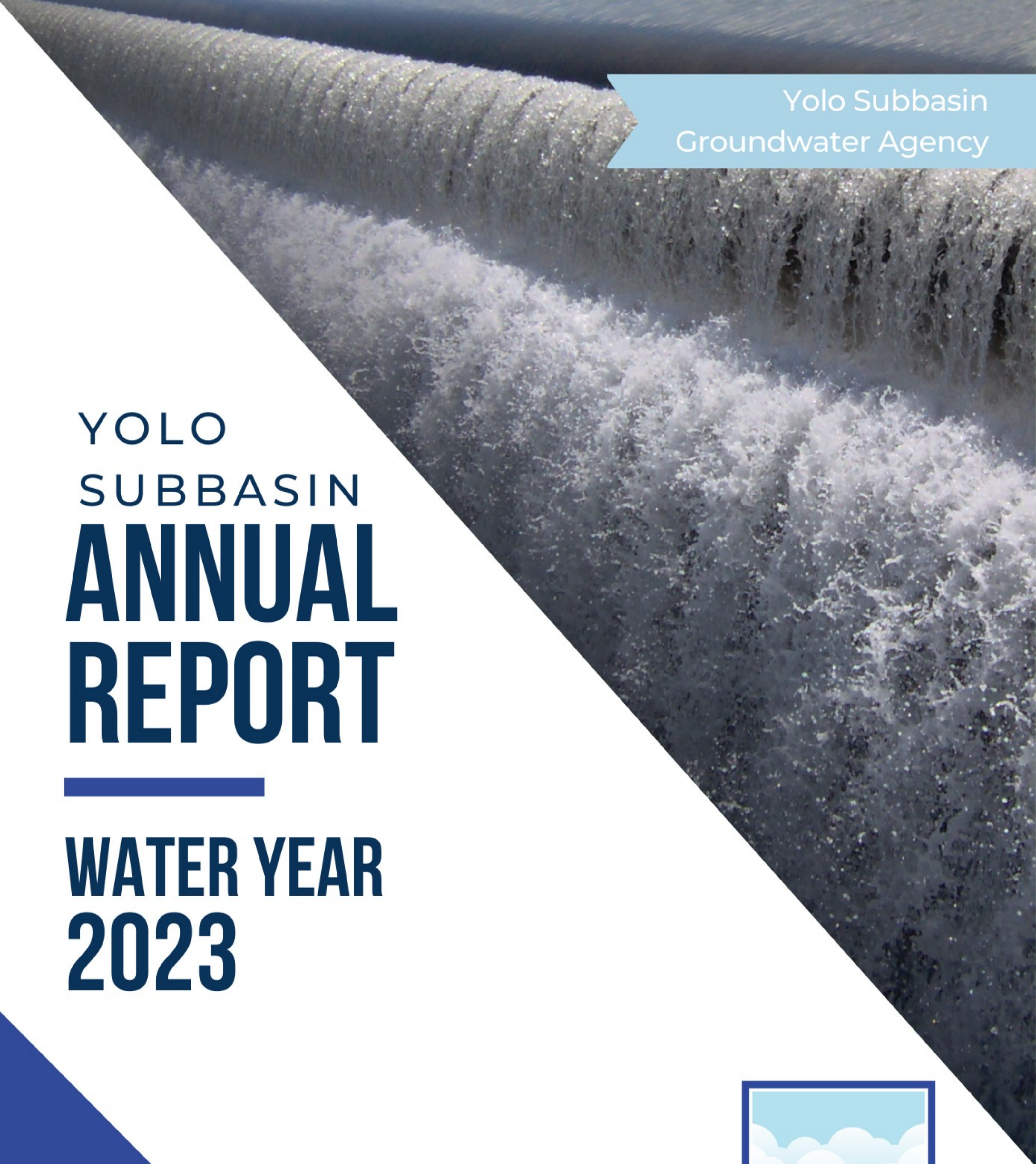
Yolo Subbasin
Groundwater Agency



YOLO SUBBASIN ANNUAL REPORT

WATER YEAR 2023

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YSGA
Yolo Subbasin Groundwater Agency
YOLOGROUNDWATER.ORG

Yolo Subbasin Groundwater Sustainability Plan

2024 Annual Report
Covering Water Year 2023

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Covers: Front: Cache Creek flows over the Capay Dam
Back: Quince flowers on a Yolo County Farm
Photo credit: YCFC&WCD, Sarah Leicht

EXECUTIVE SUMMARY

The Yolo Subbasin Groundwater Agency (YSGA) has prepared this report for the Yolo Subbasin Groundwater Sustainability Plan (GSP) in compliance with the Sustainable Groundwater Management Act (SGMA; California Water Code Section 10720 et seq.). This annual report covers Water Year 2023 (October 1, 2022 to September 30, 2023). The Yolo Subbasin (Subbasin) covers approximately 540,700 acres. The Subbasin is located in the southwestern side of the Sacramento Valley Groundwater Basin and is subdivided into six Management Areas (See Figure 1).

The sustainability goals for the Yolo Subbasin are as follows:

- Achieve sustainable groundwater management in the Yolo Subbasin by maintaining or enhancing groundwater quantity and quality through the implementation of projects and management actions to support beneficial uses and users.
- Maintain surface water flows and quality to support conjunctive use programs in the Subbasin that promote increased groundwater levels and quality.
- Operate within the established sustainable management criteria and maintain sustainable groundwater use through continued implementation of a monitoring and reporting program.
- Maintain sustainable operations to maintain sustainability over the implementation and planning horizon.

GSP Implementation in 2023 was focused on further developing and acquiring funding for various projects and management actions defined in the GSP. Budgets and schedules were developed for eight projects included in the YSGA's application to DWR's SGMA Implementation Grant Round 2 solicitation. Of these eight projects, five were selected to receive funding: Yolo Subbasin GSP Implementation, Yolo-Zamora Groundwater Recharge Pilot Project, Dunnigan Area Recharge Program, City of Winters Feasibility Studies, and YCFC&WCD Winter Water Recharge Program. Progress on each of these funded projects is discussed in Section 3.1.1.

Water Year 2023 was a wet year, in which precipitation was approximately 30" for Yolo County (148% of historical average). Wet conditions resulted in groundwater recovery, and Spring 2023 groundwater levels were almost equal to Spring 1994, 2009, and 2018 groundwater levels on average. Because of the substantial rainfall and available surface water supplies, Fall 2023 measurements illustrated a smaller seasonal drawdown (6 feet) when compared to the 2022 seasonal drawdown (17 feet) observed in average groundwater elevations.

One representative monitoring well for groundwater levels displayed an exceedance of the minimum threshold value, a significant improvement from the end of Water Year 2022 when 8 representative monitoring wells exceeded the minimum threshold. The YSGA is committed to continuing to implement projects and management actions that will facilitate groundwater recovery in areas that observed exceedances during the drought.

This annual report contains estimated acre-feet values for surface water diversions, groundwater extraction, total water use, and change in groundwater storage. Total surface and groundwater use in 2023 was approximately 745 thousand acre-feet (TAF). Due to ample surface water supplies, groundwater extraction was much less in 2023 than 2022 (243 TAF versus 321 TAF, respectively).

