



**Kern River Groundwater
Sustainability Agency (KRGSA)**

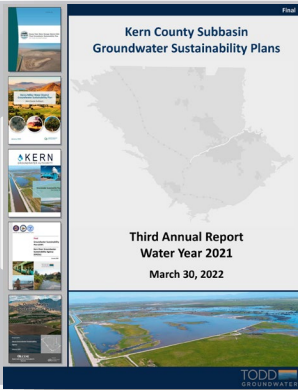
KERN COUNTY SUBBASIN AND KRGSA GSP ANNUAL REPORT - WATER YEAR 2021

KRGSA BOARD MEETING

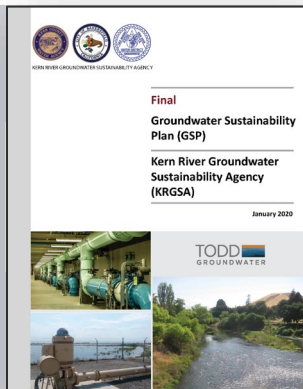
MAY 5, 2022

TODD 
GROUNDWATER

PRESENTATION OUTLINE



Kern County Subbasin 3rd Annual Report WY 2021
Coordinates all GSPs to cover entire Subbasin



KRGSA GSP Implementation Annual Report WY 2021
KRGSA Plan Area activities required by GSP

Kern County Subbasin Groundwater Sustainability Plans



Third Annual Report Water Year 2021

March 30, 2022

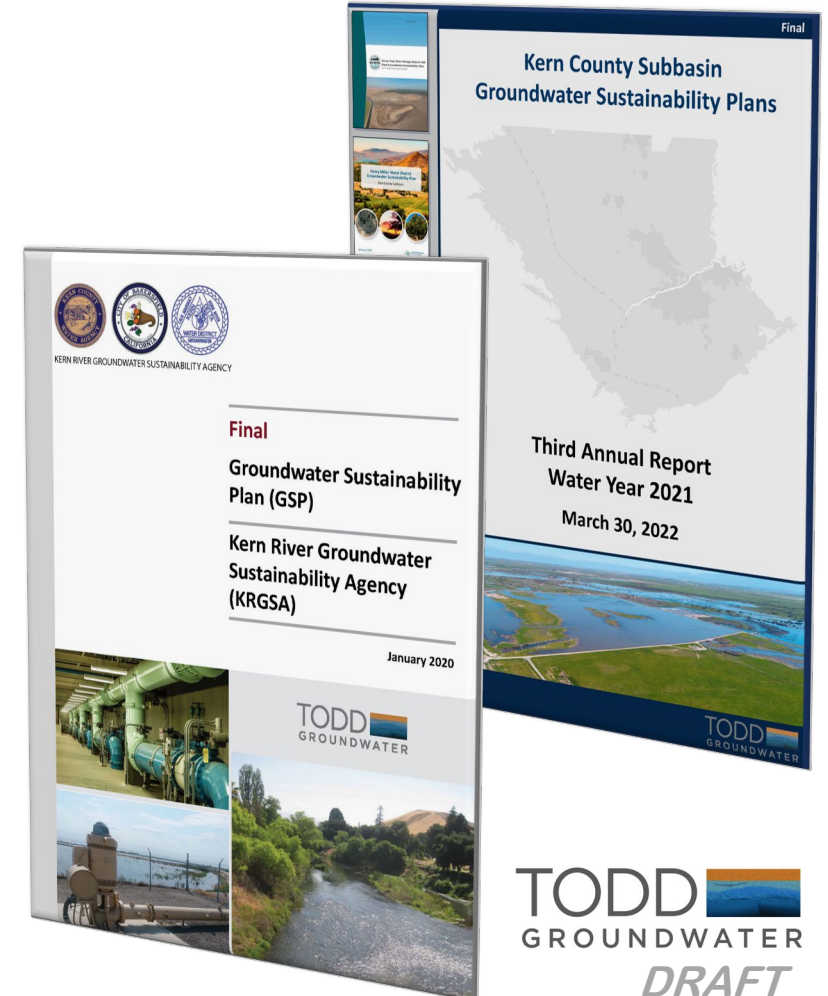


3rd GSP ANNUAL REPORT

- All GSAs in the Kern County Subbasin – including the KRGSA – coordinated on preparation of the 3rd GSP Annual Report
- Submitted to DWR April 1, 2022
- Includes a summary of KRGSA implementation activities

SUBBASIN-WIDE ANNUAL REPORT AND ADDITIONAL KRGSA GSP ACTIVITIES

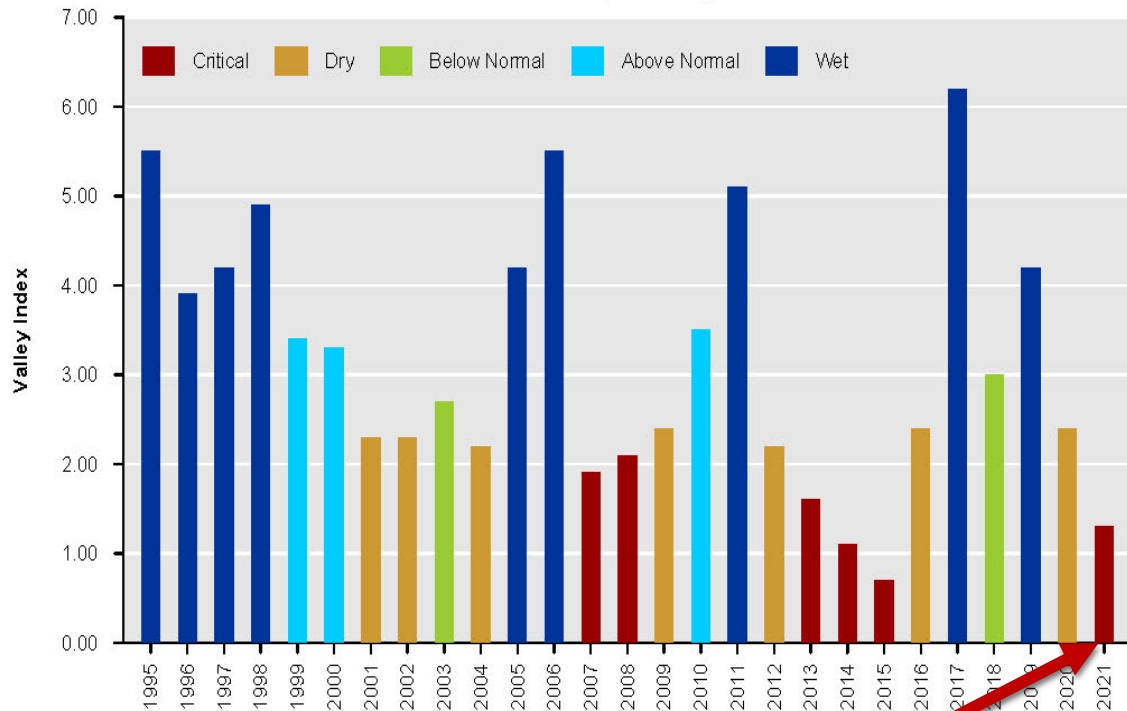
- Kern County Subbasin 3rd Annual Report WY 2021
 - Support Subbasin analysis with KRGSA data
 - Numerical model update
 - Water level mapping and hydrographs
 - Summarized KRGSA monitoring data and progress report
- KRGSA GSP Implementation Activities WY 2021
 - Water Level monitoring program
 - Subsidence monitoring program
 - Water Quality Management Action
 - Groundwater Budget for the KRGSA



