. Point 93 is located at/near the downstream end of the canal (at/near Station 89+27.14). Both benchmark survey locations are concrete nails in the side of the canal.

16.1.6. Monitoring Network for Depletions of Interconnected Surface Water

☑ **23 CCR § 354.34(c)(6)**
☑ **23 CCR § 354.34(j)**

As described in **Section 7.1.4 *Principal Aquifers and Aquitards*** and **Section 8.6 *Interconnected Surface Water Systems***, multiple lines of evidence (i.e., water quality data, hydrostratigraphy, and water levels) suggest that the principal aquifer is hydraulically separated from the Shallow Alluvium. For this reason, no Undesirable Result for this Sustainability Indicator are defined in the Olcese GSA Area.

If current water use conditions change, and the Shallow Alluvium becomes a significant source of water in the Olcese GSA Area, or if monitoring of shallow well MWS-1 indicates that a hydraulic connection does in fact exit between the Olcese Sand Aquifer Unit and the Shallow Alluvium, SMCs for Depletion of Interconnected Surface Water will be revisited, and the Monitoring Network will be adjusted accordingly, including installation of an additional shallow monitoring well. It is anticipated that such monitoring would include the Kern River and Cottonwood Creek stream flows (possibly by measurement of surface water stage), spring flows and other relevant characteristics of GDEs in the Olcese GSA Area.

16.2. Monitoring Protocols for Data Collection and Monitoring

☑ 23 CCR § 352.2

The monitoring protocols that will be followed for SGMA compliance purposes under this GSP are consistent with those described in the Olcese GSA CASGEM Monitoring Plan, attached to this GSP for reference (see **Appendix H**). These protocols are also consistent with those described in the Coordination Agreement and Appendices thereto (see **Appendix J**).

16.3. Representative Monitoring

☑ 23 CCR § 354.36

Well #4 and Canyon View Ranch Well are considered to be representative of groundwater conditions in the Olcese Sand Aquifer Unit, and Minimum Thresholds and Measurable Objectives have been defined for these two well locations (see **Section 14** and **Section 15**). Groundwater level measurements of these wells will be used to estimate annual change in storage in the Olcese GSA portion of the Kern Subbasin.

The new shallow monitoring well, MWS-1, installed in 2019 and included in the Monitoring Network, is not representative of groundwater conditions in the Principal Aquifer (Olcese Sand Aquifer Unit). Rather, it is included in the Monitoring Network to assess the connection between the Shallow Alluvium and the Olcese Sand Aquifer Unit, as described further in **Section 18** ***Projects and Management Actions***.

16.4. Assessment and Improvement of Monitoring Network

☑ 23 CCR § 354.38

16.4.1. Review and Evaluation of the Monitoring network

Per the GSP Emergency Regulations, the monitoring network will be evaluated at least every five years, in relation the circumstances described in 23 CCR § 354.38(e), and will be adjusted, as necessary, by the Olcese GSA.

16.4.2. Identification, Description, and Steps to Fill Data Gaps

Though having two wells monitoring the Olcese Sand Aquifer in the Olcese GSA Area is consistent with the recommended monitoring well density in DWR's Monitoring Networks and Identification of Data Gaps Best Management Practices (BMP) (DWR, 2016c), two data points are not enough to estimate groundwater flow direction or hydraulic gradients. Given that the Canyon View Ranch Well is screened within the shallower portion of the principal aquifer and Well #4 is screened in the deeper portion, calculating gradients using only these two points might lead to an overestimation in the magnitude of the gradient. For this reason, two additional wells (District wells #2 and #3) will be monitored as non SGMA-compliance wells to provide additional information to estimate hydraulic gradients. Subsequent evaluation of the monitoring network will consider whether the information provided by these wells improves estimates of flow direction and hydraulic gradients.

16.5. Monitoring Reports

☑ **23 CCR § 354.40**

Monitoring data will be stored in the data management system (DMS) developed for the Olcese GSA. A copy of the monitoring data will be included in the Annual Report and submitted electronically to DWR in coordination with the other basin GSAs.

Table MN-1
Summary of Monitoring Network
Olcese Groundwater Sustainability Agency
Kern County

			Sustainability Indicator(s) *(1,2,3)*						CASGEM Details			Monitoring Site Location			
Monitoring Site ID	**Monitoring Site Type**	**Frequency of Measurement**	Groundwater Level	Groundwater Storage	Seawater Intrusion	Groundwater Quality	Land Subsidence	Interconnected Surface Water	**Station ID**	**Well ID**	**Well Type (CASGEM / Voluntary)**	**Latitude (° WGS 84)**	**Longitude (° WGS 84)**	**Description of Site Location**	**Long-term Access Agreement in Place?**
SGMA Compliance Monitoring Site															
Well #4	Well	Semi-annually	x	x					354310N1188411W002	51789	CASGEM	35.430995	-118.8410557	800 feet north of Kern River and 3/4 mile west of Rancheria Road (from WCR)	NA
Canyon View Ranch Well	Well	Semi-annually	x	x					354386N1188035W002	51788	CASGEM	35.4386391	-118.8034723	2 mi. E. of Rancheria Rd. on Hwy. 178 then N. on dirt road 400 ft, then E. 1300 ft. along S. side of canal to well location	NA
Point 55	Benchmark	5 years					x		NA			no data	no data	approximate mid-point of canal; near Station 55+11.13	NA
Point 93	Benchmark	5 years					x		NA			no data	no data	downstream end of canal; near Station 89+27.14	NA
Additional Monitoring Locations															
Well #2	Well	Semi-annually	x						354335N1188112W002	51790	Voluntary	35.4334825	-118.811153	1 mi. E. of Rancheria Rd. on Hwy. 178 then N. on dirt road 1000 ft, then E. 1950 ft. along S. side of canal to crossing, then cross to N. side of canal, then E. 1500 ft. along N. side of canal, then 300 ft. N. to well location.	NA
Well #3	Well	Semi-annually	x						354298N1188119W002	51791	Voluntary	35.4298314	-118.8119323	1.2 mi. E. of Rancheria Rd. on Hwy. 178 then S. on dirt road 500 ft, then E. 300 ft. to well location @ S.E. corner of reservoir	NA
MWS-1	Well	Semi-annually	x						NA	NA	NA	35.433466	-118.811588	approximately 130 feet east of Well #2	NA
MWS-2	Well	Semi-annually	x						NA	NA	NA	TBD	TBD	TBD	NA

Table MN-1
Summary of Monitoring Network
Olcese Groundwater Sustainability Agency
Kern County