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1. INTRODUCTION

The Yolo Subbasin Groundwater Agency Joint Powers Agreement (JPA) was officially executed on June 19, 2017 by 19 member agencies and five affiliated parties via memoranda of understandings (MOU). Since the YSGA was formed, three additional member agencies have signed onto the JPA; three other member agencies consolidated into one; and one affiliated party has entered into an MOU with the JPA, which has resulted in 20 member agencies and six affiliated parties for a total of 26 YSGA members.

The Yolo Subbasin Groundwater Sustainability Plan (GSP) was adopted on January 24, 2022 by the YSGA Board of Directors, and submitted to the California Department of Water Resources (DWR) on January 28, 2022 by YSGA staff. The GSP provides an overview of the planning considerations, hydrogeologic properties, and hydrologic conditions of the area from 1970 to 2018. It also outlines a water budget for the Yolo Subbasin, establishes Sustainable Management Criteria, and identifies projects and management actions to maintain sustainability. For a summary of the plan's contents, please refer to the Executive Summary of the Yolo Subbasin GSP[1].

This 2024 Annual Report is intended to provide an update on current activities and conditions within the Subbasin and bring the GSP up to date (as a continuation to the 2023 Annual Report). This report therefore covers Water Year 2023 (October 1, 2022 – September 30, 2023).

2. PLAN AREA

The Yolo Subbasin (Subbasin) covers approximately 540,700 acres, spanning nearly 845 square miles. The Subbasin is located in the southwestern side of the Sacramento Valley Groundwater Basin and is about 27 miles wide from west to east and up to 45 miles long from north to south. The current Subbasin boundaries are the result of the consolidation of portions of the Capay Valley, Colusa, and Solano subbasins via two applications for jurisdictional modifications of the Subbasin's boundary. Land use designations within the YSGA jurisdictional boundary are predominately agriculture and native vegetation, accounting for approximately 60 and 30 percent, respectively. Approximately five percent of the Subbasin contains managed wetlands, which provide migratory bird habitat and other ecosystem services. Source of water for agricultural lands is a combination of surface water and groundwater. Urban and incorporated land use areas are scattered throughout the Subbasin and account for approximately five percent of the Subbasin. The Yolo Subbasin boundary, member agencies, and affiliated parties are shown in Figure 1.

The Subbasin contains six Management Areas for implementation of project and management actions to achieve groundwater sustainability. In developing these Management Areas, YSGA considered geologic, aquifer, and topographic characteristics. To prevent undesirable results in adjacent Management Areas, consistent minimum thresholds and measurable objectives have been developed as discussed in the Yolo Subbasin GSP (Section 3 – Sustainable Management Criteria)[2]. The six Management Areas are known as the Capay Valley, Dunnigan Hills, North Yolo, Central Yolo, South Yolo, and Clarksburg.

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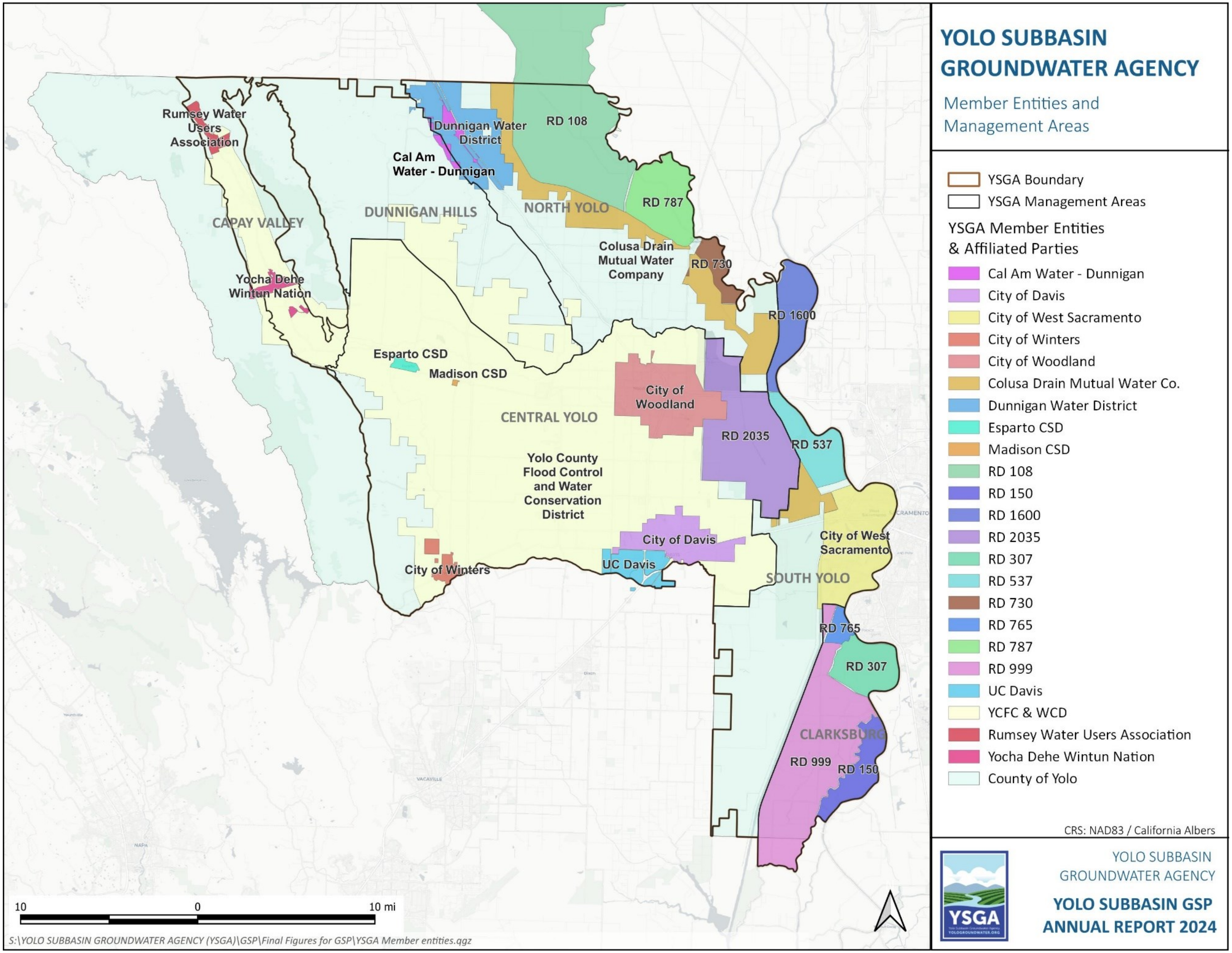
[1] https://www.yologroundwater.org/files/3aac57af3/YoloGSP_Adopted_ExecutiveSummary.pdf

[2] https://www.yologroundwater.org/files/acff83c75/YoloGSP_Adopted.pdf#page=279

FIGURE 1: YOLO SUBBASIN MAP



3. GROUNDWATER MANAGEMENT ACTIVITIES AND MILESTONES

3.1 GSP IMPLEMENTATION PROGRESS

In addition to the general administrative and implementation activities, the YSGA spent time developing a robust process for reviewing well permit applications in compliance with Executive Orders N-7-22 and N-3-23[3]. Coming out of the 2020-2022 drought period, the YSGA received concerns from stakeholders about areas where groundwater levels were showing potential downward trends and rural residential wells experienced issues. In June 2023, the YSGA began working towards a delineation and policy framework for "Focus Areas" where groundwater level declines and stakeholder concerns had been identified. More information about this process is available on the YSGA website[4].