HYDROLOGIC INDICES FOR WATER YEAR TYPE

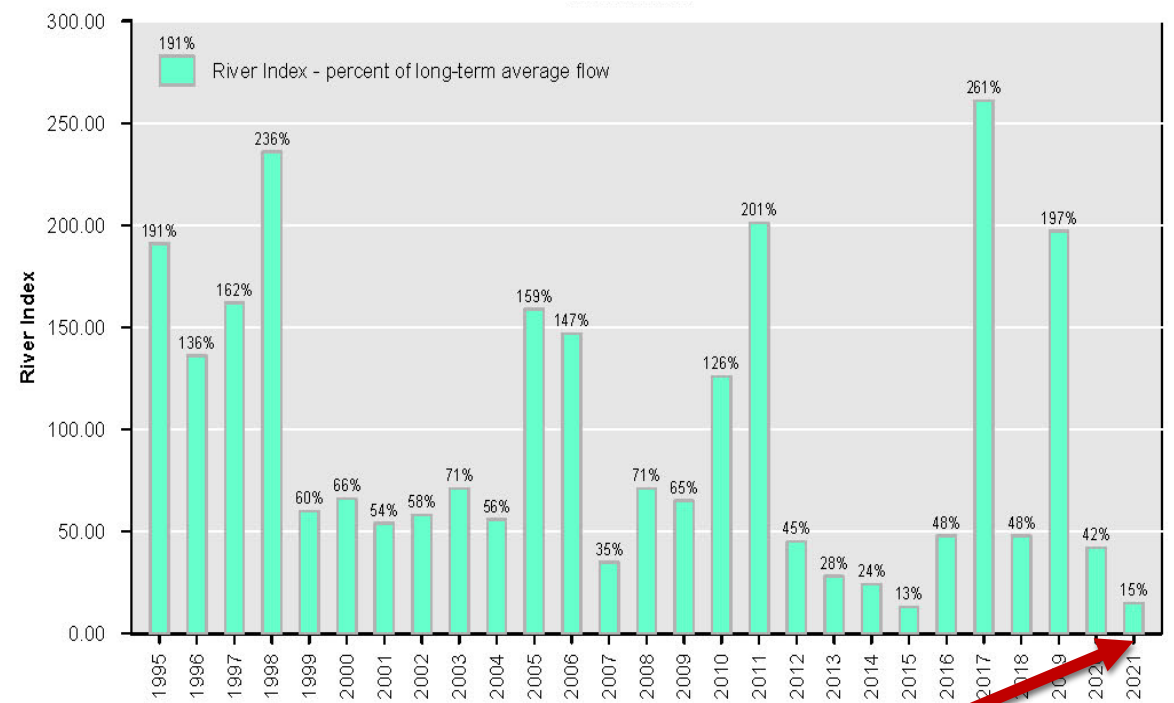
WY 2021 CRITICALLY DRY CONDITIONS

San Joaquin Valley Water Year Type



WY 2021 – Critically dry

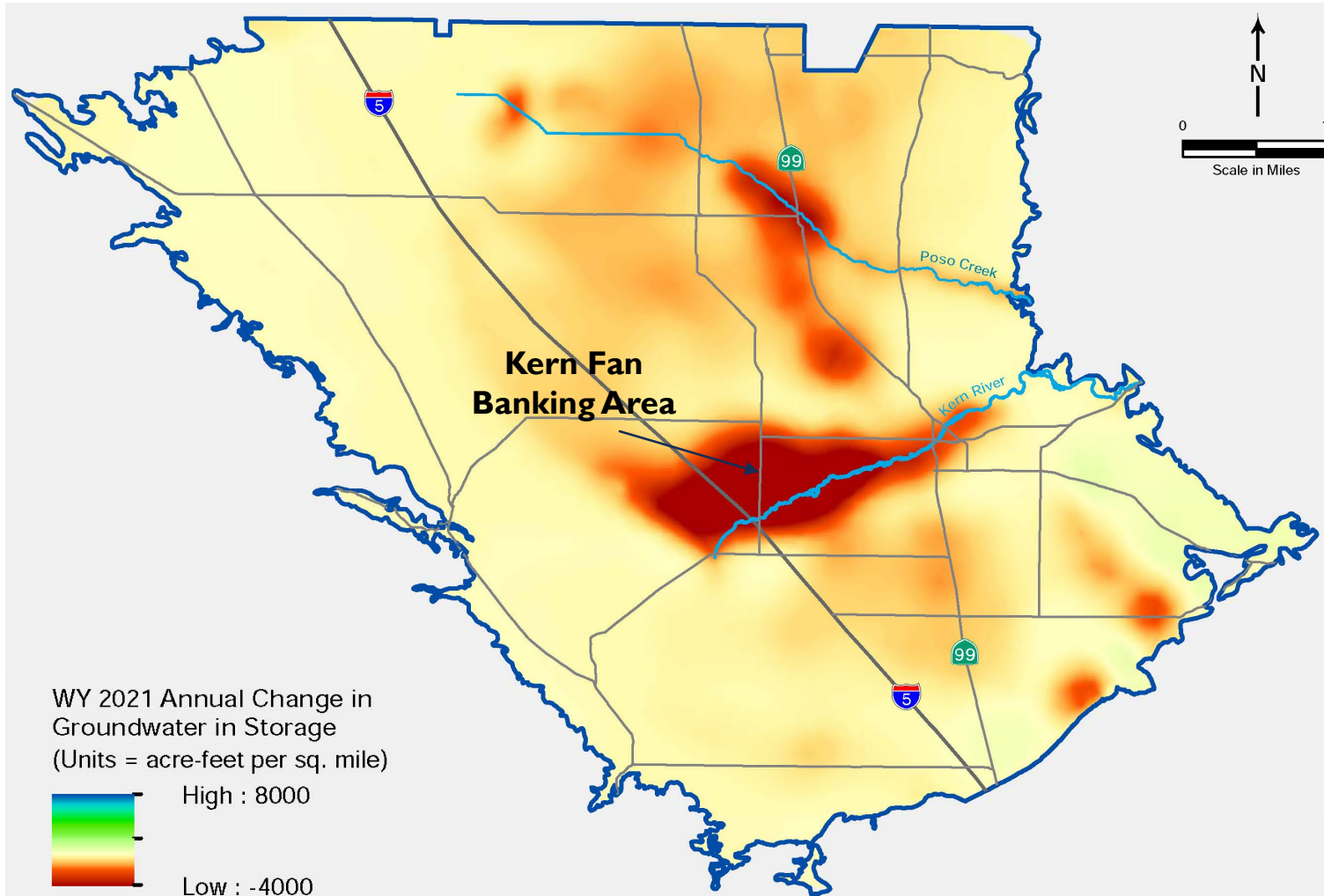
Kern River Index (Runoff April-July and Annual)



WY 2021 – Kern River 15%
of long-term average flow

WY 2021 ANNUAL REPORT

CHANGE in GROUNDWATER in STORAGE



- Drought conditions resulted in Subbasin-wide water level declines
- Decline of Groundwater in Storage for WY 2021: **-1,812,211 AF**
- Largest declines in areas of concentrated recovery pumping associated with water banking

DWR WATER USE TABLES, WY 2021

DATA UPLOADED TO SGMA PORTAL WEBSITE

- DWR provides templates for compiling surface water and groundwater volumes used in the Subbasin by water source and water use sector
- About 3.3 MAF used in the Subbasin in WY 2021
- Groundwater makes up about 75% of the supply in the critically dry WY 2021
- Decreased surface water supplies in WY 2021:
 - 57% of the available surface water supply in WY 2020
 - 30% of the available surface water supply in WY 2019
- Agriculture is the largest water user (about 75%)
- Other Water Use Type includes recovery pumping for the Managed Aquifer Recharge projects (e.g., banking)
- *Important SGMA strategy: maximize surface water use in the KRGSA!*

