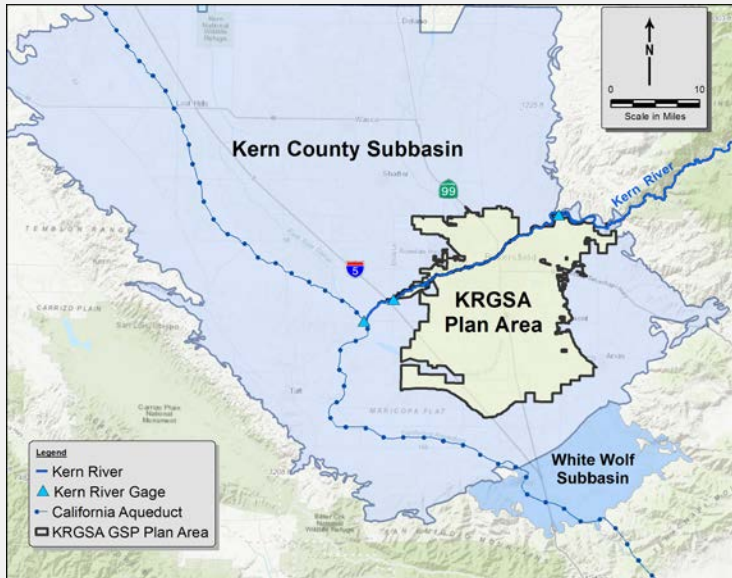




KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

# Groundwater Sustainability Plan (GSP)



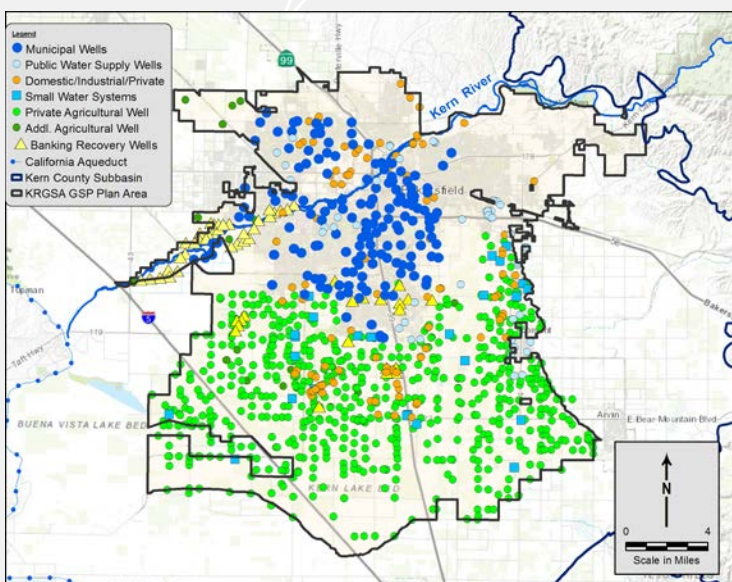
## Kern River Groundwater Sustainability Agency (KRGSA)

### Groundwater Sustainability Plan (GSP) Plan Area

The GSP Plan Area is located in the Kern County Subbasin, the largest groundwater basin in California. Covering about 2,834 square miles, the Subbasin extends from the Tehachapi/San Emigdio Mountains in the south to the northern Kern County line.

The KRGSA Plan Area covers 361 square miles, about 13 percent of the Subbasin. The area includes most of the Bakersfield city limits and extends from 7<sup>th</sup> Standard Road in the northwest to near Copus Road in the south. Both Highway 99 and I-5 cross the Plan Area. The area contains about 16 miles of the Kern River from the foothills on the northeast to the 2<sup>nd</sup> Point measuring station near I-5 in the southwest.

KRGSA member agencies include the City of Bakersfield (City), Kern County Water Agency – Improvement District No. 4 (ID4), Kern Delta Water District (KDWD), and other agencies. The City, ID4, and KDWD serve as the GSP Plan Managers.