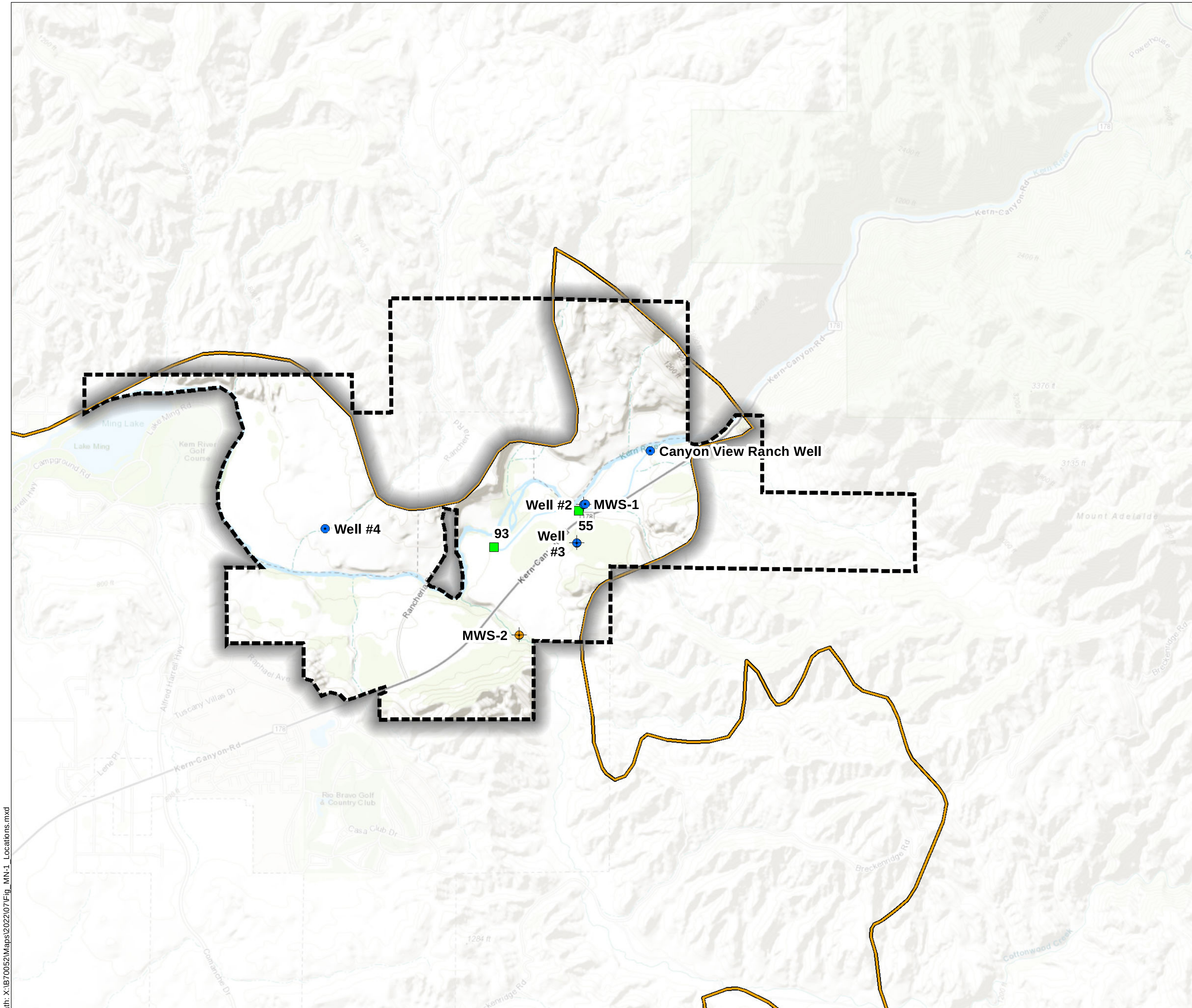
Monitoring Site ID	Reference Point			Well Use	Well Status	Well Completion Type	Well Construction Details						DWR Well Completion Report No.	Principal Aquifer Monitored *(4)*
	Ground Surface Elevation (ft amsl)	Reference Point Elevation (ft amsl)	Reference Point Description				Total Completed Depth (ft bgs)	Borehole Depth (ft bgs)	Top of Perforations Depth (ft bgs)	Bottom of Perforations Depth (ft bgs)	Casing Diameter (in)	Well Capacity (gpm)		
SGMA Compliance Monitoring Site														
Well #4	582.08	584.40	Top of 1" sounding tube	IRRIGATION	Active	Single	2,000	2,020	860	2,000	18	4,000	e0306768	Olcese Sand Aquifer
Canyon View Ranch Well	672.80	673.51	Top of 2-1/2" sounding tube	PUBLIC SUPPLY	Active	Single	340	341	140	340	10	250	WCR0107769	Olcese Sand Aquifer
Point 55	NA	79.97 *(5)*	concrete nail in side of canal	NA	NA	NA	NA						NA	NA
Point 93	NA	71.88 *(5)*	concrete nail in side of canal	NA	NA	NA	NA						NA	NA
Additional Monitoring Locations														
Well #2	631.9	635.21	Top of airline	IRRIGATION	Active	Single	1,612	1,612	560	1,612	16	2,867	WCR0021002	Olcese Sand Aquifer
Well #3	719.85	723.26	Top of airline	IRRIGATION	Active	Single	1,900	1,910	800	1,890	16	3,000	e0082660	Olcese Sand Aquifer
MWS-1	630.52	631.84	Top of casing	MONITOR	Active	Single	155	160	55	155	7	NA	WCR2019-005221	Shallow Alluvium
MWS-2	TBD	TBD	Top of sounding tube	MONITOR	NA	Single	TBD	TBD	TBD	TBD	TBD	NA	NA	Shallow Alluvium

Abbreviations

amsl = above mean sea level
bgs = below ground surface
CASGEM = California Statewide Groundwater Elevation Monitoring
DWR = California Department of Water Resources
ft = feet
gpm = gallons per minute
in = inches
NA = not applicable
TBD = to be determined
WGS = World Geodetic System

Notes

(1) Seawater intrusion is not considered to be a sustainability indicator of concern to the Olcese GSA Area and is thus not monitored for SGMA compliance.
(2) Existing water quality monitroring programs will continue, however, groundwater quality is not considered to be a sustainability indicator of concern to the Olcese GSA Area and is thus not monitored for SGMA compliance.
(3) Depletion of Interconnected Surface Water is not considered to be a sustainability indicator of concern to the Olcese GSA Area and is thus not monitored for SGMA compliance.
(4) The Shallow Alluvium is not a principal aquifer in the Olcese GSA Area, however, monitoring will be used to assess the degree of hydraulic connections between the Shallow Alluvium and the principal aquifer (Olcese Sand Aquifer Unit).
(5) Reference point elevations for subsidence monitoring locations (Point 55 and Point 93) are relative to a local datum (see Appendix F).



Legend

- Olcese Water District
- Kern County Subbasin (DWR 5-022.14)

SGMA Monitoring Network for Groundwater Levels and Storage

- Existing

Additional Monitoring Sites for Groundwater Levels

- Existing
- Potential (see Note 2)

SGMA Monitoring Network for Subsidence

- Benchmark Location

Abbreviations

DWR = California Department of Water Resources
OWD = Olcese Water District
P/MA = Project / Management Action

Notes

1. All locations are approximate.
2. See Table MN-1 for details of Monitoring Network.

Sources

1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 July 2022.
2. Additional monitoring site MWS-2 may be installed as part of the contingent P/MA #1, if that P/MA is implemented (see Section 18).

N

0 0.5 1
Miles

Monitoring Network

eki environment & water

Olcese Water District
Kern County, California
July 2022
B70052.03

Figure MN-1

Path: X:\B70052\Maps\2022\07\Fig_MN-1_Locations.mxd

PROJECTS AND MANAGEMENT ACTIONS

17. INTRODUCTION TO PROJECTS AND MANAGEMENT ACTIONS

☑ **23 CCR § 354.42**

This section presents the Projects and Management Actions (P/MAs) proposed by the Olcese Groundwater Sustainability Agency (Olcese GSA) to support achievement of the sustainability goal within the Olcese GSA Area. As discussed in earlier sections, groundwater conditions within the Olcese GSA Area are relatively stable and do not indicate overdraft conditions, and therefore P/MAs to address overdraft conditions are not necessary. Furthermore, no Undesirable Results for any applicable sustainability indicators have occurred, based on available data.