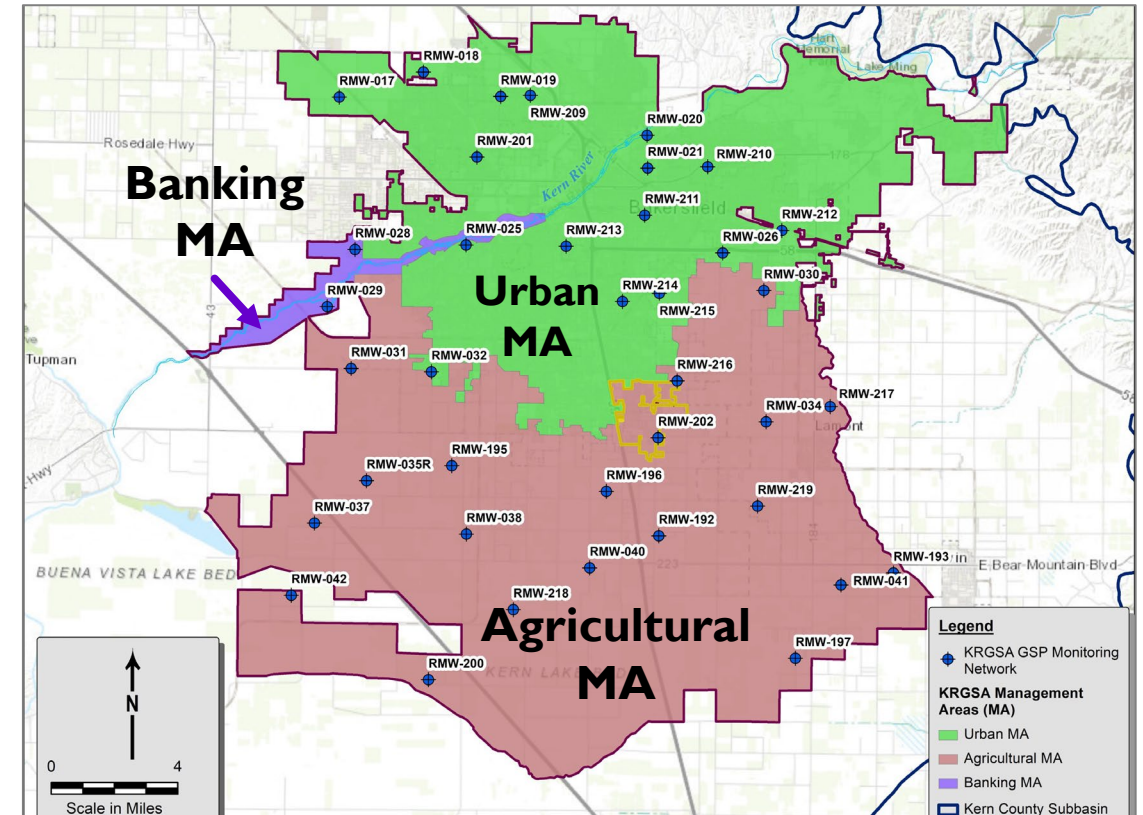
Total Water Supply by Water Source	
Water Source	Acre-ft
Groundwater	2,471,156
Surface Water	774,033
Recycled Water	51,926
Reused Water	121
Other Water Source Type	0
Total Water Supply	3,297,235

Total Water Supply by Water Use	
Water Use Sector	Acre-ft
Urban	215,870
Agricultural	2,467,092
Managed Wetland	18,036
Managed Recharge	74,887
Native Vegetation	0
Other Water Use Type	491,137
Total Water Use	3,267,023

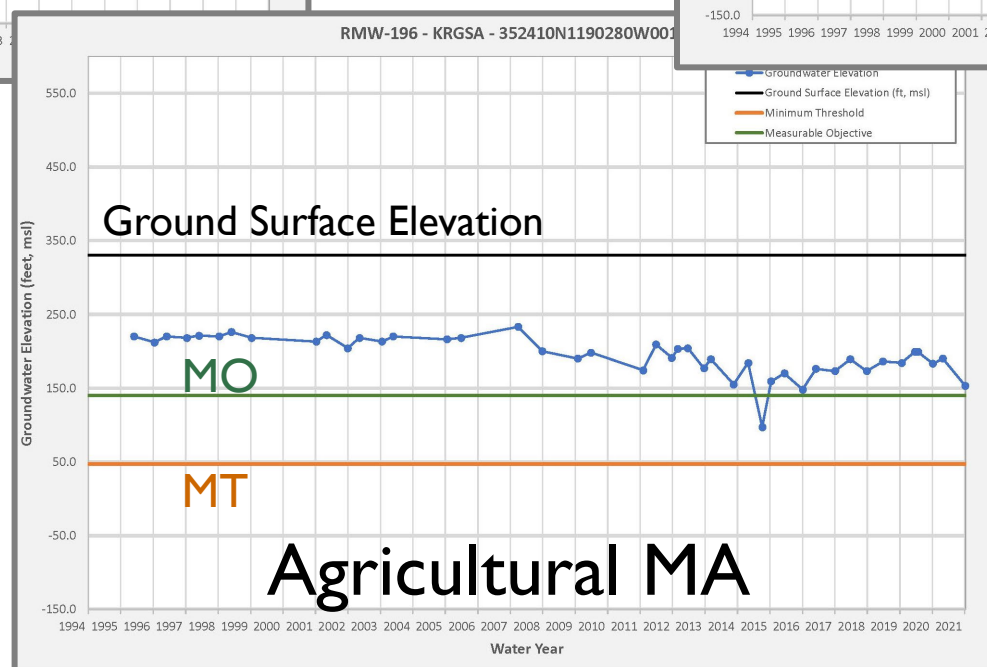
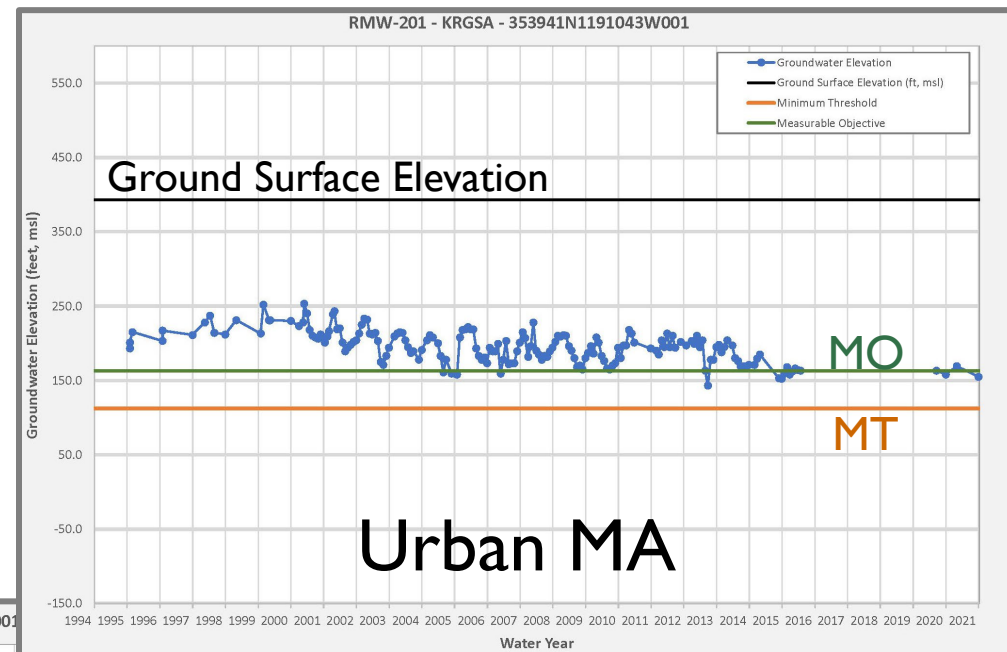
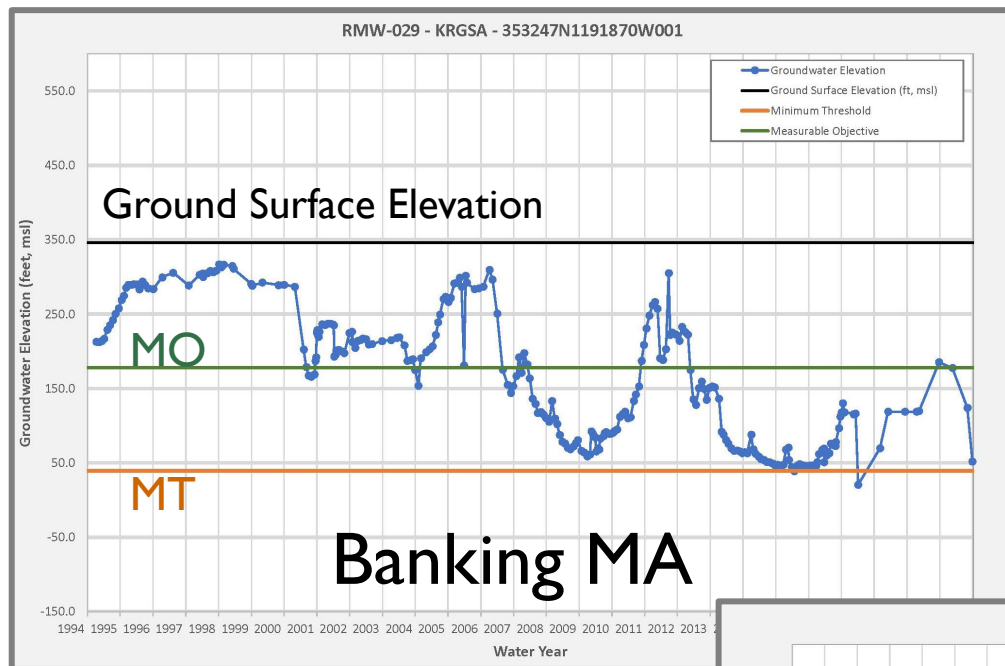
Totals do not match exactly due to different methods used to compile data; error <1%.