3.1.1 Projects and Management Actions

GSP Implementation in 2023 was focused on further developing and acquiring funding for various projects and management actions defined in the GSP. Budgets and schedules were developed for eight projects included in the YSGA's application to DWR's SGMA Implementation Grant Round 2 solicitation. Of these eight projects, five were selected to receive funding, for a total award of $7,917,000: Yolo Subbasin GSP Implementation, Yolo-Zamora Groundwater Recharge Pilot Project, Dunnigan Area Recharge Program, City of Winters Feasibility Studies, and YCFC&WCD Winter Water Recharge Program. Progress on each of these funded projects is discussed below:

Yolo Subbasin GSP Implementation:

- Three outreach meetings were held with stakeholders in the Hungry Hollow Focus Area to identify concerns related to domestic wells and data gaps. The YSGA requested facilitation support services from DWR to continue with public outreach in the area and assist with the process of developing a white paper on projects and management actions specific to the Hungry Hollow Focus Area.
- YSGA staff met with The Nature Conservancy to begin refining the GSP's interconnected surface water sustainable management criteria.
- YSGA staff drafted and submitted a grant application to the USBR WaterSMART program requesting funding for a domestic well mitigation program and improved climate forecasting tools.

Yolo-Zamora Groundwater Recharge Pilot Project:

- On November 9, 2022, YSGA staff hosted a meeting with landowners in the Yolo-Zamora area to discuss the project and receive feedback from stakeholders. Twenty landowners provided letters of support for this project, which were included in the grant application to DWR.
- A kick-off meeting occurred in January 2024 to inform landowners of the pilot project funding and to plan for activities related to the trickle flow recharge to Yolo-Zamora and the feasibility study for a long-term recharge program.

[3] https://www.gov.ca.gov/wp-content/uploads/2022/03/March-2022-Drought-EO.pdf;
https://www.gov.ca.gov/wp-content/uploads/2023/02/Feb-13-2023-Executive-Order.pdf?emrc=b12708
[4] https://www.yologroundwater.org/well-permit-verification

Dunnigan Area Recharge Program:

- Following a successful pilot project in 2022 where 200 acre-feet of water was recharged through Buckeye Creek, Dunnigan Water District recharged a total of 2,184 acre-feet in Water Year 2023, with 690 acre-feet recharged through Buckeye Creek and 1,494 acre-feet applied and recharged through farmers' fields.
- Dunnigan Water District pursued a temporary permit application with the State Water Board in 2023.

YCFC&WCD Winter Water Recharge Program:

- In Water Year 2023, approximately 4,604 acre-feet was recharged through the District's unlined canal system.
- The District initiated a water availability analysis in pursuit of a permanent winter water right, and received a temporary permit from the State Water Board for March and April 2024 excess winter flow diversions from Cache Creek.

City of Winters Feasibility Studies:

- The City of Winters solicited proposals from qualified firms to complete feasibility analyses of various surface water sources and recycled water treatment options.

SGMA Implementation Grant awards were announced October 2023. The YSGA has proceeded with receiving approvals from the YSGA Board for advancing activities related to GSP implementation and all components funded under the SGMA Implementation Grant funds will be completed by April 2026.

3.1.2 Outreach and Engagement

The YSGA hosted regular Board and Executive Committee meetings throughout the year providing the public with an update on the status of GSP implementation. Additionally, the YSGA participated in the following public meetings to provide updates on GSP implementation in the Yolo Subbasin:

- January 2023: Yolo County Irrigated Lands Program
- April 2023: California Water Commission Meeting
- May 2023: Groundwater Resources Association/UC Davis Groundwater Short course
- May 2023: Co-Hosted Yolo County Water Awareness Forum
- May 2023: Cache Creek Technical Advisory Committee Meeting
- July 2023: City of Woodland Chamber of Commerce Meeting
- July and September 2023: Yolo County Board of Supervisors Meetings
- August 2023: Yolo County Cattlemen's Association
- Throughout 2023: Westside IRWM Coordinating Committee Meetings
- Throughout 2023: Yolo County Flood Control & Water Conservation District Meetings

Additionally, the YSGA participated in dozens of coordination meetings with Yolo County's Division of Environmental Health to develop well permitting procedures for complying with the Governor's Executive Order N-7-22 and N-3-23. The YSGA also participated in numerous meetings with neighboring GSAs to discuss well permitting strategies and lessons learned.

The YSGA participated in many inter-agency coordination meetings with other Groundwater Sustainability Agencies, and continued to participate in meetings related to the Environmental Defense Fund and Water Data Consortium's Groundwater Accounting Platform.

Annual inter-basin coordination meetings also occurred with Colusa, Solano, North American, and South American Subbasins.

Lastly, the YSGA had the privilege of providing updates at the following meetings:

- DWR's 2023 Groundwater Awareness Event
- Butte County Water Resources Brown Bag Seminar
- DWR’s 2023 Groundwater Sustainability Agency Forum
- Northern California Water Association SGMA Field Tour
- UC Davis Hydrologic Sciences Group
- California Data Collaborative Summit
- Association of California Water Agencies 2023 Spring Conference

Public comments received during the 2023 Water Year were primarily related to concerns over agricultural well permitting oversight and transparency. Rural residential well owners were concerned about impacts to groundwater tables and individual domestic wells and requested that the YSGA revise the written verification process as part of complying with the Governor’s Executive Orders N-7-22 and N-3-23. Public comments were also provided to the Yolo County Board of Supervisors that resulted in significant coordination among the YSGA and Yolo County to ensure the well permitting procedures were aligned. Additionally, several public comments were made regarding water quality considerations.

3.1.3 Addressing Recommended Corrective Actions

On October 26, 2023, DWR released its determination for the Yolo Subbasin GSP, approving the plan and recommending 24 corrective actions be implemented prior to the 2027 periodic update. In the 2025 Annual Report, the YSGA will thoroughly describe the actions that were taken during the 2024 Water Year to address recommended corrective actions. Table 1 below outlines the corrective actions recommended by DWR and the YSGA’s planned approach for addressing them.

In March 2024, the YSGA released a request for qualifications to solicit technical assistance in resolving the corrective actions and ensuring significant progress occurs in the 2024 Water Year for corrective actions to be fully addressed in the 2027 periodic update.