That being said, the existing monitoring infrastructure is not fully sufficient to conclusively determine that Undesirable Results are not occurring or would not occur in the future. Therefore, the primary objective of the P/MAs described below is to improve the monitoring infrastructure in order to refine the understanding of groundwater conditions within the Olcese GSA Area, particularly with respect to potential hydraulic connection between the principal aquifer (Olcese Sand Aquifer Unit) and the Shallow Alluvium which is itself closely connected to surface water and the riparian ecosystems along the Kern River.

18. PROJECTS AND MANAGEMENT ACTIONS

18.1. List of Projects and Management Actions

☑ 23 CCR § 354.44(b)(1)

Per the GSP Emergency Regulations (23 CCR § 354.44), below is a list of the P/MAs that will be undertaken by the Olcese GSA in support of achieving the Sustainability Goal within the Olcese GSA Area.

Non-contingent Projects and Management Actions

The following P/MAs have been (in the case of project #1) or will be undertaken immediately upon adoption of this GSP:

1. Install a shallow monitoring well in the vicinity of Olcese Water District production wells #2 and #3 of the purposes of evaluating potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium (completed in Summer 2019).
2. Conduct a study of the potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium by monitoring groundwater levels in the new shallow monitoring well and in Wells #2 and #3 during one or more summertime irrigation pumping season to determine if water levels in the Shallow Alluvium respond to changes in groundwater levels in the principal aquifer (in progress). Data collected to date indicate little to no connection between shallow groundwater levels and deep aquifer levels or pumping.

Contingent Projects and Management Actions

If results from the study of Shallow Alluvium groundwater level response to pumping in the principal aquifer (Non-contingent Project #2, above) shows a significant response, the following "contingent" Projects and Management Actions will be undertaken:

1. Install a second shallow monitoring well in the vicinity of potential GDEs along Cottonwood Creek and conduct regular (semi-annual) monitoring of groundwater levels for a period of at least three years to assess potential response groundwater levels in the Shallow Alluvium to pumping of the principal aquifer.
2. Refine definitions of Undesirable Results, Minimum Thresholds, and Measurable Objectives for applicable sustainability indicators (i.e., Chronic Lowering of Groundwater Levels and Depletion of Interconnected Surface Water) based on results from Non-contingent Project #2 and Contingent Project #1 for inclusion in the first 5-year GSP update.

18.2. Details of Projects and Management Actions

Details of the various Non-contingent and Contingent P/MAs are presented in **Table PMA-1**. Per the GSP Emergency Regulations (23 CCR § 354.44(b)), **Table PMA-1** includes the following details about each of the Projects and Management Actions:

- Circumstances for implementation
- Public noticing
- Permitting and regulatory process

- Time-table for initiation and completion, and the accrual of expected benefits
- Expected benefits and how they will be evaluated
- How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.
- Legal authority required
- Estimated costs for the projects and managements and plans to meet those costs (economic analysis and finance strategy for projects and management actions)
- Management of groundwater extractions and recharge
- Relationship to additional GSP elements as described in Water Code §10727.4.

Table PMA-1
Details of Projects and Management Actions

Olcese Groundwater Sustainability Agency
Kern Subbasin

Project / Management Action Number	Type	Description	Circumstances for Implementation	Public Noticing Process	Permitting and Regulatory Process Requirements	Status, Time Table for Initiation and Completion, Accrual of Expected Benefits	Expected Benefits	How It Will Be Accomplished	Legal Authority Required	Estimated Costs	Management of Groundwater Extractions and Recharge	Relationship to Additional GSP Elements
Non-Contingent												
1	Project	Install a shallow monitoring well in the vicinity of District production wells #2 and #3 for the purposes of evaluating potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium	Non-contingent Project / Management Action to be implemented upon adoption of Olcese GSA Area GSP	Notice of implementation included in Olcese GSA Area GSP	Requires well drilling permit from Kern County Environmental Health Department	Status: not yet initiated; Initiation within 3 months of GSP adoption; Completion within 6 months of GSP adoption	Improved ability to monitor groundwater conditions in Shallow Alluvium	Contracting with well drilling contractor	None	$25,000 - $50,000	Not applicable	Provides information relevant to understanding potential impacts to GDEs
2	Management Action	Conduct a study of the potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium		Notice of implementation included in Olcese GSA Area GSP	None	Status: not yet initiated; Initiation upon completion of Non-contingent Project #1	Improved understanding of potential hydraulic connection between Olcese Sand Aquifer Unit and Shallow Alluvium	Contracting with professional hydrogeological consultant	None	$40,000 - $80,000	Not applicable	Provides information relevant to understanding potential impacts to GDEs
Contingent												
1	Project	Install a second shallow monitoring well in the vicinity of potential GDEs along Cottonwood Creek, and conduct regular (semi-annual) monitoring of groundwater levels	Implementation if results from Non-contingent Project #2 shows evidence of hydraulic connection between Olcese Sand Aquifer Unit and Shallow Alluvium	None required	Requires well drilling permit from Kern County Environmental Health Department	Status: not yet initiated; Initiation within 3 months of completion of Non-contingent Management Action #2	Improved ability to monitor groundwater conditions in Shallow Alluvium	Contracting with well drilling contractor	None	$25,000 - $50,000	Not applicable	Provides information relevant to understanding potential impacts to GDEs
2	Management Action	Refine definitions of Undesirable Results, Minimum Thresholds, and Measurable Objectives for applicable sustainability indicators (i.e., Chronic Lowering of Groundwater Levels and Depletion of Interconnected Surface Water) based on results from Non-contingent Project #2 and Contingent Project #1 for inclusion in the first 5-year GSP update	Implementation if results from Non-contingent Project #2 and Contingent Project #1 show evidence of hydraulic connection between Olcese Sand Aquifer Unit and Shallow Alluvium	Public noticing during GSP 5-year update per GSP Regulations and SCEP	Sustainable Management Criteria to be developed per SGMA GSP Regulations	Status: not yet initiated; Initiation at least 1 year prior to adoption of 5-year GSP update	Improved definition of Sustainabile Management Criteria	To be accomplished in a manner similar to initial GSP development process, including public notice/ stakeholder engagement	Authority of GSA under SGMA to develop and implement GSP	Efforts will be included as part of development of GSP 5-Year Update; cost to be determined	To be determined, if necessary, as part of GSP 5-year Update	None

Abbreviations:
GDEs = Groundwater Dependent Ecosystems
GSA = Groundwater Sustainability Agency
GSP = Groundwater Sustainability Plan
SCEP = Stakeholder Communication and Engagement Plan
SGMA = Sustainable Groundwater Management Act

PLAN IMPLEMENTATION

19. PLAN IMPLEMENTATION

☑ 23 CCR § 351(y)

Per the GSP Emergency Regulations (23 CCR § 351(y)), "plan implementation" refers to "an [Groundwater Sustainability] Agency's exercise of the powers and authorities described in the Act, which commences after an Agency adopts and submits a Plan or Alternative to the Department and begins exercising such powers and authorities". This section describes the activities that will be performed by Olcese Water District (District) as part of GSP implementation within Olcese Groundwater Sustainability Agency (GSA) Area, with a focus on the first five years.

Key Groundwater Sustainability Plan (GSP) implementation activities to be undertaken by the District over the next five years include:

- Monitoring and data collection;
- Projects & Management Action (P/MA) implementation, including policy development, as necessary, to support GSP implementation;
- Technical and non-technical coordination with other water management entities within the Kern County Subbasin (Department of Water Resources [DWR] Basin No. 5-022.14; "Kern Subbasin");
- Continued outreach and engagement with stakeholders;
- Annual reporting; and
- Evaluation and updates, as necessary, of the District's GSP as part of the required periodic evaluations (i.e., "five-year updates").