KRGSA GSP WATER LEVEL MONITORING NETWORK

- 3 Management Areas (MAs) based on primary land and water use
- 38 wells - GSP Monitoring Network
- Developed minimum thresholds (MTs) and measurable objectives (MOs) for each well to track sustainable management
- Report semi-annual water level data to the DWR online SGMA portal (coordinated by the Subbasin Plan Manager)



38 wells in 3 Management Areas
Urban (15-green), Banking (3-purple),
Agricultural (20-red)



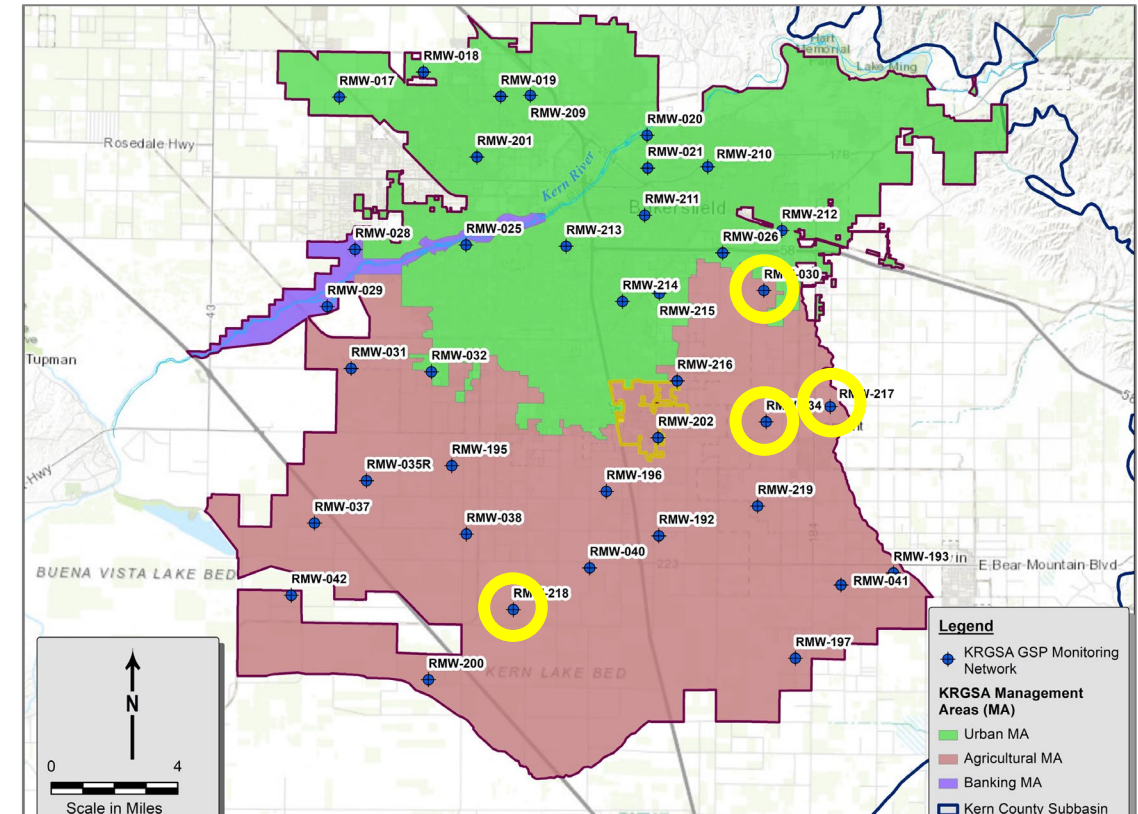
MO – Measurable Objective
MT – Minimum Threshold