TABLE 1: PLANNED APPROACH TO ADDRESS CORRECTIVE ACTIONS

Action	Description	GSP Section	Planned Approach to Address	Timeline for Revision
1	**Revise the SMC for the chronic lowering of groundwater levels**			
1a	Review states that the definition of significant and unreasonable effects is "vague and circular". Need to define what exactly constitutes significant and unreasonable effects for chronic lowering of groundwater levels that the GSA is managing the Subbasin to avoid.	3.3.1, pg. 281	YSGA plans to work with the technical team to ensure a clear definition of significant and unreasonable effects for chronic lowering of groundwater levels.	2027 Periodic Update
1b	Provide additional discussion and amend the definition of undesirable results. Specifically, regarding the 51 percent of RMWs exceeding the minimum threshold in two MAs, the GSA should explain how local exceedances within just one management area are not considered an undesirable result. Further, the GSA should clearly define a time component for when an undesirable result will occur, similar to how the time component for minimum threshold exceedances is defined as two consecutive fall measurements that exceed the MT.	3.3.1, pg. 281	YSGA plans to work with the technical team to amend the undesirable results definition to incorporate a time component and clearly define the reason why two Management Areas trigger the undesirable result.	2027 Periodic Update
1c	The GSP provides little information on how the basin conditions at the minimum thresholds of groundwater levels will avoid undesirable results for any other sustainability indicators. Department staff recommend the GSA describe the relationship between established minimum thresholds for the chronic lowering of groundwater levels and how they avoid undesirable results for each of the other sustainability indicators, especially in the North Yolo Management Area where minimum thresholds are set below historical lows.	3.3.1 & 3.3.2, pg. 281-282 3.3.2.1.2 pg. 285	YSGA plans to work with the technical team to clearly define how the basin conditions at the minimum thresholds of groundwater levels will avoid undesirable results for any other sustainability indicators.	2027 Periodic Update
2	**Revise the SMC for degraded water quality**			
2a	Revise the definition of undesirable results for degraded groundwater quality so that exceedances of minimum thresholds caused by groundwater extraction, whether the GSA has implemented projects or not, are considered in the assessment of undesirable results in the Subbasin.	3.5.1 pg. 292	YSGA plans to work with the technical team to revise the definition of undesirable results for degraded groundwater quality so that groundwater extractions and groundwater level minimum threshold exceedances are considered in the assessment of the undesirable results.	2027 Periodic Update
2a1	*Staff also recommend the GSA consider including a metric, such as an isocontour concentration map, in the minimum threshold to define the areas experiencing elevated concentration.*	3.5.2 pg. 294		
2a2	*The GSA should consider discussing the rationale for choosing the 50 percent minimum threshold exceedance in defining undesirable results.*	3.5.1 pg. 292		

Action	Description	GSP Section	Planned Approach to Address	Timeline for Revision
2b	The GSA should revise the GSP to provide the rationale to support their approach that TDS is the only quality constituent that requires the establishment of sustainable management criteria. Alternatively, the GSP should establish sustainable management criteria for all the constituents of potential concern identified in the Basin that have the potential to cause undesirable results.	3.5 pg. 291	YSGA plans to work with the technical team to evaluate whether all the water quality constituents of potential concern within the Subbasin should be incorporated into the GSP and have sustainable management criteria established.	2027 Periodic Update
3	**Revise the SMC for land subsidence**			
3a	Identify critical infrastructure susceptible to land subsidence and describe what constitutes significant and unreasonable effects that lead to undesirable results.	3.6.1 pg. 294	YSGA plans to work with the technical team to develop a plan for identifying critical infrastructure susceptible to land subsidence and describing what constitutes significant and unreasonable effects that lead to undesirable results.	2027 Periodic Update
3b	Revise the operational definition of undesirable results to consider localized instances of subsidence and how they would be determined to be significant and unreasonable. This should include describing how minimum thresholds being exceeded in multiple management areas or a quarter one of one management area does not constitute an undesirable result. Provide additional discussion and justification on the quantitative definition of undesirable results of subsidence:	3.6.1 pg. 294 3.6.2 pg. 299	YSGA plans to work with the technical team to revise the operational definition of undesirable results to consider localized instances of subsidence and the determination of what constitutes significant and unreasonable effects. Additionally, the technical team will formally document the appropriate quantitative definition of undesirable results of subsidence.	2027 Periodic Update
3b1	*How the value of "25 percent of the management or sub-MA" mean was determined, and whether it means 25 percent of monitoring sites or 25 percent of area, and*	3.6.1.3 pg. 295		
3b2	*How to address local or regional undesirable results by requiring three (3) or more management areas or sub-MAs experiencing the minimum threshold exceedances.*	3.6.1 pg. 294		
3c	Department staff note that setting the minimum threshold as the current rate of land subsidence that is occurring in the Subbasin does not meet the intent of SGMA to minimize or avoid subsidence. Department staff recommend the GSA include a cumulative metric for land subsidence that may lead to significant and unreasonable impacts occurring in the Subbasin and revise the minimum thresholds as appropriate. The GSA should also elaborate on how the proposed management will avoid or minimize the land subsidence that has been occurring and increasing in severity recently in the Subbasin.	3.6.1 pg. 294 3.6.2 pg. 299	YSGA plans to work with the technical team to re-evaluate the land subsidence minimum threshold to include a cumulative metric for evaluating when land subsidence may lead to significant and unreasonable impacts occurring in the Subbasin, and will elaborate on how proposed management will minimize land subsidence.	2027 Periodic Update

Action	Description	GSP Section	Planned Approach to Address	Timeline for Revision
3d	Establish a minimum threshold for the Capay Valley MA.	3.6.2 pg. 299	YSGA plans to work with the technical team to establish a land subsidence minimum threshold for the Capay Valley Management Area.	Future Periodic Update when sufficient data exists
3e	Revise the measurable objective and interim milestones for land subsidence to a value that achieves the sustainability goal for the basin within 20 years of Plan implementation. Using the current rate of land subsidence as a minimum threshold or measurable objective is not appropriate and should be revised by the GSA.	3.6.3 pg. 299 3.6.4 pg. 299	YSGA plans to work with the technical team to revise the measurable objective and interim milestones for land subsidence.	2027 Periodic Update
4	**Revise the SMC for interconnected surface water**			
4a	Provide additional discussion and amend the definition of undesirable results. Explain the selection of the value of 50 percent of ISW monitoring wells exceeding the minimum threshold in two or more ISW management areas in the same reporting year. Specifically, the GSA should explain how local exceedances within just one management area are not considered an undesirable result.	3.8.1 pg. 301	YSGA plans to work with the technical team to amend the definition of undesirable results and clearly explain the trigger of ISW monitoring wells exceeding the minimum threshold to result in the undesirable results.	2027 Periodic Update
4b	Identify specific beneficial users and uses of interconnected surface water for each reach and describe specifically what constitutes significant and unreasonable effects of depletion of interconnected surface water and use this information to potentially revise the sustainable management criteria.	3.8.1 pg. 301	YSGA plans to work with the technical team to identify specific beneficial users and uses of ISW for each reach and will describe specifically what constitutes significant and unreasonable effects of depletion of ISW.	2027 Periodic Update
4c	Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.	3.8	YSGA plans to consult with the technical team to determine whether to sue DWR's ISW guidance, when available, to quantify minimum thresholds, measurable objectives, and management actions.	Upon issuance of guidance
4d	Continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.	3.8	YSGA plans to continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of ISW and define segments of interconnectivity and timing.	Ongoing
4e	Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSA's jurisdictional area.	3.8	YSGA will continue to prioritize collaboration and coordination with local, state, and federal regulatory agencies as well as interested parties to better understand all beneficial uses and users that may be impacted by pumping-induced surface water depletion within the Yolo Subbasin.	Ongoing
5	**Revise the monitoring network**			