Each of these activities is discussed in more detail below.

19.1. Plan Implementation Activities

19.1.1. Monitoring and Data Collection

As discussed in **Section 16 *Monitoring Network***, successful sustainable groundwater management relies on a foundation of data to support decision making. As such, collection of data within the Olcese GSA Area will be a key part of GSP implementation. These data collection efforts include data on applicable sustainability indicators to be collected from the networks of Representative Monitoring Sites (RMS), as well as other data and information required for management and reporting under the Sustainable Groundwater Management Act (SGMA), as described below.

Monitoring of Applicable Sustainability Indicators

Section 16 *Monitoring Network* discusses the monitoring networks (i.e., Representative Monitoring Sites; RMS) and protocols that will be used for the applicable sustainability indicators within the Olcese GSA Area, including Chronic Lowering of Groundwater Levels, Reduction of Groundwater Storage (using groundwater levels as a proxy), and Land Subsidence. Those protocols will be followed in the defined networks as part of GSP implementation. Data collected will be incorporated into the District's own Data Management System (DMS) for subsequent inclusion in the basin-wide DMS. These data will be used to support coordination efforts within the Kern Subbasin (e.g., as part of Annual Reports; see **Section 19.1.5 *Annual Reporting***).

Monitoring results at the defined RMS locations will be evaluated against applicable Sustainable Management Criteria (SMCs; i.e., Undesirable Results [URs], Minimum Thresholds [MTs], and Measurable Objectives [MOs]) to support local management efforts. In addition to the monitoring for groundwater levels at the RMS locations, the District will continue to collect water quality data from selected wells within the Olcese GSA Area in support of its agricultural water operations. Those data collection activities will also be conducted to support improved local understanding and groundwater management decisions. If it is determined in the future that SMCs are warranted for this Sustainability Indicator, the GSP will be amended as such.

The District anticipates that within the first five years of GSP implementation (i.e., in the 2020 – 2025 timeframe), the following efforts related to monitoring will be performed:

- Semi-annual monitoring for water levels at the defined RMS locations, with the potential for more frequent (i.e., monthly) monitoring and/or monitoring of additional well sites;
- Semi-annual monitoring for water quality at selected District well locations, with the potential for monitoring of additional well sites; and
- Collection of survey data from the network of benchmark locations, two of which are used to assess conditions relative to MTs and MOs established in this amended Olcese GSP; and
- Coordination of the local DMS with the basin-wide DMS.

<u>Collection of Other Required Information</u>

Besides the data on Sustainability Indicators described above, collection and reporting of other types of information is required under SGMA (see further discussion below in **Section 19.1.5 <u>Annual Reporting</u>**). These other types of information include:

- Groundwater extraction information; and
- Surface water supply data

Groundwater extraction will be measured at each of the District's supply wells, as it has been historically, and quantified for inclusion in the Annual Reports consistent with the Coordination Agreement and Appendices thereto (see **Appendix J**). Surface water supply data will be collected, as it has been historically, at the District's diversion points along the Kern River. All surface water diversions will be accounted for as to which surface water right they pertain to in support of the basin-wide accounting of these supply sources.

19.1.2. <u>Project and Management Action Implementation</u>

A main part of GSP implementation will be the implementation of P/MAs to address and prevent potential Undesirable Results. As described in **Section 18 *Projects and Management Actions***, a set of P/MAs has been developed whose principal aim is to improve understanding of groundwater conditions within the Olcese GSA Area (see **Table PMA-1**, which provides the required details about each P/MA). Initial steps in implementation of these P/MAs will include performing various planning studies or analyses to refine the concepts into actionable projects. Once the necessary initial studies are completed, P/MAs will undergo, as necessary, final engineering design and then implementation.

As of the end of WY 2021, the Olcese GSA has completed the following related to implementation of its planned P/MAs:

Study of Potential Connection Between Shallow Alluvium and Principal Aquifer

The shallow monitoring well installation that is non-contingent P/MA #1 has already been completed in 2019. Details of the new monitoring well are provided in **Appendix I**. Olcese GSA has also initiated its study of the potential hydraulic connection between the Olcese Sand Aquifer Unit and the Shallow Alluvium by monitoring groundwater levels in the new shallow monitoring well and in Wells #2. Steps taken towards completion of this study have included installation of data-logging pressure transducers collecting high-frequency water level data since fall 2020, and collection of manual depth to water measurements, along with monthly groundwater extraction information collected as part of Olcese Water District's routine operations. Additional water quality sampling of these two wells and the Kern River has also been conducted. This project is being implemented by the Olcese GSA with support from outside professional hydrogeologic consultants, and data collection is ongoing.

If results indicate a potential connection between the shallow alluvium and the Olcese Sand Aquifer Unit, an additional shallow monitoring well will be installed and monitored over a period of at least three years to further assess potential response of groundwater levels in the Shallow Alluvium to pumping of the principal aquifer (i.e., contingent P/MA #1). Results of these efforts will be documented for inclusion in the next GSP update (discussed further below).

In addition to the above specific P/MA activities, the District continues to actively participate in the local, regional and state-wide water market(s) to balance the District's supplies. The District will also actively explore and pursue grant funding source to support other P/MAs listed in **Table PMA-1**.

19.1.3. Intrabasin Coordination

Just as this GSP has been developed as part of a coordinated GSP process in the Kern Subbasin, coordination amongst all water management entities involved in SGMA in the Kern Subbasin will continue during GSP implementation. This coordination will include both technical and non-technical matters, as discussed below.

Technical Coordination

Continued technical coordination will be critical to ensure that all entities in the Kern Subbasin as a whole approach local groundwater management using a robust shared framework of data, information, and technical assumptions. The Olcese GSA will coordinate with other water management entities on technical matters including, but not limited to, the following:

- DMS development and maintenance;
- Groundwater model refinement and updates;
- Water budget refinement and collection of supporting data;
- the Basin Study;
- DWR airborne electromagnetic (AEM) data collection effort; and

- Basin-wide monitoring and reporting efforts.

Non-Technical Coordination

Non-technical coordination will involve matters related to policy, advocacy, governance, and the like. Olcese GSA representatives will continue to actively participate in coordination meetings with the other Kern Subbasin GSAs. Specific additional non-technical coordination activities will be pursued, as necessary.

19.1.4. Stakeholder Engagement

The Olcese GSA's Stakeholder Communication and Engagement Plan (SCEP; **Appendix D**) is a key part of the GSP, and will continue to be refined, updated, and executed during GSP implementation. Anticipated stakeholder engagement activities include, but are not limited to:

- Regular SGMA updates during Olcese GSA Board meetings;
- Hosting stakeholder workshops, as needed;
- Posting of relevant announcements and information on the Olcese GSA website (www.olcesewaterdistrict.org); and
- Conducting informational discussions and meetings, as necessary, with interested stakeholders.

19.1.5. Annual Reporting

☑ **23 CCR § 356.2(b)(1)(2)(3)**

Per the GSP Emergency Regulations (23 CCR § 356.2(b)), an annual report on basin conditions and GSP implementation status is required to be submitted to the Department of Water Resources (DWR) by April 1 of each year following GSP adoption. These annual reports will be prepared on the basin-level but will require input from each local entity, including from Olcese GSA. Activities required at the Olcese GSA level and the Kern Subbasin level are described below.