*Examples for meeting
sustainable
management criteria*

KRGSA GSP MONITORING NETWORK

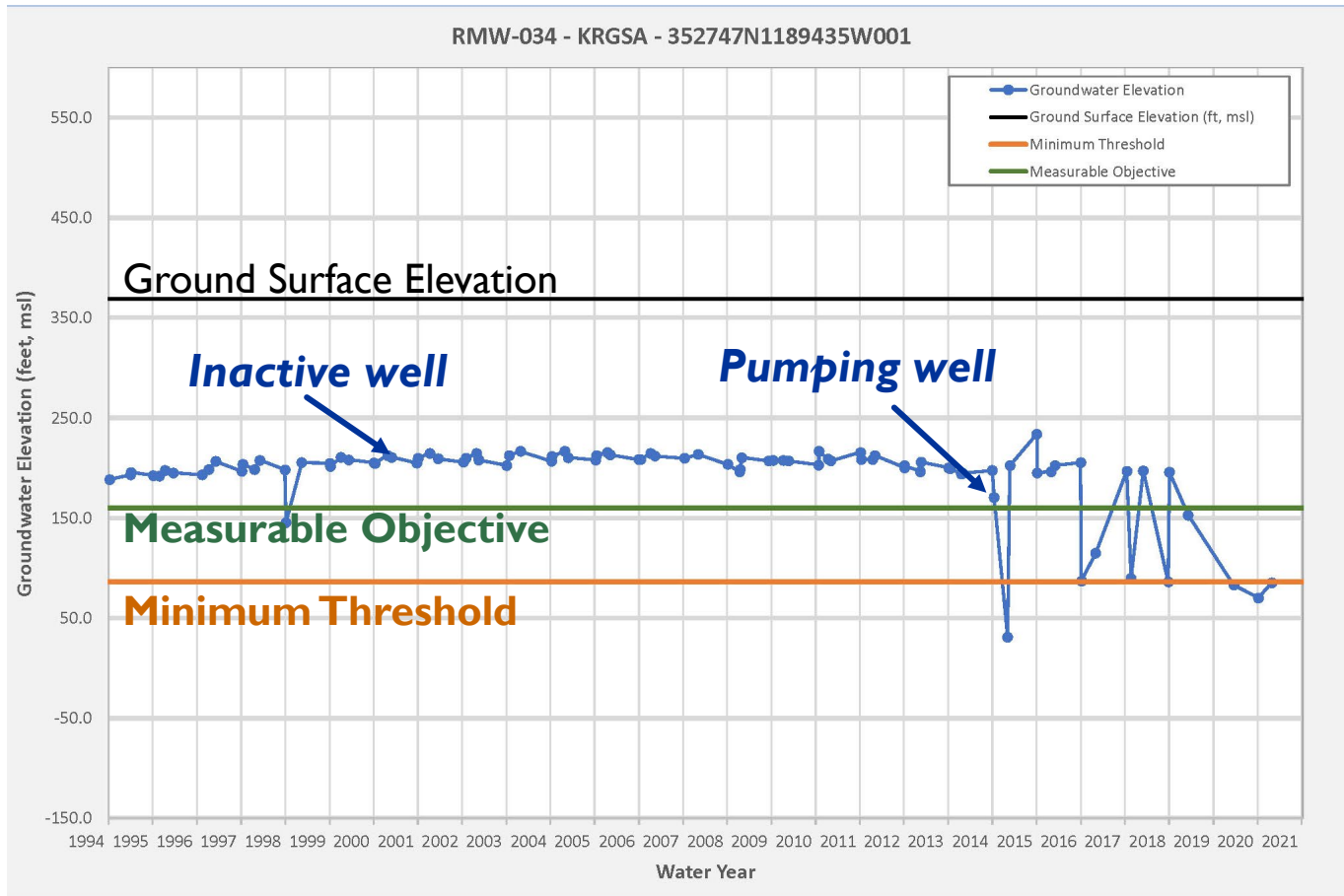
WY 2021 MT EXCEEDANCES

- Minimum Threshold (MT) exceedances in 4 wells in east central and southern KRGSA
 - 3 of these 4 are active production wells
 - Problematic if water levels in well have not fully recovered from pumping drawdowns prior to measurement
 - Need to monitor static water levels – not pumping water levels, which are impacted by well inefficiencies
 - Objective: identify regional declines in the aquifer; not pumping declines in a well



38 wells in 3 Management Areas
Urban (15-green), Banking (3-purple),
Agricultural (20-red)

KRGSA HYDROGRAPHS WITH MT EXCEEDANCES

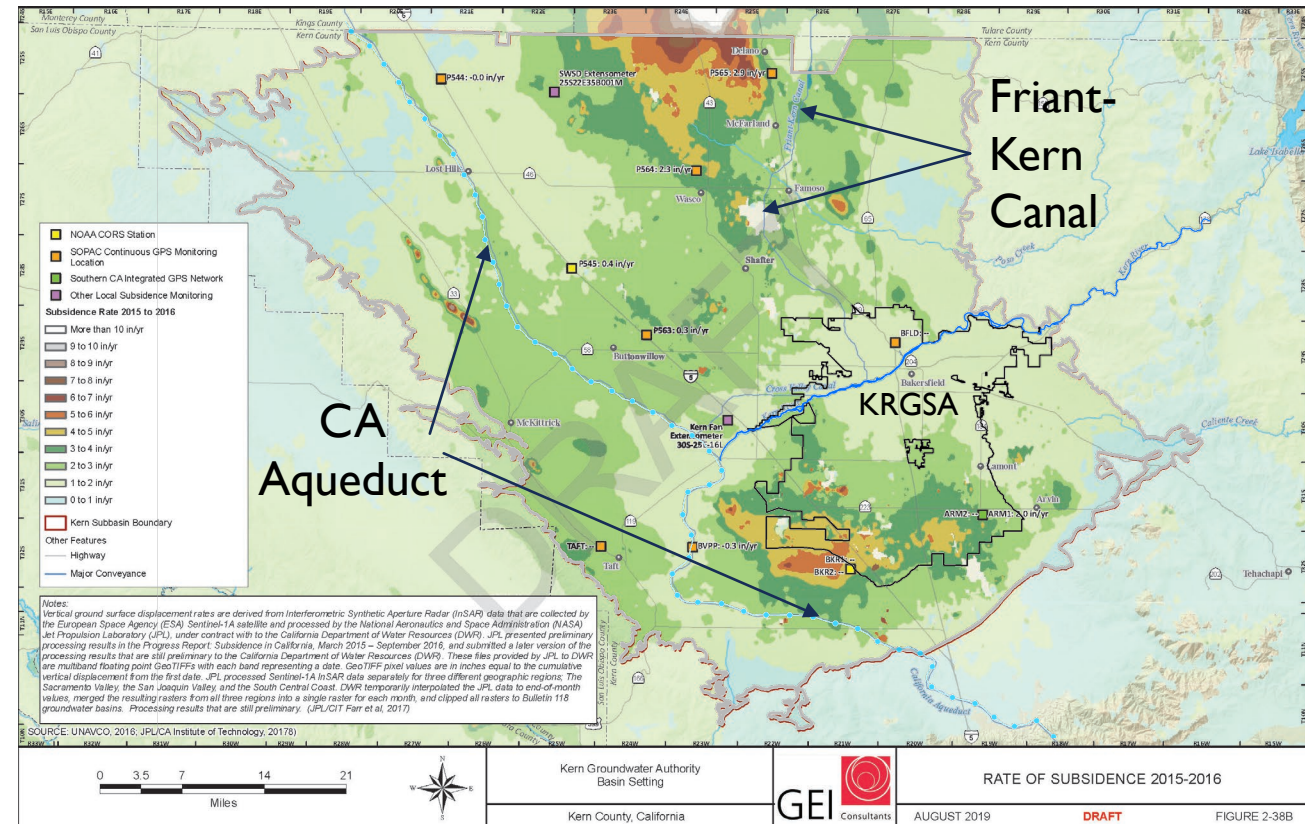


- Some MT exceedances appear to be related to active pumping in monitoring network well
- Not currently “undesirable results”
- Research for replacement wells
- Included request for new monitoring wells in recent grant application