Action	Description	GSP Section	Planned Approach to Address	Timeline for Revision
5a	Define the monitoring site type and data collection frequency in tabular format for the degraded water quality monitoring network in the GSP.	4.6.1 & 4.6.2 pg. 317-322. Table 4-3 pg. 321	YSGA staff will define the monitoring site type and data collection frequency in tabular format for the degraded water quality monitoring network in the GSP.	2027 Periodic Update
5b	Conduct a reconciliation between the details of the monitoring network provided in the GSP with the requirements of the data and reporting standards in the GSP Regulations. Where requirements of the data and reporting standards are not provided, the GSA should include this information in the periodic update of the GSP. Also, updates to the monitoring network must be reflected in the SGMA Portal's Monitoring Network Module.	Section 4 pgs. 307-344	Where requirements of the data and reporting standards are not provided, YSGA will include this information in the periodic update of the GSP.	2027 Periodic Update
Misc. Corrections				
Misc1	Correct the Subbasin land use percentages to add up to 100%. Currently states "60% agriculture, 31% vegetation, 6% managed wetlands, and 5% urban and incorporated land use areas" which adds up to 102%, due to rounding errors.	1.5.2 pg. 63	YSGA will correct this error in the periodic update of the GSP.	2027 Periodic Update
Misc2	Correct the number of wells uploaded to SGMA Portal (59) to the correct number of representative wells (62). Make sure all of them are identified as representative monitoring points, as only 54 are identified as representative monitoring points currently.	Fix in SGMA Portal	YSGA will coordinate with Department staff to clarify the discrepancy.	Immediate
Misc3	Regarding the domestic well mitigation program, Department staff recommend the GSAs utilize the Department's Drinking Water Guidance as appropriate and provide updates to the GSP about the progress of this program during GSP implementation.	Table 5-1 pg. 350	YSGA will utilize this guidance in development of the domestic well mitigation program.	Immediate, ongoing

3.1.4 Upcoming in Water Year 2024

In the upcoming Water Year 2024, the YSGA will continue to work with project proponents to implement the SGMA Implementation Grant Funding projects and to optimize groundwater recharge opportunities. Additionally, the YSGA will be working to address the corrective actions requested by DWR in the GSP approval letter.

Lessons learned from the YSGA's updated well permitting review process will provide additional guidance and direction on how to initiate appropriate demand management strategies within the YSGA's authority. The YSGA will also need to focus efforts on establishing an equitable and sustainable revenue structure to ensure long-term implementation of the GSP and critical projects and management actions.

The YSGA will continue to work to establish Advisory Committees for each of the six Management Areas. These Management Area Advisory Committees will review groundwater conditions biannually and select the appropriate projects and management actions to ensure local response to changing conditions.

3.2 MONITORING NETWORK REVISIONS

3.2.1 Additional Monitoring Sites

Over the course of the 2023 Water Year, 28 monitoring sites were added to the Yolo Subbasin monitoring network. This includes five real-time sites and 23 sites that will be measured seasonally in spring and fall of each year. 21 of these sites were added by digitizing historical records provided by Dunnigan Water District. In addition, three multi-completion monitoring wells were drilled through DWR's Technical Support Services program. These wells are sited in strategic locations along the west side of the Subbasin and will be outfitted with real-time monitoring equipment soon. The wells have a total of 11 discrete completions among the three sites.

The added sites are summarized in Table 2. Current data for all monitoring wells, including those listed above, is available on the YSGA's groundwater mapping site[5] and stored in the Yolo County Water Resources Information Database (WRID)[6]. Data will also be made available to DWR via the CASGEM portal[7]. As additional data is collected at these sites, representative monitoring wells will be chosen from these locations in data gaps and areas of concern.

TABLE 2: ADDITIONAL MONITORING SITES

State Well Number	Monitoring Type	Management Area	Latitude	Longitude	Monitoring Start Date
12N01W08G500M	Spring/Fall	North Yolo	38.9071	-121.9948	3/31/2023
12N01W26Q001M	Spring/Fall	North Yolo	38.8530	-121.9384	3/17/1977
12N01W23H001M	Spring/Fall	North Yolo	38.8752	-121.9347	9/1/1975
12N01W06J001M	Spring/Fall	North Yolo	38.9151	-122.0083	4/6/1953
12N01W08D001M	Spring/Fall	North Yolo	38.9096	-122.0082	4/7/1971
12N01W04E001M	Spring/Fall	North Yolo	38.9185	-121.9872	3/1/1991
12N01W04Q001M	Spring/Fall	North Yolo	38.9138	-121.9789	9/1/2014
12N01W22A003M	Spring/Fall	North Yolo	38.8815	-121.9552	11/30/2004

[5] https://sgma.yologroundwater.org
[6] https://wrid.facilitiesmap.com
[7] https://casgem.water.ca.gov

State Well Number	Monitoring Type	Management Area	Latitude	Longitude	Monitoring Start Date
12N01W14E003M	Spring/Fall	North Yolo	38.8910	-121.9497	7/8/1959
12N01W23Q001M	Spring/Fall	North Yolo	38.8674	-121.9425	4/10/2020
12N01W22P500M	Spring/Fall	North Yolo	38.8701	-121.9623	3/1/2009
12N1W35G500M	Spring/Fall	North Yolo	38.8456	-121.9408	3/1/1990
12N01W08L500M	Spring/Fall	North Yolo	38.9001	-122.0045	3/1/2009
12N01W09A500M	Real-time	North Yolo	38.9107	-121.9735	10/1/1990
12N01W07C500M	Spring/Fall	North Yolo	38.9108	-122.0170	3/1/2009
12N01W10K500M	Spring/Fall	North Yolo	38.9034	-121.9578	4/14/2009
12N01W21D500M	Spring/Fall	North Yolo	38.8814	-121.9894	8/15/2009
12N01W22B500M	Spring/Fall	North Yolo	38.8815	-121.9611	11/12/2009
12N01W36G500M	Spring/Fall	North Yolo	38.8480	-121.9210	1/29/2015
12N01W36G501M	Spring/Fall	North Yolo	38.8469	-121.9209	3/1/1990
12N01W36E500M	Spring/Fall	North Yolo	38.8457	-121.9308	10/1/2018
12N01W11Q500M	Spring/Fall	North Yolo	38.8962	-121.9424	3/1/1990
12N01W11K500M	Spring/Fall	North Yolo	38.9030	-121.9424	3/1/2009
08N01E04D500M	Real-time	Central Yolo	38.5740	-121.8729	7/19/2023
11N01W12F500M	Spring/Fall	North Yolo	38.8200	-121.9258	8/14/2023
11N02W22H502M, 11N02W22H500M, 11N02W22H501M	Multi-completion; real-time	Central Yolo	38.7920	-122.0624	9/25/2023
09N01W06C501M, 09N01W06C502M, 09N01W06C503M, 09N01W06C500M	Multi-completion; real-time	Central Yolo	38.6637	-122.0175	9/25/2023
08N01W09F500M, 08N01W09F502M, 08N01W09F501M, 08N01W09F503M	Multi-completion; real-time	Central Yolo	38.5546	-121.9812	9/25/2023

4. MONITORING AND CONDITIONS ASSESSMENT

4.1 HYDROLOGIC CONDITIONS

Table 3 provides a summary of Water Years 2019 to 2023 describing Water Year type, annual precipitation values, and observed changes in groundwater levels. Two critical years (2021-2022) following a dry year (2020) resulted in declining groundwater levels as observed in the Yolo Subbasin average hydrograph (Figure 2). The dry and critical conditions of 2020, 2021, and 2022 led to 4 feet, 13 feet, and 5 feet of groundwater decline, consecutively. Wet conditions in Water Year 2023 contributed to significant groundwater level recovery (approximately 16 feet).