Olcese GSA-Level Activities

In support of the annual reporting requirements, the Olcese GSA will provide to the basin-level entity preparing the reports all monitoring data from the RMS in its designated monitoring networks, as well as the other required information discussed in the subsection of **Section 19.1.1** above entitled *Collection of Other Required Information*. The Olcese GSA will also provide review and comment on the draft reports to ensure that local information is properly incorporated into the basin-level reports.

Basin-Level Activities

An entity will be designated at the basin level to compile and consolidate all of the local information into annual reports that meet the requirements of the GSP Emergency Regulations (23 CCR § 356.2).

19.1.6. Periodic Evaluations of GSP

☑ **23 CCR § 356.4**

Per the GSP Emergency Regulations (23 CCR § 356.4), the Olcese GSA will conduct a periodic evaluation of its GSP, at least every five years, and will modify the GSP as necessary to ensure that the Sustainability Goal defined for the Kern Subbasin (see **Section 12 *Sustainability Goal*** is achieved within the Olcese GSA

Area. The GSP elements that will be covered in the periodic evaluation are described below. It is anticipated that, as additional information is collected both locally and basin-wide, the 2025 plan may require substantial revision, especially on matters related to the water budget, P/MAs and sustainability criteria.

Sustainability Evaluation

This section will evaluate the current groundwater conditions for each applicable sustainability indicator within the Olcese GSA Area, including progress toward achieving Interim Milestones (IMs) and MOs and avoiding URs.

Plan Implementation Progress

This section will evaluate the current implementation status of P/MAs, along with an updated project implementation schedules and any new projects that are not included in this GSP.

Reconsideration of GSP Elements

Per 23 CCR § 356.4 (c), elements of the GSP, including the Plan Area, Basin Setting, Management Areas, URs, MTs, and MOs, will be reviewed and revised if necessary.

Monitoring Network Description

This section will provide a description of the Monitoring Network, including identification of data gaps, assessment of monitoring network function with an analysis of data collected to date, identification of actions that are necessary to improve the monitoring network, and development of plans or programs to fill data gaps.

New Information

This section will provide a description of significant new information that has been made available since the adoption or amendment of the GSP, or the last five-year assessment, including data obtained to fill identified data gaps (i.e., such as the data that will be collected pursuant to the proposed P/MAs). As discussed in the subsection above entitled *Reconsideration of GSP Elements*, if evaluation of the Basin Setting, MO, MT, or UR definitions warrant changes to any aspect of the GSP, this new information would also be included.

Regulations or Ordinances

The Olcese GSA possesses the legal authority to implement regulations or ordinances related to the GSP. This section will provide a description of relevant actions taken by Olcese GSA, including a summary of related regulations or ordinances.

Legal or Enforcement Actions

This section will summarize legal or enforcement actions, if any, taken by Olcese GSA in relation to the GSP, along with how such actions support sustainability in the Olcese GSA Area.

Plan Amendments

This section will provide a description of proposed or complete amendments to the GSP.

Coordination

This section will describe coordination activities relevant to the Olcese GSA Area.

19.2. Plan Implementation Costs

☑ 23 CCR § 354.6(e)

Per the GSP Emergency Regulations (23 CCR § 354.6(e) and § 354.44(b)(8)), this section provides estimates of the costs to Olcese GSA to implement this GSP and potential sources of funding to meet those costs.

19.2.1. Estimated Costs

Costs to the Olcese GSA to implement this GSP can be divided into several groups, as follows:

- Costs of local groundwater management activities;
- Costs for basin-wide groundwater management activities; and
- Costs to implement P/MAs, including capital/one-time costs and ongoing costs.

Table PI-1, below, provides an estimate of the annual costs for each item in the above groups for the five-year period from 2020 – 2024.

Table PI-1. Estimated Costs for Plan Implementation

Cost Category	**Estimated Costs over 2020 – 2024 Period**
Costs of Local Groundwater Management Activities	
Monitoring and Data Collection	$5,000 per year
Stakeholder Engagement	$5,000 per year
Annual Reporting (review and comment of basin-wide reports)	$15,000 per year
Periodic Evaluation of GSP	$200,000
Costs for Basin-wide Groundwater Management Activities	
Technical Coordination with other GSAs	$10,000 per year
Non-Technical Coordination with other GSAs	$5,000 per year
Costs to Implement P/MA Implementation Costs	
Non-Contingent P/MA #1 – Installation of a Shallow Monitoring Well	completed in 2019; cost was $40,000
Non-Contingent P/MA #2 – Study to Evaluate Potential Hydraulic Connection between Shallow Alluvium and Principal Aquifer	$40,000 - $80,000
Non-Contingent P/MA #3 – Establish Local Subsidence Monitoring Network	$5,000 - $15,000
Total Annual / Recurring Costs over 2020 – 2024 Period	**$40,000 per year**
Total One-Time / Non-Recurring Costs over 2020 – 2024 Period (including P/MAs and Period Evaluation of GSP)	**$245,000 - $295,000**

Costs beyond 2025 have yet to be determined, but are likely to be at least as great as the $40,000-per-year recurring costs shown above.

19.2.2. Sources of Funding to Meet Costs

As shown in **Table PI-1**, costs for GSP implementation are estimated to be significant – i.e., between approximately $450,000 and $500,000 over the next five years, and at least $40,000 per year thereafter, with potential additional costs to be determined. The Olcese GSA will likely meet the estimated costs through a combination of contributions from its main landowner, Nickel Family LLC, and grant funding, if available.

19.3. Plan Implementation Schedule

This section discusses a general estimated schedule for GSP implementation. The GSP Emergency Regulations do not specifically require that a schedule for GSP implementation over the 20-year implementation period (i.e., 2020 through 2040) be provided, and any such schedule would be subject to considerable uncertainty. However, based on certain factors and constraints inherent to the GSP process, an approximate schedule has been developed. These factors include the following:

- The GSP Emergency Regulations require achievement of the Sustainability Goal (i.e., avoidance of Undesirable Results) within 20 years of GSP adoption, which in the case of the Kern Subbasin means by 2040.
- The annual reporting and periodic evaluation requirements discussed in **Section 19.1** ***Plan Implementation Activities*** dictate when certain activities will occur.
- **Table PMA-1** and **Section 18** ***Projects and Management Actions*** include information on the timeframe for implementation of specific P/MAs; in summary, all non-contingent P/MAs identified in this GSP will be implemented within the first five years following GSP adoption by the Olcese GSA, and additional contingent P/MAs, if necessary, will likely be initiated before the first GSP update in 2025.

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APPENDICES

Appendix A

DWR Determination Letter on Kern Subbasin GSPs (January 2022)

CALIFORNIA DEPARTMENT OF WATER RESOURCES

SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

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January 28, 2022

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RE: Incomplete Determination of the 2020 Groundwater Sustainability Plans Submitted for the San Joaquin Valley – Kern County Subbasin

Dear Patricia Poire,

The Department of Water Resources (Department) has evaluated the five groundwater sustainability plans (GSPs) submitted for the San Joaquin Valley – Kern County Subbasin (Subbasin), as well as the materials considered to be part of the required coordination agreement. Collectively, the five GSPs and the coordination agreement are referred to as the Plan for the Subbasin. The Department has determined that the Plan is incomplete pursuant to Section 355.2(e)(2) of the GSP Regulations.

The Department based its incomplete determination on recommendations from the Staff Report, included as an enclosure to the attached Statement of Findings, which describes that the Subbasin's Plan does not satisfy the objectives of the Sustainable Groundwater Management Act (SGMA) nor substantially comply with the GSP Regulations. The Staff Report also provides corrective actions which the Department recommends the Subbasin's 11 groundwater sustainability agencies (GSAs) review while determining how and whether to address the deficiencies in a coordinated manner.