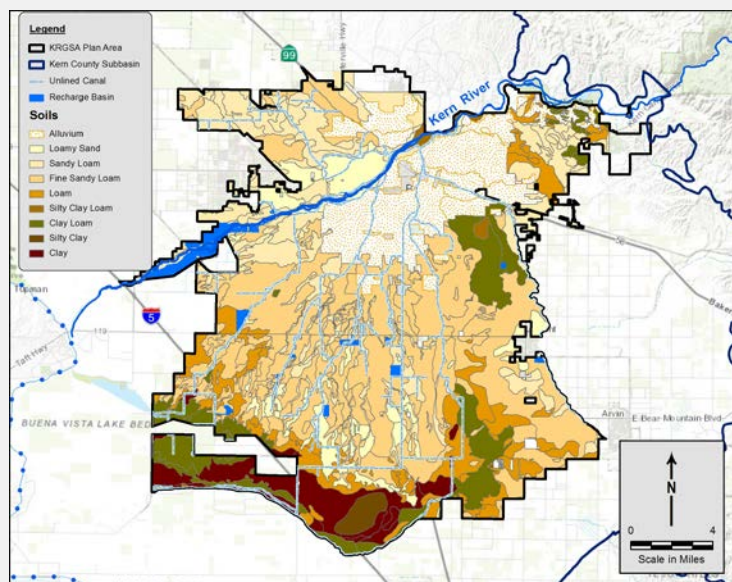


## Land Use and Groundwater Wells in KRGSA Plan Area

Most of the northern KRGSA Plan Area is urban with sparsely populated or undeveloped areas in the northeast. The primary land use in the southern KRGSA Plan Area is agriculture. The west-central Plan Area is dominated by recharge basins and groundwater banking projects, mostly along the Kern River. Land use in the Plan Area is approximated as follows:

- 41% Agricultural
- 33% Urban
- 26% Undeveloped

The KRGSA relies heavily on groundwater with more than 1,000 active wells (see map at left). Most northern wells are municipal (blue dots) and banking recovery wells (yellow triangles). Southern wells are mostly agricultural (green dots). Additional private and public wells are distributed throughout the Plan Area.

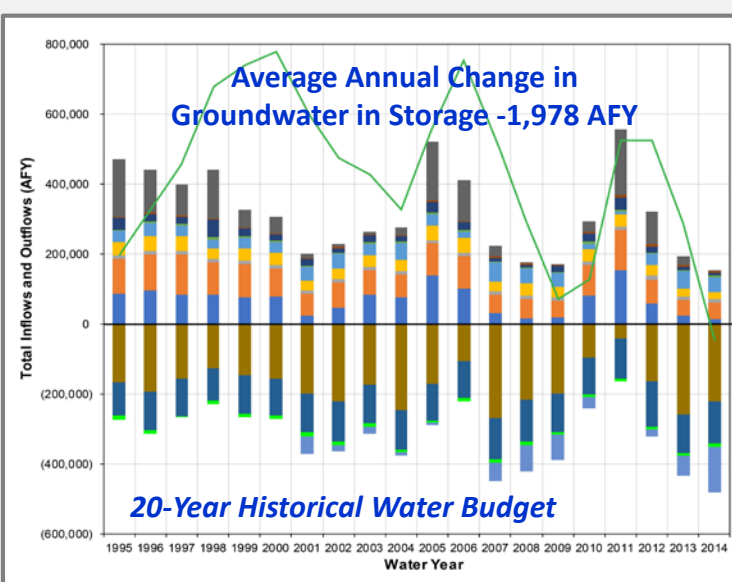


## Conjunctive Use and Managed Recharge

Three primary water sources support beneficial uses in the Plan Area.

- Imported Water – ID4 manages and treats water from the State Water Project (SWP) to provide drinking water to much of the northern Plan Area. KDWD manages SWP water for agricultural irrigation in the southern Plan Area.
- Kern River Water – The City manages the Kern River on behalf of the Kern River Watermaster to provide drinking water, agricultural irrigation, and other uses.
- Groundwater – Public and private wells supplement surface water supplies.

These three sources are managed conjunctively in the KRGSA to optimize water supply. Both imported water and Kern River water are also recharged for replenishment and/or recovery in recharge basins, the river channel and along unlined canals. Areas of managed and natural recharge are indicated on the map.