MULTI-FACETED APPROACH TO SUBSIDENCE MONITORING

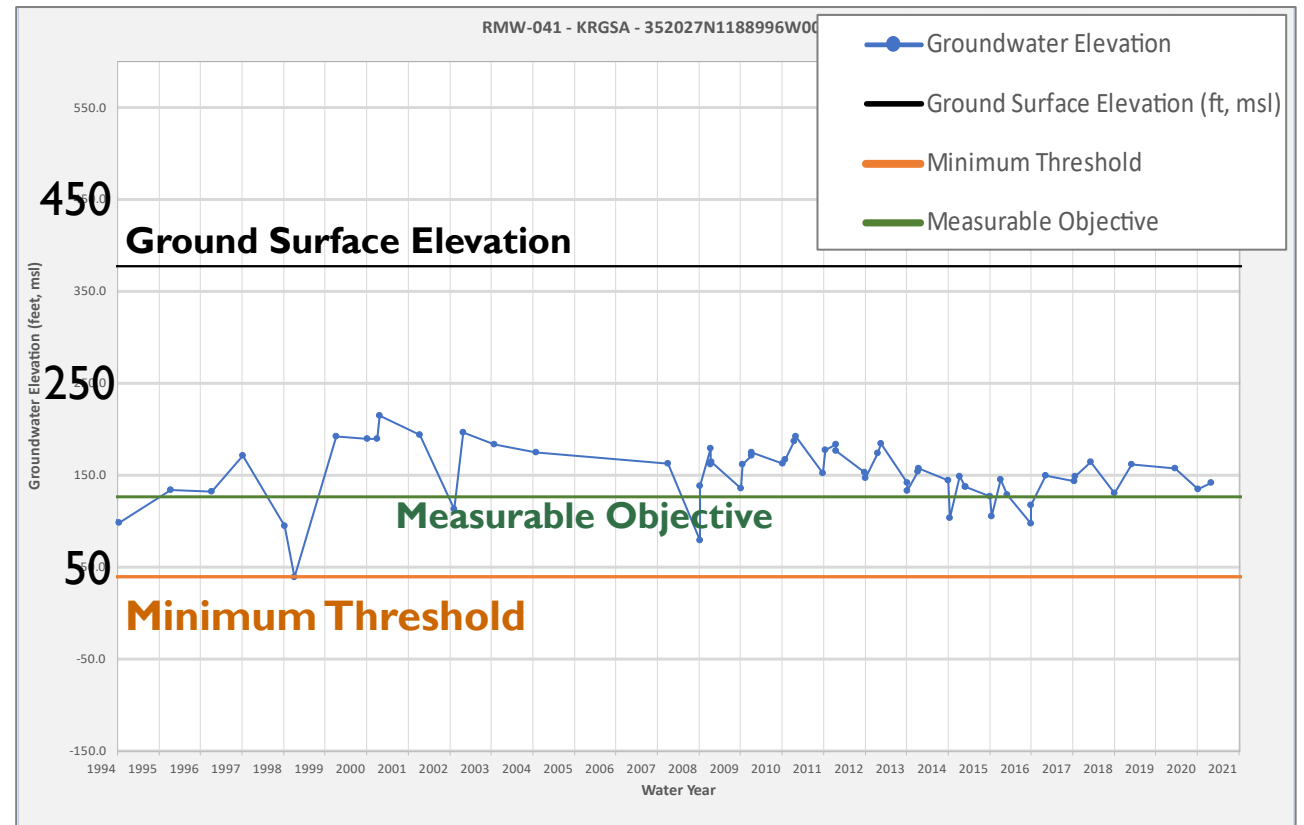
KRGSA GSP

- Historical land subsidence in southern KRGSA and adjacent districts
- Thick clay deposits associated with paleo-lake beds in the southern Kern County Subbasin
- No adverse impacts to critical infrastructure in KRGSA to date – no “undesirable results”
- KRGSA monitoring – water levels, local GPS station, regional InSAR data
- Subbasin-wide monitoring to target CA Aqueduct and Friant-Kern Canal



KRGSA WATER LEVEL MONITORING FOR LAND SUBSIDENCE

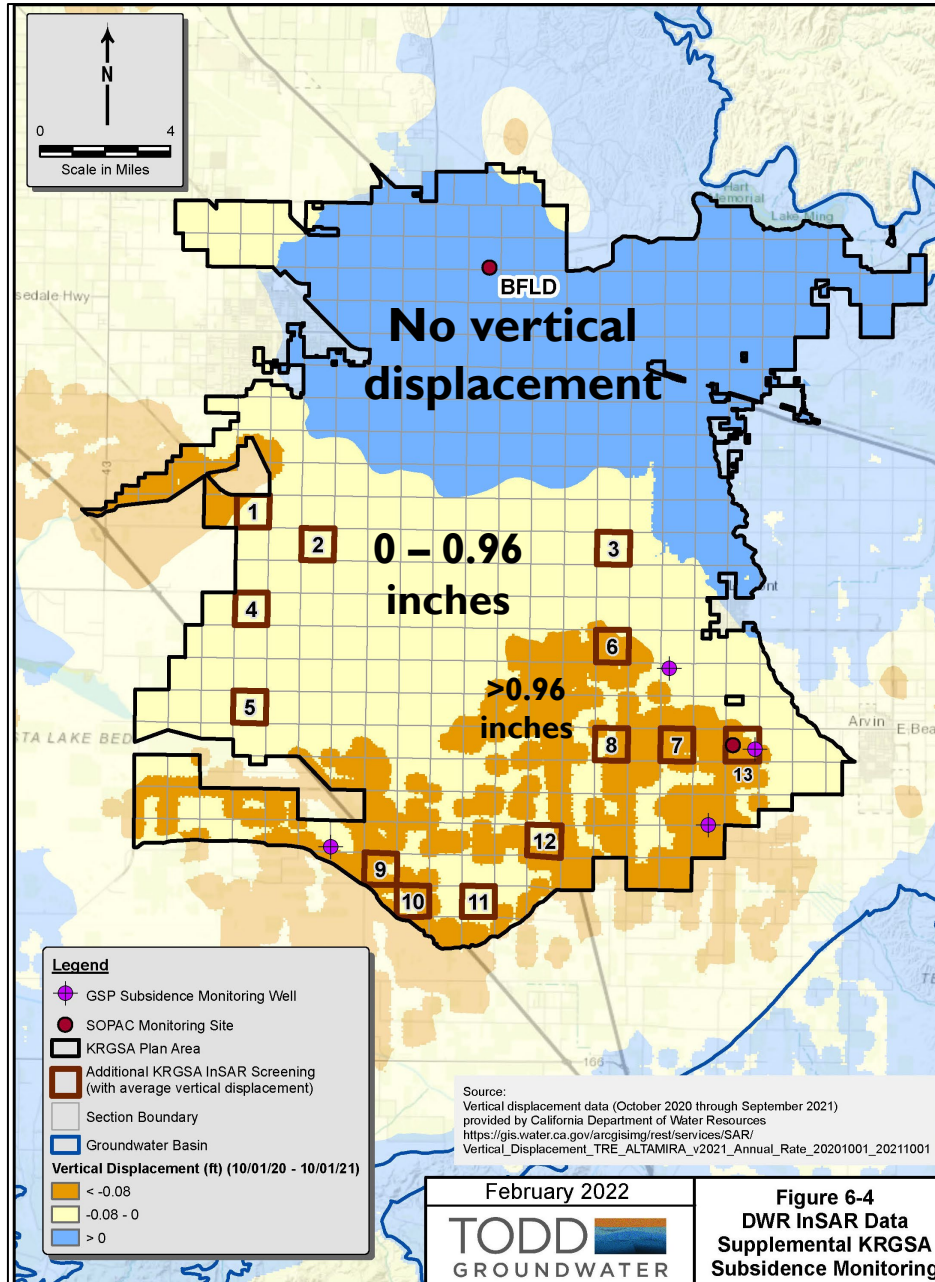
- Maintain **water levels** close to or above historical low levels to prevent exacerbation of future land subsidence and to avoid “undesirable results”
- Water levels in areas of larger subsidence rates in the KRGSA are currently **above historic low water levels**
- Time lag expected between groundwater recovery and cessation of land subsidence; recent drought of record triggered regional increase in land subsidence
- Some subsidence expected to continue into the future



Water Year 1995 - 2021

DWR InSAR DATA WY 2021

- Supplemental Subsidence Monitoring – 13 locations both inside and outside historically impacted areas