The Subbasin's GSAs have 180 days, the maximum allowed by the GSP Regulations, to address the identified deficiencies. Where addressing the deficiencies requires modification of the Plan, the GSAs must adopt those modifications into their respective GSPs and all applicable coordination agreement materials, or otherwise demonstrate that those modifications are part of the Plan before resubmitting it to the Department for evaluation no later than July 27, 2022. The Department understands that much work has occurred to advance sustainable groundwater management since the GSAs submitted their GSPs in January 2020. To the extent to which those efforts are related or responsive to the Department's identified deficiencies, we encourage you to document that as part of your Plan resubmittal. The Department prepared a Frequently Asked Questions document to provide general information and guidance on the process of addressing deficiencies in an incomplete determination.

Department staff will work expeditiously to review the revised components of your Plan resubmittal. If the revisions sufficiently address the identified deficiencies, the

Department will determine that the Plan is approved. In that scenario, Department staff will identify additional recommended corrective actions that the GSAs should address early in implementing their GSPs (i.e., no later than the first required periodic evaluation). Among other items, those corrective actions will recommend the GSAs provide more detail on their plans and schedules to address data gaps. Those recommendations will call for significantly expanded documentation of the plans and schedules to implement specific projects and management actions. Regardless of those recommended corrective actions, the Department expects the first periodic evaluations, required no later than January 2025 – one-quarter of the way through the 20-year implementation period – to document significant progress toward achieving sustainable groundwater management.

If the Subbasin's GSAs cannot address the deficiencies identified in this letter by July 27, 2022, then the Department, after consultation with the State Water Resources Control Board, will determine the GSP to be inadequate. In that scenario, the State Water Resources Control Board may identify additional deficiencies that the GSAs would need to address in the state intervention processes outlined in SGMA.

Please contact Sustainable Groundwater Management Office staff by emailing sgmps@water.ca.gov if you have any questions about the Department's assessment, implementation of your Plan, or to arrange a meeting with the Department.

Thank you,

Paul Gosselin
Deputy Director of Sustainable Groundwater Management

Attachment: 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

STATEMENT OF FINDINGS REGARDING THE DETERMINATION OF INCOMPLETE STATUS OF THE SAN JOAQUIN VALLEY – KERN COUNTY SUBBASIN GROUNDWATER SUSTAINABILITY PLANS

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA), is likely to achieve the sustainability goal for the basin covered by the GSP, and whether the GSP adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the GSP within two years of its submission. (Water Code § 10733.4.)

SGMA allows for multiple GSPs implemented by multiple groundwater sustainability agencies (GSAs) and coordinated pursuant to a single coordination agreement that covers the entire basin to be an acceptable planning scenario. (Water Code § 10727.) In the San Joaquin Valley – Kern County Subbasin (Subbasin), five separate GSPs were prepared by 11 GSAs pursuant to the required coordination agreement. This Statement of Findings explains the Department's decision regarding the multiple GSPs covering the Subbasin submitted jointly by the multiple GSAs. Collectively, the five GSPs and the coordination agreement are referred to as the Plan for the Subbasin. Individually, the GSPs include the following:

- *Kern Groundwater Authority Groundwater Sustainability Plan* (KGA GSP) – prepared by the Kern Groundwater Authority (KGA) GSA, Semitropic Water Storage District (SWSD) GSA, Cawelo Water District (CWD) GSA, City of McFarland GSA, Pioneer GSA, and West Kern Water District (WKWD) GSA.
    - *Divided into 15 management areas, 22 sub-management areas.*

- *Kern River Groundwater Sustainability Plan* (Kern River GSP) – prepared by the Kern River GS and Greenfield County Water District GSA.
    - *Divided into three management areas, 11 sub-management areas.*

- *Buena Vista Water Storage District GSA Groundwater Sustainability Plan* (BV GSP) – prepared by the Buena Vista Water Storage District (BV) GSA.
    - *Divided into two management areas.*

- *Olcese Groundwater Sustainability Agency Groundwater Sustainability Plan* (Olcese GSP) – prepared by the Olcese Water District (OWD) GSA.

- *Henry Miller Water District Groundwater Sustainability Plan* (Henry Miller GSP) – prepared by the Henry Miller Water District (HMWD) GSA.

Department management has reviewed the enclosed Staff Report, which recommends that the deficiencies identified should preclude approval of the Plan. Based on its review of the Staff Report, Department management is satisfied that staff have conducted a thorough evaluation and assessment of the Plan and concurs with, and hereby adopts, staff's recommendation and all the corrective actions provided. The Department thus deems the Plan incomplete based on the Staff Report and the findings contained herein.

A. The GSPs do not establish undesirable results that are consistent for the entire Subbasin.

    1. While the Coordination Agreement presents Subbasin-wide undesirable results, the Subbasin's fragmented approach towards establishing management criteria that define undesirable conditions in various parts of the Subbasin does not satisfy SGMA's requirement to use same data and methodologies.

B. The Subbasin's chronic lowering of groundwater levels sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

    1. The GSPs relied on disparate methods to develop groundwater level minimum thresholds across the numerous GSPs and management areas.

    2. The GSPs do not consistently and sufficiently document the effects of their selected minimum thresholds on beneficial uses and users in the Subbasin, nor explain how the minimum thresholds and measurable objectives that are set below historical lows will impact other applicable sustainability indicators, specifically water quality, land subsidence, and reduction of groundwater storage.

C. The Subbasin's land subsidence sustainable management criteria do not satisfy the requirements of SGMA and the GSP Regulations.

    1. The Plan lacks a Subbasin-wide, coordinated approach to establishing land subsidence sustainable management criteria.

    2. The GSPs and management areas that use their minimum thresholds for the chronic lowering of groundwater levels as proxy criteria for subsidence do not sufficiently demonstrate that groundwater levels (specifically groundwater levels below historical lows) are a reasonable proxy to avoid land subsidence that would substantially interfere with surface land uses.

Based on the above, the Plan submitted by the GSAs in the San Joaquin Valley – Kern County Subbasin is determined to be incomplete because the Plan does not satisfy the requirements of SGMA, nor does it substantially comply with the GSP Regulations. The corrective actions provided in the enclosed Staff Report are intended to address the deficiencies that, at this time, preclude the Plan's approval. The GSAs have up to 180 days to address the deficiencies outlined above and detailed in the Staff Report. Once the GSAs resubmit their respective GSPs and the required coordination agreement, the Department will review the revised Plan to evaluate whether the deficiencies were sufficiently addressed. Should the GSAs fail to take sufficient actions to correct the deficiencies identified by the Department, the Department shall disapprove the Plan if, after consultation with the State Water Resources Control Board, the Department determines the Plan to be inadequate pursuant to 23 CCR § 355.2(e)(3)(C).