TABLE 3: HYDROLOGIC CONDITIONS

Water Year	Sacramento Valley Index[8]	Sac Valley Water Year Type	Yolo Subbasin Precipitation[9]	Percent of Yolo County Average[10]	Annual Groundwater Change (Fall to Fall)
2019	10.2	Wet	29.22”	146%	+5 ft
2020	6.0	Dry	9.29”	46%	-4 ft
2021	3.8	Critical	7.05”	35%	-13 ft
2022	4.6	Critical	9.06”	45%	-5 ft
2023	9.3	Wet	29.63”	148%	+16 ft

4.2 GROUNDWATER ELEVATIONS AND STORAGE

Figure 2 displays the historical average depth to water in the representative monitoring network for Water Year 2023, which includes 62 Representative Monitoring Wells (RMWs). This historical average depth to water hydrograph covers Spring 1975 to Fall 2023. A dry Water Year 2020 prevented recovery of groundwater levels and stunted the 2020 irrigation season. Critical conditions in Water Years 2021 and 2022 led to very limited spring recovery and resulted in seasonal drawdowns of 18 feet and 17 feet, respectively. With wet hydrologic conditions, Water Year 2023 provided significant recovery in groundwater levels. Levels showed the second-highest fall-to-spring recovery on record, behind only that of Spring 1977, and seasonal drawdown was 6 feet.

Figure 3 and Figure 4 display the seasonal high and low groundwater elevation contours for Water Year 2023.

[8] http://cdec4gov.water.ca.gov/reportapp/javareports?name=WSI
[9] Determined with an area average using PRISM data for the Capay Valley and western foothills and readings from the Davis CIMIS Station for the eastern portion of the Subbasin.
PRISM: https://prism.oregonstate.edu/
CIMIS: https://cimis.water.ca.gov/
[10] 20.06” based on 1901-2000 NOAA Base Period: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance

FIGURE 2: YOLO SUBBASIN AVERAGE DEPTH TO WATER

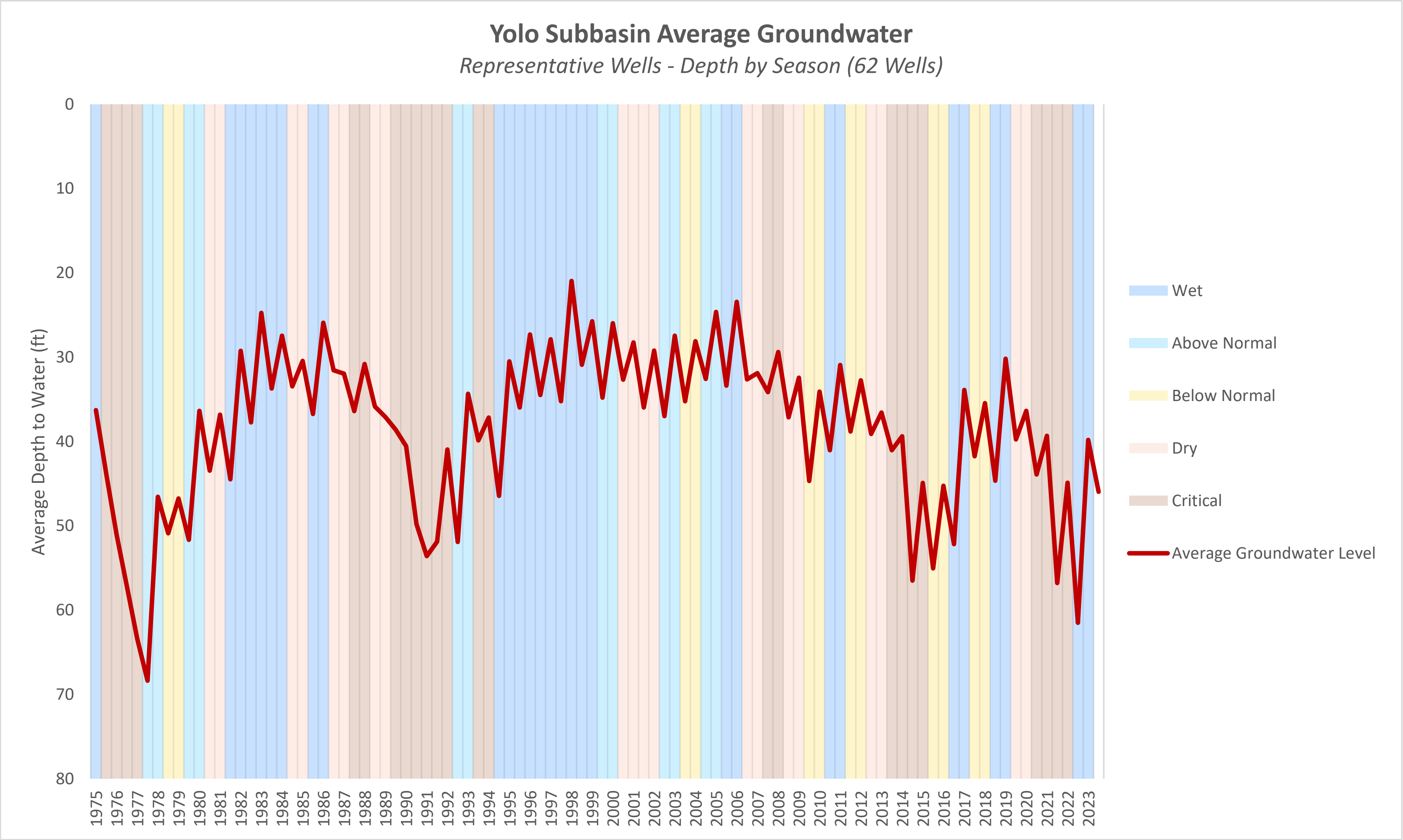
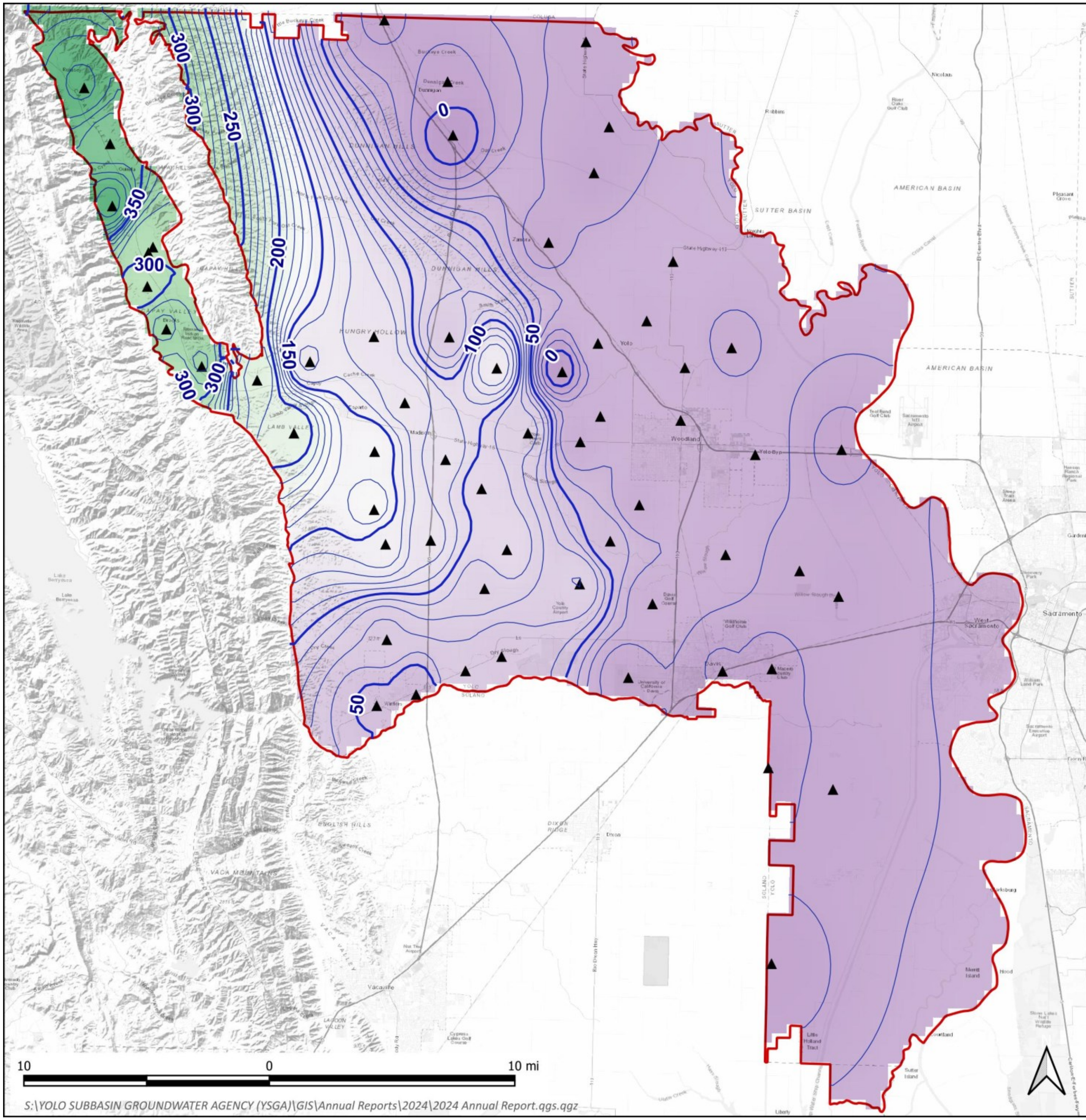