## Basin Setting

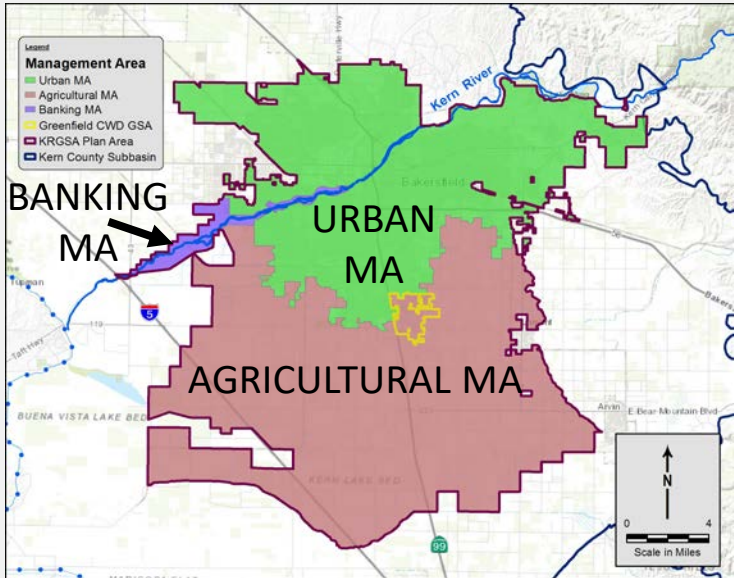
The GSP evaluates the Basin Setting of the Plan Area and addresses the following topics:

- **Hydrogeologic Conceptual Model** - describes the physical conditions of the groundwater basin including geology, topography, soils, hydrology, basin geometry and the aquifers and aquitards that control groundwater recharge, storage, and movement.
- **Groundwater Conditions** – evaluates groundwater occurrence and flow, groundwater levels and quality, inelastic land subsidence due to groundwater withdrawal, and interconnected surface water, if any.
- **Water Budgets** - provide an accounting of inflows and outflows of the groundwater system including an analysis of historical, current, and projected future conditions. Annual Change of Groundwater in Storage from the historical water budget is shown at left, indicating minimal depletion over 20 years.



KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

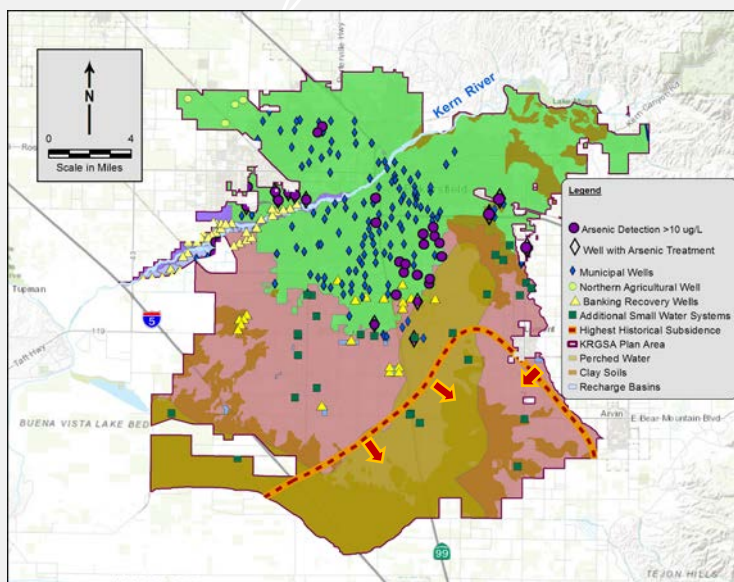
# Groundwater Sustainability Plan (GSP)



**Management Areas (MA) and Sustainability Indicators**

Three Management Areas (MAs) have been delineated to accommodate different sustainable management criteria, to facilitate management actions, and to align management responsibilities with agency jurisdictional boundaries. The GSP evaluates the six sustainability Indicators, listed below, for each MA. *Undesirable results* are defined as any sustainability indicator determined by the KRGSA to be significant and unreasonable.

	<b>Chronic Lowering of Water Levels</b>		<b>Inelastic Land Subsidence</b>
	<b>Reduction of Groundwater in Storage</b>		<b>Interconnected Surface Water (not identified in KRGSA)</b>
	<b>Degraded Water Quality</b>		<b>Seawater Intrusion (Not applicable to KRGSA)</b>