Signed:

Karla Nemeth, Director
Date: January 28, 2022

Enclosure: Groundwater Sustainability Plan Assessment Staff Report – San Joaquin Valley – Kern County Subbasin

State of California
Department of Water Resources
Sustainable Groundwater Management Office
Groundwater Sustainability Plan Assessment Staff Report

Groundwater Basin Name:	San Joaquin Valley Basin – Kern County Subbasin (No. 5-022.14)
Number of GSPs:	5 (see list below)
Number of GSAs:	11 (see list below)
Point of Contact:	Patricia Poire, Kern Groundwater Authority
Recommendation:	Incomplete
Date:	January 28, 2022

The Sustainable Groundwater Management Act (SGMA)[1] allows for any of the three following planning scenarios: a single groundwater sustainability plan (GSP) developed and implemented by a single groundwater sustainability agency (GSA); a single GSP developed and implemented by multiple GSAs; and multiple GSPs implemented by multiple GSAs and coordinated pursuant to a single coordination agreement.[2] GSAs developing GSPs are expected to comply with SGMA and substantially comply with the Department of Water Resources' (Department) GSP Regulations.[3] The Department is required to evaluate an adopted GSP within two years of its submittal date and issue a written assessment.[4]

In the Kern County Subbasin (Subbasin), multiple GSAs developed multiple GSPs for the entire Subbasin, which are coordinated pursuant to a required coordination agreement.[5] In total, five GSPs were prepared and will be implemented by 11 GSAs. The GSPs include 20 management areas and possibly 33 sub-management areas within the larger management areas.[6] The five GSPs include:

- *Kern Groundwater Authority Groundwater Sustainability Plan* (KGA GSP) – prepared by the Kern Groundwater Authority (KGA) GSA, Semitropic Water Storage District (SWSD) GSA, Cawelo Water District (CWD) GSA, City of McFarland GSA, Pioneer GSA, and West Kern Water District (WKWD) GSA.
    - Divided into 15 management areas, 22 sub-management areas.

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[1] Water Code § 10720 *et seq*.
[2] Water Code § 10727.
[3] 23 CCR § 350 *et seq*.
[4] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[5] Water Code § 10733.4(b).
[6] A Total number of management areas and sub-management areas is not explicitly disclosed for the Plan; Department staff compiled these numbers from the review of all the GSPs.

- *Kern River Groundwater Sustainability Plan* (Kern River GSP) – prepared by the Kern River GS and Greenfield County Water District GSA.
  - Divided into three management areas, 11 sub-management areas.
- *Buena Vista Water Storage District GSA Groundwater Sustainability Plan* (Buena Vista GSP) – prepared by the Buena Vista Water Storage District (Buena Vista) GSA.
  - Divided into two management areas.
- *Olcese Groundwater Sustainability Agency Groundwater Sustainability Plan* (Olcese GSP) – prepared by the Olcese Water District (OWD) GSA.
- *Henry Miller Water District Groundwater Sustainability Plan* (Henry Miller GSP) – prepared by the Henry Miller Water District (HMWD) GSA.

Collectively, the five GSPs and the coordination agreement will, for evaluation and assessment purposes, be treated and referred to as the Plan for the Subbasin.

Of the five GSPs, the Kern Groundwater Authority (KGA) GSP is by far the largest in terms of both area covered and agencies involved. The KGA is made up of 16 member agencies legally bound by a joint powers agreement (JPA) which recognizes KGA as "assuming responsibility for development of a comprehensive GSP for an area which includes agricultural lands, urban and industrial development as well as oil fields."[7] Of the 16 KGA member agencies, six agencies are GSAs through the process outlined in SGMA.[8] It is, therefore, Department staff's understanding that KGA acts as the sole GSA for 10 member agencies and acts as the GSA for the purposes of developing a GSP for the remaining six member agencies that are also established GSAs. It is also Department staff's understanding that, through the JPA, the KGA GSA operates as a facilitation and administrative entity only, leaving the authorities of SGMA implementation to the individual member agencies, some of which, as noted above, are GSAs and some of which are not.[9] The KGA GSP defined 15 management areas, each with its own management area plan (MAP); seven of those management areas are divided further into additional management areas, creating sub-management areas within the KGA GSA boundary.[10] Thus, the KGA GSP acts as an "umbrella plan" for the management area plans prepared by individual member agencies engaged in the JPA.

Table 1 summarizes the GSAs and agencies associated with management areas for the Subbasin.

[7] KGA GSP, Section 1.1, p. 21; Appendix A, pp. 263-299.
[8] Water Code § 10723 *et seq.*
[9] KGA GSP, p. 31-32; KGA GSP, p. 266, 269-270, 278.
[10] KGA GSP, p. 183-184.

Table 1. Summary of Kern County Subbasin GSPs, GSAs, and Management Areas

GSP/GSAs	Management Areas (# of Sub-Management Areas)
Kern Groundwater Authority GSP	
1. Cawelo GSA 2. Kern Groundwater Authority GSA 3. McFarland GSA 4. Pioneer GSA 5. Semitropic Water Storage District (WSD) GSA 6. West Kern Water District (WD) GSA	1. Arvin-Edison WSD 2. Cawelo WD 3. Eastside Water Management Area 4. Kern Water Bank 5. Kern-Tulare WD (2) 6. North Kern WSD & Shafter-Wasco Irrigation District (3) 7. Kern County Water Agency – Pioneer 8. Rosedale-Rio Bravo WSD (2/5)* 9. Semitropic WSD (3) 10. Shafter-Wasco Irrigation District – 7th Standard Rd. 11. Southern San Joaquin Municipal Utility District (2) 12. Tejon WD (2) 13. West Kern WD (4/5)** 14. Westside District Authority 15. Wheeler Ridge-Maricopa WSD
Kern River GSP	
1. Greenfield County WD GSA 2. Kern River GSA	1. Agricultural (5) 2. Banking (3) 3. Urban (3)
Buena Vista GSP	
1. Buena Vista WSD GSA	1. Buttonwillow 2. Maples⁺
Henry Miller GSP	
1. Henry Miller WD GSA	N/A
Olcese GSP	
1. Olcese GSA	N/A

* Rosedale-Rio Bravo WSD identifies four separate "Monitoring Zones" with sustainable management criteria. There are no sustainable management criteria associated with the areas identified as management areas.

** West Kern WD MA-5 is not included in the KGA Umbrella Plan but is included in the West Kern WD management area plan.

Department staff have thoroughly evaluated the Plan, the Subbasin's coordination agreement, and other information provided or available and known to staff and have identified deficiencies in the Plan that staff recommends should preclude its approval.[11] In addition, consistent with the GSP Regulations, Department staff have provided corrective actions that the GSAs should review while determining how and whether to

[11] 23 CCR §355.2(e)(2).

address the deficiencies in a coordinated manner.[12] The deficiencies and corrective actions are explained in greater detail in Section 3 of this staff report and are generally related to the need to further coordinate amongst the GSAs and to define sustainable management criteria in the manner that is consistent with SGMA and the GSP Regulations.

This assessment includes four sections:

- **Section 1 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 2 – Required Conditions:** Describes the submission requirements, Plan completeness, and basin coverage required for a Plan to be evaluated by the Department.
- **Section 3 – Plan Evaluation:** Provides a detailed assessment of identified deficiencies in the Plan. Consistent with the GSP Regulations, Department staff have provided corrective actions for the GSAs to address the deficiencies.
- **Section 4 – Staff Recommendation:** Provides staff's recommendation regarding the Department's determination.

[12] 23 CCR §355.2(e)(2)(B).