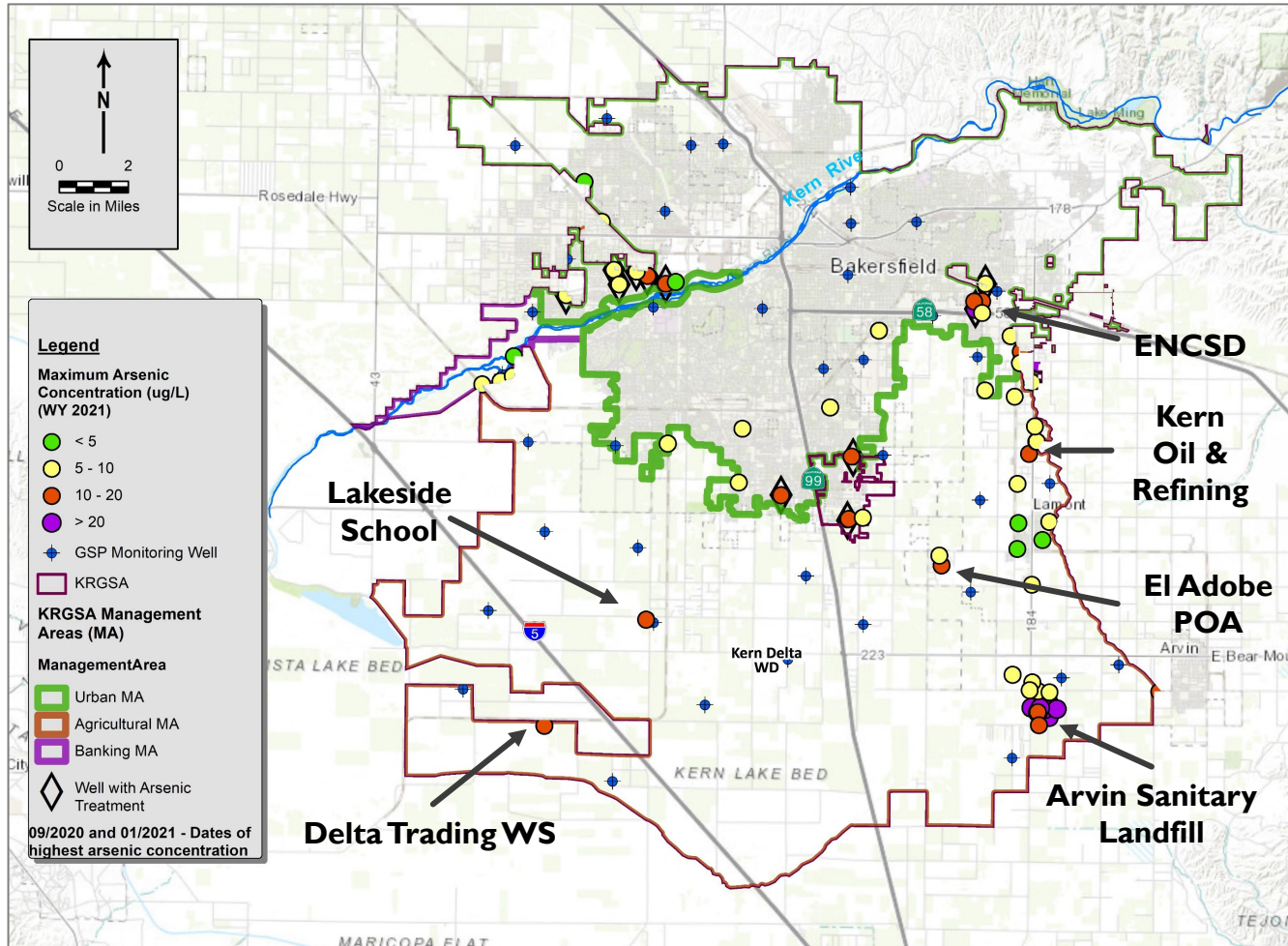


InSAR Cell ID	Average Vertical Displacement WY 2021 (inches)	Last Year Data to Compare WY 2020 (inches)	Difference (inches)
1	-0.732	-1.075	-0.343
2	-0.259	-0.724	-0.465
3	-0.514	-1.250	-0.736
4	-0.247	-0.503	-0.257
5	-0.549	-1.124	-0.574
6	-1.089	-1.556	-0.467
7	-1.780	-2.375	-0.595
8	-1.295	-1.282	0.014
9	-1.988	-2.862	-0.874
10	-1.150	-1.359	-0.209
11	-0.013	-0.011	0.002
12	-1.092	-1.057	0.035
13	-1.256	-1.822	-0.566

- WY 2021 Subsidence rates: 0.013 in/year to 1.99 in/year
- Overall subsidence rates for WY 2021 lower than WY 2020 (green values at left)
- Method error: ± 0.12 inches/year

KRGSA WATER QUALITY TRACKING

ARSENIC CONCENTRATIONS IN GROUNDWATER WY 2021



- Track constituents of concern (arsenic) from existing water quality monitoring programs as part of a KRGSA GSP Management Action
- Exceedances of arsenic MCL in multiple water supply wells; all of these wells also exceeded MCL prior to WY 2021
- Some water systems already have arsenic wellhead treatment (City, GCWD, ENCS)
- Highest concentrations at Arvin Sanitary Landfill – multiple wells up to 120 ug/L
- Arsenic concentrations similar or lower than historical data and do not appear to be exacerbated by GSP management

KRGSA “CHECKBOOK” GROUNDWATER BUDGET WY 2016 – WY 2021

- “Checkbook method” tabulates inflows and outflows at ground surface; excludes subsurface flows
- Banking recharge and pumping recovery by others removed
- Decline in groundwater in storage of -227,305 AFY for critically dry WY 2021; compares to a decline of almost 2MAFY for the Subbasin
- Overall positive water balance for average hydrologic conditions (e.g., WY 2016 – WY 2021)

<i>All values in acre-feet/ Water Year (AFY)</i>	2016	2017	2018	2019	2020	2021	Average 2016-2021
INFLOWS							
Water Zone Budget 1 (Improvement District 4)	19,589	32,810	24,209	25,979	18,104	7,905	21,432
Water Zone Budget 2 (City of Bakersfield)	48,637	248,243	77,745	151,881	104,941	35,536	111,164
Water Zone Budget 3 (Kern Delta Water District)	121,818	208,194	165,925	187,931	125,869	95,372	150,852
Water Zone Budget 5 (Additional Pumping - Return Flows)	11,750	11,129	12,179	11,425	13,548	12,815	12,141
	201,795	500,376	280,058	377,216	262,461	151,627	295,589
OUTFLOWS							
Water Zone Budget 1 (Improvement District 4)	16,873	7,667	5,531	5,461	10,708	20,766	11,168
Water Zone Budget 2 (City of Bakersfield)	65,551	56,954	53,843	54,989	61,016	71,124	60,579
Water Zone Budget 3 (Kern Delta Water District)	183,527	137,921	201,423	160,590	117,526	241,917	173,817
Water Zone Budget 5 (Additional Pumping)	38,211	34,928	41,638	36,127	41,001	45,126	39,505
	304,162	237,470	302,435	257,167	230,251	378,933	285,070
INFLOWS - OUTFLOWS	-102,368	262,906	-22,377	120,049	32,210	-227,305	10,519
Kern River Annual Index	51%	277%	55%	180%	47%	23%	106%

Note: Water budget zones were established to facilitate data collection and prevention of double-counting and do not reflect all local flows within agency boundaries.

- **Positive balance (10,519 AFY) for WY 2016–2021 indicates improvement over the negative balance (-29,000 AFY) for WY 1995–2014 GSP historical average conditions**