FIGURE 3: GROUNDWATER ELEVATION CONTOUR – SPRING 2023



GROUNDWATER ELEVATION SPRING 2023

Interpolated Groundwater Elevation
Feet MSL

- ▲ Representative Monitoring Well
- Yolo Subbasin Boundary
- Major
- Minor

Groundwater Elevation

+394 ft

-56 ft

CRS: NAD83 / California Albers

YOLO SUBBASIN
GROUNDWATER AGENCY

YOLO SUBBASIN GSP
ANNUAL REPORT 2024

FIGURE 4: GROUNDWATER ELEVATION CONTOUR – FALL 2023

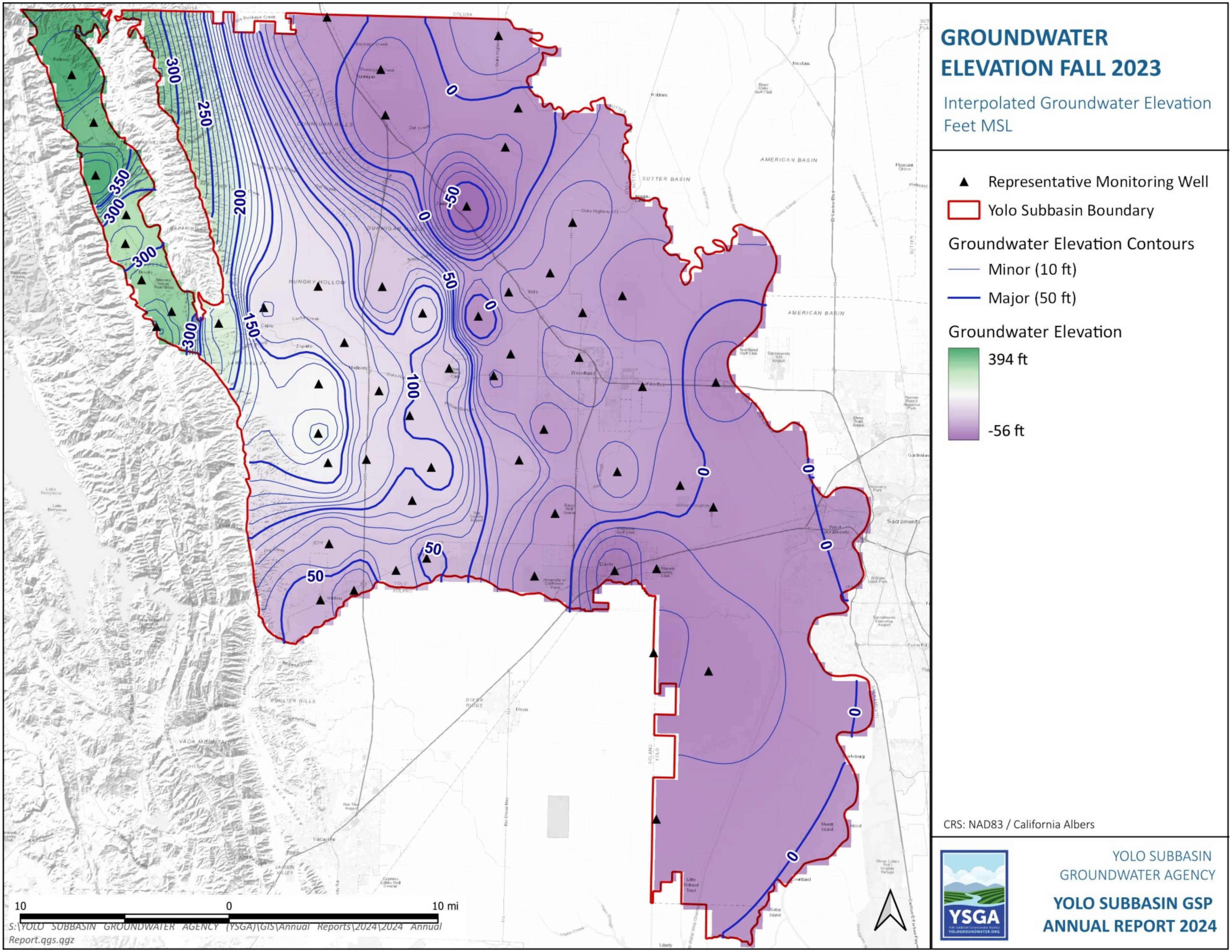


Table 5 through Table 9 show spring and fall groundwater elevation values in the RMWs for each management area and provide a comparison to the sustainable management criteria values as established in the Yolo Subbasin GSP. These RMWs, and the sustainable management criteria assigned to them, represent both the groundwater levels and groundwater storage sustainability indicators. The sustainable management criteria for groundwater elevation and storage are outlined in Table 4. No basin-wide undesirable results occurred during the 2023 Water Year according to these criteria.

Fall measurements in which the groundwater elevation fell below the minimum threshold value are highlighted in orange. One RMW exceeded the minimum threshold in Water Year 2023. Figure 5 provides a map of the water level in representative wells relative to the minimum threshold.

The last two columns in Table 5 through Table 9 provide the five-year (2019-2023) fall average groundwater elevation, and the difference in feet between the measurable objective value and the five-year average. Due to the recent historic drought, the 5-year running average groundwater level at most RMWs is currently below the measurable objective. However, Fall 2023 measurements in many wells recovered close to the measurable objective value. The individual hydrograph of each of these RMWs is provided in Attachment A.