1 EVALUATION CRITERIA

The Department evaluates whether a Plan conforms to certain statutory requirements of SGMA[13] and is likely to achieve the basin's sustainability goal.[14] To achieve the sustainability goal, the Plan must demonstrate that implementation will lead to sustainable groundwater management, which means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.[15] Undesirable results are required to be defined quantitatively by the GSAs overlying a basin and occur when significant and unreasonable effects for any of the applicable sustainability indicators are caused by groundwater conditions occurring throughout the basin.[16] The Department is also required to evaluate whether the Plan will adversely affect the ability of an adjacent basin to implement its groundwater sustainability program or achieve its sustainability goal.[17]

For a Plan to be evaluated by the Department, it must first be determined that it was submitted by the statutory deadline[18] and that it is complete and covers the entire basin.[19] Additionally, for those GSAs choosing to develop multiple GSPs, the Plan submission must include a coordination agreement.[20] The coordination agreement must explain how the multiple GSPs in the basin have been developed and implemented utilizing the same data and methodologies and that the elements of the multiple GSPs are based upon consistent interpretations of the basin's setting. If these required conditions are satisfied, the Department evaluates the Plan to determine whether it complies with SGMA and substantially complies with the GSP Regulations.[21] As stated in the GSP Regulations, "[s]ubstantial compliance means that the supporting information is sufficiently detailed and the analyses sufficiently thorough and reasonable, in the judgment of the Department, to evaluate the Plan, and the Department determines that any discrepancy would not materially affect the ability of the Agency to achieve the sustainability goal for the basin, or the ability of the Department to evaluate the likelihood of the Plan to attain that goal."[22]

When evaluating whether the Plan is likely to achieve the sustainability goal for the basin, Department staff review the information provided for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.[23] The Department's review considers whether there is a reasonable relationship between the

[13] Water Code §§ 10727.2, 10727.4, 10727.6.
[14] Water Code § 10733(a).
[15] Water Code § 10721(v).
[16] 23 CCR § 354.26.
[17] Water Code § 10733(c).
[18] 23 CCR § 355.4(a)(1).
[19] 23 CCR §§ 355.4(a)(2), 355.4(a)(3).
[20] 23 CCR § 357.4.
[21] 23 CCR § 350 *et seq*.
[22] 23 CCR § 355.4(b).
[23] 23 CCR § 351(h).

information provided by the GSAs and the assumptions and conclusions presented in the Plan, including whether the interests of the beneficial uses and users of groundwater in the basin have been considered; whether sustainable management criteria and projects and management actions described in the Plan are commensurate with the level of understanding of the basin setting; and whether those projects and management actions are feasible and likely to prevent undesirable results.[24] The Department also considers whether the GSAs have the legal authority and financial resources necessary to implement the Plan.[25]

To the extent overdraft is present in a basin, the Department evaluates whether the Plan provides a reasonable assessment of the overdraft and includes reasonable means to mitigate it.[26] When applicable, the Department will assess whether coordination agreements have been adopted by all relevant parties and satisfy the requirements of SGMA and the GSP Regulations.[27] The Department also considers whether the Plan provides reasonable measures and schedules to eliminate identified data gaps.[28] Lastly, the Department's review considers the comments submitted on the Plan and evaluates whether the GSAs have adequately responded to the comments that raise credible technical or policy issues with the Plan.[29]

The Department is required to evaluate the Plan within two years of its submittal date and issue a written assessment.[30] The assessment is required to include a determination of the Plan's status.[31] The GSP Regulations provide three options for determining the status of a Plan: approved,[32] incomplete,[33] or inadequate.[34]

After review of the Plan, Department staff may conclude that the information provided is not sufficiently detailed, or the analyses not sufficiently thorough and reasonable, to evaluate whether it is likely to achieve the sustainability goal for the basin. If the Department determines the deficiencies precluding approval may be capable of being corrected by the GSAs in a timely manner,[35] the Department will determine the status of the Plan to be incomplete. A formerly deemed incomplete Plan may be resubmitted to the Department for reevaluation after all deficiencies have been addressed and incorporated into the Plan within 180 days after the Department makes its incomplete determination. The Department will review the revised Plan to evaluate whether the identified deficiencies were sufficiently addressed. Depending on the outcome of that evaluation,

[24] 23 CCR §§ 355.4(b)(1), (3), (4) and (5).
[25] 23 CCR § 355.4(b)(9).
[26] 23 CCR § 355.4(b)(6).
[27] 23 CCR § 355.4(b)(8).
[28] 23 CCR § 355.4(b)(2).
[29] 23 CCR § 355.4(b)(10).
[30] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[31] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[32] 23 CCR § 355.2(e)(1).
[33] 23 CCR § 355.2(e)(2).
[34] 23 CCR § 355.2(e)(3).
[35] 23 CCR § 355.2(e)(2)(B)(i).

the Department may determine the resubmitted Plan is approved. Alternatively, the Department may find a formerly deemed incomplete GSP is inadequate if, after consultation with the State Water Resources Control Board, it determines that the GSAs have not taken sufficient actions to correct any identified deficiencies.[36]

The staff assessment of the Plan involves the review of information presented by the GSAs, including models and assumptions, and an evaluation of that information based on scientific reasonableness. In conducting its assessment, the Department does not recalculate or reevaluate technical information provided in the Plan or perform its own geologic or engineering analysis of that information. The recommendation to approve a Plan does not signify that Department staff, were they to exercise the professional judgment required to develop a Plan for the basin, would make the same assumptions and interpretations as those contained in the Plan, but simply that Department staff have determined that the assumptions and interpretations relied upon by the submitting GSAs are supported by adequate, credible evidence, and are scientifically reasonable.

Lastly, the Department's review and assessment of an approved Plan is a continual process. Both SGMA and the GSP Regulations provide the Department with the ongoing authority and duty to review the implementation of the Plan.[37] Also, GSAs have an ongoing duty to reassess their GSPs, provide annual reports to the Department, and, when necessary, update or amend their GSPs.[38] The passage of time or new information may make what is reasonable and feasible at the time of this review to not be so in the future. The emphasis of the Department's periodic reviews will be to assess the GSA's progress toward achieving the basin's sustainability goal and whether implementation of the Plan adversely affects the ability of GSAs in adjacent basins to achieve their sustainability goals.

[36] 23 CCR § 355.2(e)(3)(C).
[37] Water Code § 10733.8; 23 CCR § 355.6 *et seq*.
[38] Water Code §§ 10728 *et seq.*, 10728.2.

2 Required Conditions

A GSP, to be evaluated by the Department, must be submitted within the applicable statutory deadline.[39] The GSP must also be complete and must, either on its own or in coordination with other GSPs, cover the entire basin.[40] Additionally, when multiple GSPs are developed in a basin, the submission of all GSPs must include a coordination agreement.[41] The coordination agreement must explain how the multiple GSPs in the basin have been developed and implemented utilizing the same data and methodologies and that the elements of the multiple GSPs are based upon consistent interpretations of the basin's setting. If a Plan is determined to be incomplete, Department staff may require corrective actions that address minor or potentially significant deficiencies identified in the Plan. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must sufficiently address those required corrective actions within the time provided, not to exceed 180 days, for the Plan to be reevaluated by the Department and potentially approved.

2.1 Submission Deadline

SGMA required basins categorized as high- or medium-priority as of January 1, 2017 and that were subject to critical conditions of overdraft to submit a GSP no later than January 31, 2020.[42]

The Point of Contact representing 11 GSAs submitted the Subbasin's Plan on January 30, 2020, in compliance with the statutory deadline. The Plan consists of five GSPs and the required coordination agreement.

2.2 Completeness

GSP Regulations specify that the Department shall evaluate a Plan if that Plan is complete and includes the information required by SGMA and the GSP Regulations.[43] For those basins choosing to submit multiple GSPs, a coordination agreement is required.

The 11 GSAs submitted five adopted GSPs that cover the Subbasin. Department staff found the GSPs, and the collective Plan, to be complete and include the required information, sufficient to warrant an evaluation by the Department. The Department posted the Subbasin's five GSPs and coordination agreement to its website on February 19, 2020.

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[39] Water Code § 10720.7.
[40] 23 CCR § 355.4(a)(3).
[41] Water Code § 10733.4(b); 23 CCR § 357.4.
[42] Water Code § 10720.7(a)(1).
[43] 23 CCR § 355.4(a)(2).