KRGSA GSP PROJECT IMPLEMENTATION PROGRESS IN WY 2021

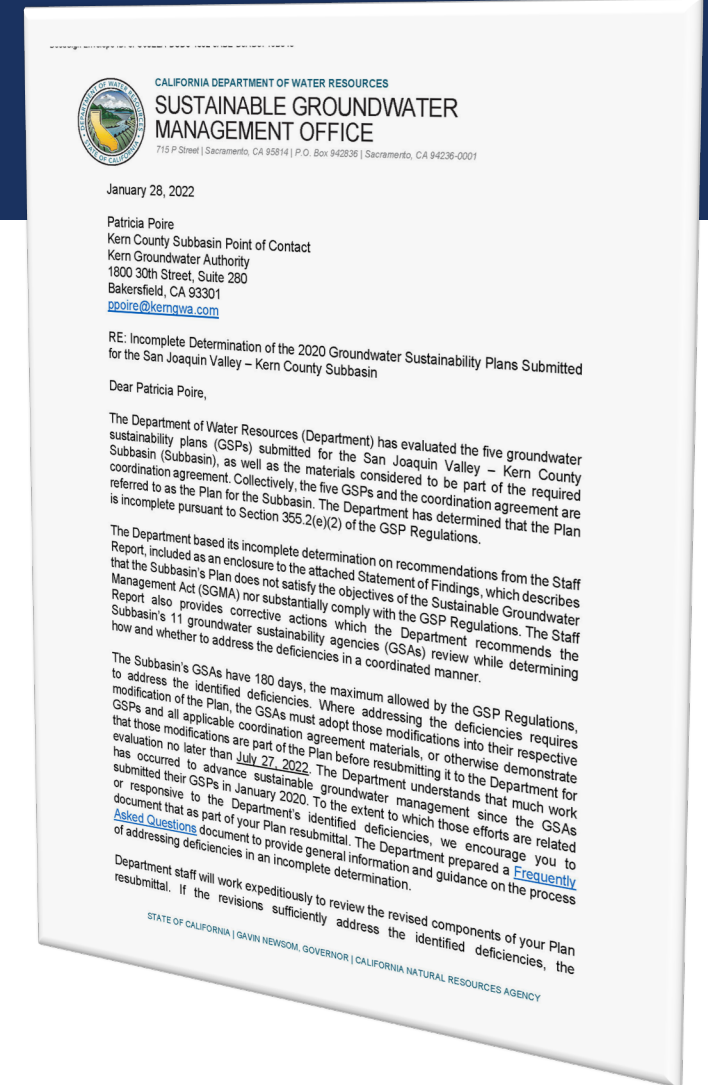
- The **City** recharged 9,485 AF in City-owned facilities as part of its *Optimized Conjunctive Use Program*. The City also made improvements in the Kern River channel to allow for unimpeded low river flows and recharge. In WY 2021, about 23,417 AF of recycled water was used; the City is conducting a master study to increase recycled water available for irrigation of City parks.
- **KDWD** as a result of its *WAP* GSP Project, an additional 9,165 AF of transfer water was retained for active management – a supply that would have been previously unavailable without the project. In addition, the District was able to run water down the Eastside Canal earlier than usual operations to partially mitigate local groundwater declines.
- **ID4** developed a 2020 UWMP that incorporated *climate change impacts* as provided in the DWR 2019 Delivery Capability Report. ID4 also continued implementation of its *Cross Valley Canal Extension Lining Project* (Pool No. 8) to increase reliability of surface water supply during dry conditions.
- Numerous other GSP projects and management actions are also underway.



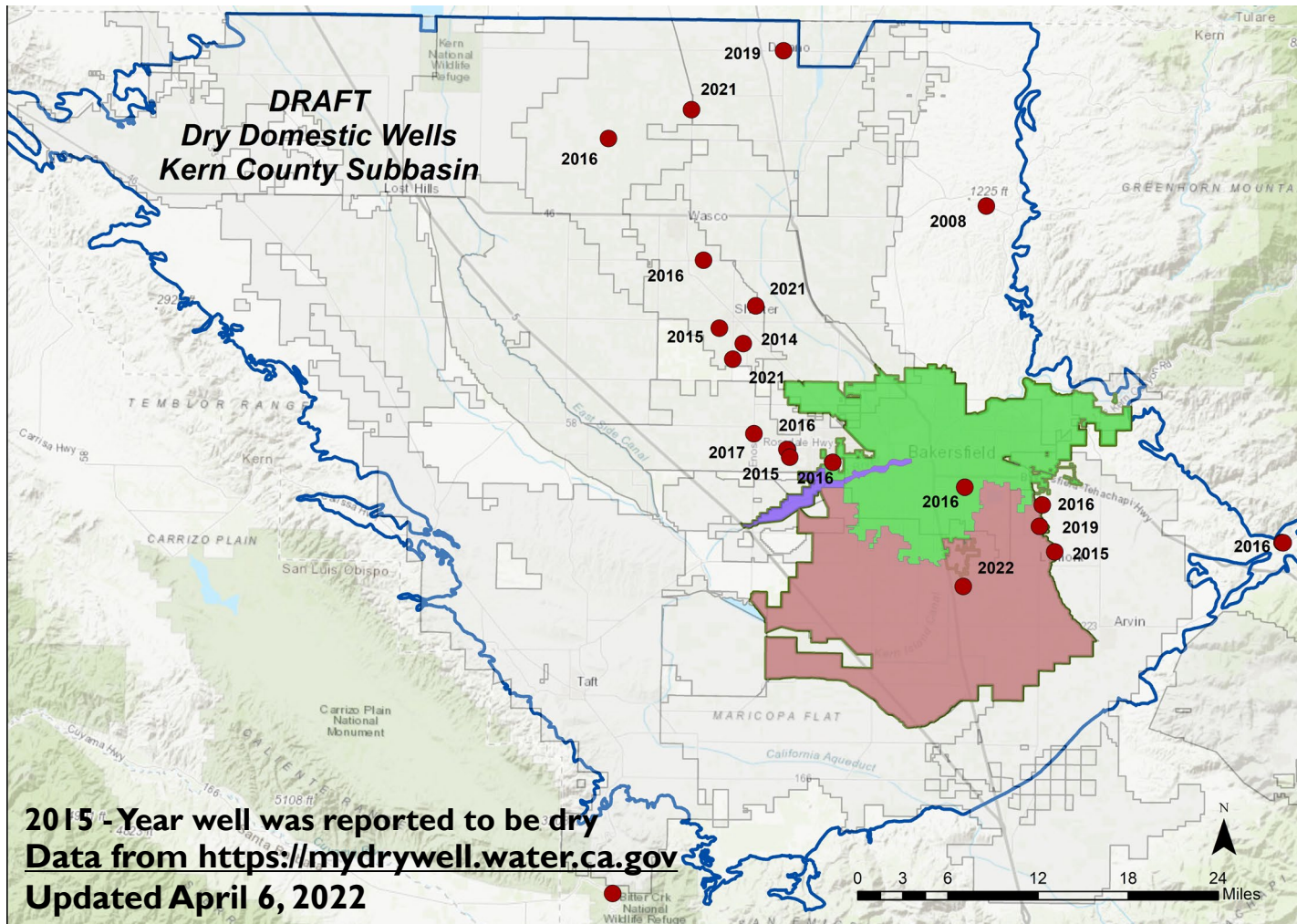
**Groundwater
Recharge
and
Conjunctive
Use**

DWR EVALUATION PROCESS AND KRGSA AMENDED GSP

- DWR evaluated all GSPs collectively for one “determination of adequacy”
- Jan 28, 2022 - DWR Letter of Determination
 - Kern County Subbasin GSPs determined to be collectively “Incomplete”
 - Corrective actions for 3 overall deficiencies
 - Chronic Lowering of Water Levels Undesirable Results
 - Selection of Minimum Thresholds (MTs)
 - Sustainable management criteria for land subsidence on a subbasin-wide basis
- Only one KRGSA-specific corrective action: DWR requested clarification on a KRGSA Management Action
- Expanding the former analysis of domestic wells for the Management Action
- DWR also requires coordination with others on Subbasin-wide deficiencies
- Working on an amended KRGSA GSP due to DWR July 27, 2022



REPORTED DRY DOMESTIC WELLS KERN COUNTY SUBBASIN



- Dry Domestic Wells reported to DWR
- 19 in Kern County Subbasin; 4 in KRGSA
- Most occurred during the 2014-2016 historic low water levels
- 7 reported in 2021-2022

KRGSA GSP ADAPTIVE MANAGEMENT POLICY

- *KRGSA Plan Managers also recognize the need for flexibility in the GSP. Numerous minimum thresholds (MTs) and other sustainability criteria were selected in the absence of undesirable results; several were selected at conservative levels to ensure that the future potential for undesirable results can be mitigated. Actual MTs may be lower (or higher) than those selected. (KRGSA GSP Management Action 7.2.9)*
- Re-evaluations to be provided in the Five-Year GSP Evaluation
- Ongoing analyses summarized in Annual Reports



QUESTIONS?