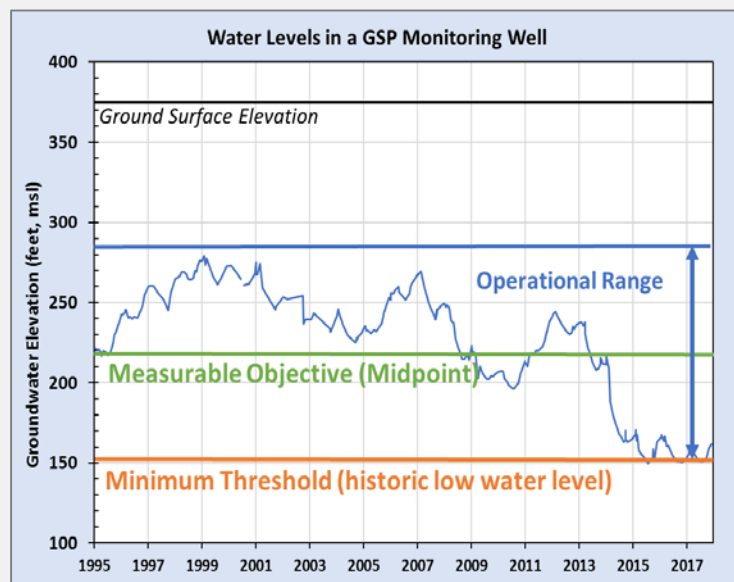
**KRGSA GSP Sustainability Considerations**

During the recent drought, water levels fell below the top of screens in more than 40 municipal wells (blue diamonds on map), creating significant expenditures for well modifications. If water levels decline further, more wells are at risk. This need for higher water levels in the Urban MA is balanced with the need for banking recovery wells and irrigation wells to lower water levels during drought in the Banking and Agricultural MAs.

Projected water budgets identified future deficits in SWP and increasing demands. Projects were developed to meet projected overdraft.

Arsenic concentrations increased in municipal wells during historic low water levels (purple dots). Although wellhead treatment managed the issue during the drought, numerous wells remain at risk if water levels decline further.

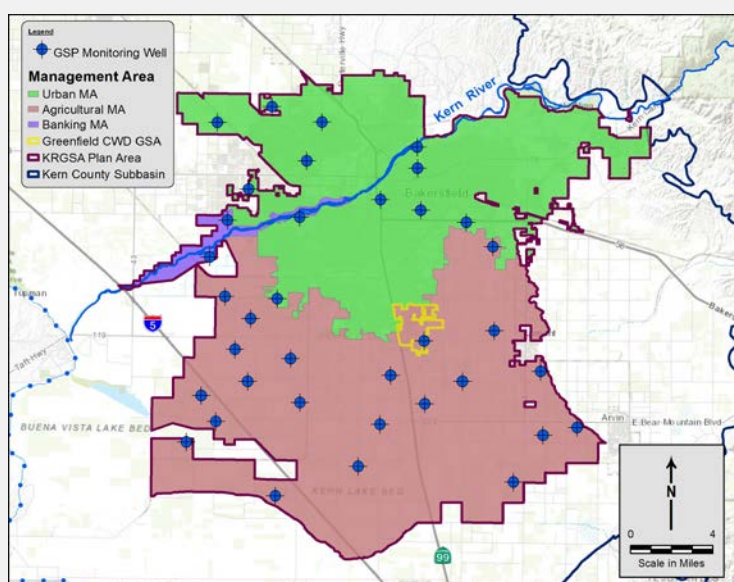
Historical land subsidence occurred in the southern Plan Area. Although no infrastructure damage has been identified, subsidence remains a concern.



**KRGSA GSP Minimum Thresholds (MTs) and Measurable Objectives (MOs)**

Based on the sustainability considerations above, undesirable results were determined to have occurred at the historic low water levels for the Water Level and Water Quality indicators for most of the Urban MA. Accordingly, minimum thresholds (MTs) are set at historic low water levels. MTs are lower in the agricultural MA and Banking MA where well screens and arsenic are of lesser concerns. This allows operational flexibility for banking and irrigation wells, especially during drought. Water levels are also maintained relatively high in areas of historical subsidence.

Measurable Objectives (MOs) are selected as the midpoint between the MT and the historical water level high to set a reasonable operational range for water levels beneath the KRGSA Plan Area. These designations allow for all sustainability indicators to be monitored by water levels only, providing a relatively simple construct to facilitate GSP monitoring and sustainable management.



**KRGSA GSP Monitoring Network**

Approximately 36 monitoring wells have been selected for the KRGSA GSP monitoring network. Wells were included based on long water level records and ease of use. Additional wells are being evaluated for possible inclusion in the program. Monitoring objectives are listed as follows:

- Demonstrate progress toward achieving MOs.
- Monitor impacts to the beneficial uses or users of groundwater.
- Monitor changes in groundwater conditions relative to MOs and MTs.
- Quantify annual changes in water budget components.
- Document performance of GSP projects and management actions.
- Ensure that management actions do not cause undesirable results.
- Demonstrate ability to achieve the KRGSA Sustainability Goal (see next page)

This monitoring program is supplemented by data from other monitoring programs in the Plan Area.



KERN RIVER GROUNDWATER SUSTAINABILITY AGENCY

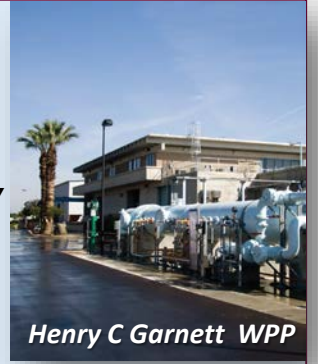
# Groundwater Sustainability Plan (GSP)

## KRGSA Sustainability Goal:

Manage groundwater resources sustainably in the KRGSA Plan Area to:

- support current and future beneficial uses of groundwater including municipal, agricultural, industrial, domestic, public supply, and environmental uses
- optimize conjunctive use of surface water and groundwater
- avoid or eliminate undesirable results over the implementation and planning horizon.

**Imported water is critical to sustainability in the Plan Area**



Henry C Garnett WPP

## Summary of Undesirable Results and Minimum Thresholds for each Management Area

KRGSA Management Area (MA)	MA Subarea and Considerations for Management		Undesirable Results for Controlling Sustainability Indicators			
			Controlling Indicator	Minimum Threshold (MT)	Percent of Wells <MT	Duration of MT Exceedance
KRGSA Urban MA	Central/South/Northeast	Municipal wellfields	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months
	Northwest corner	Transition to agricultural lands	Water Levels	20' below Historic Low WL	Any well	>3 Consecutive Months
KRGSA Agricultural MA	Along southern Urban MA	Transition with municipal wells	Water Levels/Quality	Historic Low WL	40% in Urban MA	>2 Consecutive Years
	North-Central	Greenfield CWD wells	Water Levels/Quality	Historic Low WL	Greenfield CWD MW	>2 Consecutive Years
	Northwest	Agricultural and recovery wells	Water Levels	50' below Historic Low WL	40% in Agricultural MA	>2 Consecutive Years
	South and East	Subsidence potential	Subsidence	20' below Historic Low WL	40% in Agricultural MA	>2 Consecutive Years
KRGSA Banking MA	Kern River Channel	ID4/KCWA recovery activities	Water Levels/Quality	20' below Historic Low WL	Any well	>3 Consecutive Months
	Berrenda Mesa	KCWA operational area	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months
	COB 2800 Facility	City of Bakersfield municipal wells	Water Levels/Quality	Historic Low WL	Any well	>3 Consecutive Months

Historic low water level (WL) is the lowest level observed in an area during the recent drought of 2013-2016.

### GSP PROJECT – KDWD Water Allocation Plan

- Optimizes Kern River recharge in the southern Plan Area
- Reduces groundwater pumping
- Allows local maintenance of water levels
- SEIR completed 2018 – implementation initiated



### GSP PROJECT – North Weedpatch Consolidation

- Consolidates up to 6 small water systems with East Niles CSD to address water quality concerns
- Provides for TCP and arsenic treatment to improve drinking water for disadvantaged communities

### GSP PROJECT – City of Bakersfield Optimized Conjunctive Use

- Prioritizes use of City's available Kern River water
- Water availability increases over the implementation and planning horizon
- Allows municipal pumping to be reduced to avoid undesirable results
- Meets future projected water budget deficits for decreases in imported water and increases in urban demand



### Additional GSP Projects and Management Actions

- 5-Step Action Plan if Minimum Thresholds are exceeded
- Implement a Well Metering Program
- Implement a Groundwater Extraction Reporting Program
- Conserve recycled water in the KRGSA Plan Area
- Support Delta Conveyance to preserve imported supplies
- Incorporate Climate Change Adaptation Strategies
- Improve the GSP Monitoring Program
- Coordinate water quality analysis with existing programs
- Track urbanization of agricultural lands
- Consider water exchanges for water quality improvement