Groundwater levels in the Capay Valley displayed significant recovery from the 2020-22 drought, with levels largely returning to normal and equal to or above the measurable objective. Clarksburg groundwater levels were largely unaffected by the drought and remain shallow as normal. In South Yolo, the western area along the County line has not displayed the recovery seen in the rest of the Management Area. Groundwater levels in North Yolo generally recovered to normal levels close to the measurable objective, except in the northwestern portion of the area near Dunnigan where some wells are showing a longer-term negative trend (RMWs 178, 431, and 411). In Central Yolo, groundwater levels made a significant recovery; most RMWs recovered to normal or slightly below normal levels and are approaching the measurable objectives. However, areas around Winters and along the western edge of the Management Area lacked the same recovery and some wells are showing a longer-term negative trend.

During Water Year 2023, no significant impacts such as groundwater dependent ecosystem health or emergency water shortages occurred. One dry well was reported in Fall 2023 and received temporary water assistance from Yolo OES.

While observed impacts and minimum threshold exceedances in Water Year 2023 were limited, the YSGA is still committed to ensuring groundwater sustainability and addressing the identified long-term water level declines in some monitoring wells. Groundwater recharge efforts in Central Yolo Management Area continued, and recharge expanded in the North Yolo Area. The YSGA also began working towards a delineation and policy framework for “Focus Areas” where groundwater level declines and stakeholder concerns are identified. Section 3.1.1 of this report provides more detail on these efforts.

TABLE 4: CHRONIC LOWERING OF GROUNDWATER LEVELS SUSTAINABLE MANAGEMENT CRITERIA

Undesirable Result Description	**Undesirable Result Criteria**	**Minimum Thresholds**		**Measurable Objectives**	**Interim Milestones**
The point at which significant and unreasonable impacts over the planning and implementation horizon, as determined by depth or elevation of groundwater, affect the reasonable beneficial use of, and access to, groundwater by overlying users.	Occurs when the MT criteria is exceeded in 51% or more of representative monitoring wells in two MAs.	Capay Valley	A well violates the minimum threshold when the groundwater elevation exceeds the historic (pre-2016) minimum elevation in the period of record of each Representative Well in two consecutive fall measurements.	Measurable objective is equal to the average fall (Sep.-Dec.) groundwater elevation for the Water Year period of 2000 to 2011 at each Representative Well. Performance of the measurable objective will be measured as the five (5) year running average of the minimum fall (Sep.-Dec.) groundwater elevation.	Interim milestones for the Chronic Lowering of Groundwater Levels are set equal to measurable objectives.
		Dunnigan Hills			
		Central Yolo			
		South Yolo			
		North Yolo	A well violates the minimum threshold when the groundwater elevation exceeds the historic minimum elevation in the period of record (pre-2016) of each Representative Well plus 20 percent of the depth between the historic maximum and historic minimum elevation for the period of record (pre-2016) of the Representative Well in two consecutive fall measurements.		
		Clarksburg	No minimum threshold has been established for the Clarksburg MA due to the lack of groundwater usage in the MA.	No minimum threshold has been established for the Clarksburg MA due to the lack of groundwater usage in the MA.	n/a

**Groundwater elevations are used as a proxy for the reduction of groundwater storage sustainability indicator. As such, the definition of undesirable results, minimum thresholds, measurable objectives, and interim milestones for the reduction of groundwater storage are based on and identical to those of the chronic lowering of groundwater levels sustainability indicator.*

TABLE 5: CAPAY VALLEY REPRESENTATIVE MONITORING WELL GROUNDWATER ELEVATIONS

State Well Number	Representative Well Number	Measurable Objective	Minimum Threshold	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5 yr Fall Average	Distance to Measurable Objective
DWR assigned well number	*YSGA GSP Well Number*	*Groundwater Elevation*	*Groundwater Elevation*	*Groundwater Elevation, ft. MSL* **** represents no measurement. The 2019-23 average will be calculated excluding missing measurements.*									*Fall 2019-Fall 2023*	*5-year average minus MO*
10N02W16R001M	276	215.0	207.7	216.7	216.2	214.6	214.2	211.2	215.2	209.9	218.1	218.3	214.1	-0.9
10N02W18F001M	277	315.6	304.2	318.5	317.8	325.9	314.8	311.2	314.8	312.2	322.2	317.9	317.2	1.5
10N03W02R002M	280	319.5	308.2	316.6	316.7	313.3	313.4	309.3	312.5	310.2	321.9	314.1	312.7	-6.8
11N03W09Q001M	285	383.7	355.8	384.9	389.3	382.3	381.6	377.6	387.4	382.4	393.9	385.2	382.5	-1.2
11N03W23L001M	287	296.0	287.6	298.9	298.7	298.2	***	285.9	298.6	286.0	301.6	***	292.2	-3.8
11N03W23N001M	288	287.3	271.0	298.3	297.5	294.5	289.3	284.4	297.4	286.7	301.3	290.3	290.9	3.6
11N03W33F001M	289	351.1	341.2	351.6	352.0	351.3	351.2	344.4	351.4	345.8	356.4	352.5	349.2	-1.9
12N03W20D001M	293	382.8	376.4	382.4	383.6	382.0	382.4	380.0	383.6	378.0	386.8	381.2	380.7	-2.1
11N03W35D003M	415	280.7	273.0	282.1	284.1	281.2	283.1	275.9	286.1	278.1	292.5	286.9	280.8	0.1
10N03W24B002M	416	324.8	281.1	343.7	339.6	327.2	326.6	310.4	305.2	303.1	298.0	340.7	325.0	0.2

TABLE 6: NORTH YOLO REPRESENTATIVE MONITORING WELL GROUNDWATER ELEVATIONS

State Well Number	Representative Well Number	Measurable Objective	Minimum Threshold	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5 yr Fall Average	Distance to Measurable Objective
DWR assigned well number	*YSGA GSP Well Number*	*Groundwater Elevation*	*Groundwater Elevation*	*Groundwater Elevation, ft. MSL* **** represents no measurement. The 2019-23 average will be calculated excluding missing measurements.*									*Fall 2019-Fall 2023*	*5-year average minus MO*
11N01E02D001M	127	-13.3	-88.3	-10.3	7.6	-27.2	5.6	-37.1	0.5	-33.1	10.4	-10.9	-23.7	-10.4
11N01E16P001M	128	-33.1	-129.8	-24.1	17.3	-25.9	10.5	-58.5	-8.0	-86.9	15.7	-56.3	-50.3	-17.3
12N01E03R002M	129	9.1	-44.3	3.5	19.2	-9.0	15.3	-32.8	16.3	-2.9	20.9	12.5	-5.8	-14.9
12N01E26A002M	131	-4.2	-46.1	-2.0	13.0	-12.5	5.6	-29.7	3.3	-8.6	12.8	-0.7	-10.7	-6.5
10N03E33B011M	153	3.8	-73.3	7.5	14.2	3.1	11.3	1.7	10.8	-23.4	18.0	-11.2	-4.5	-8.3
12N01W14M001M	178	10.5	-30.9	-7.5	10.8	-14.9	-5.9	-29.5	-33.7	-28.5	8.8	-10.4	-18.2	-28.7
12N01W26L002M	431	13.1	-43.8	-5.6	6.0	-16.3	-9.2	-35.3	-17.3	-41.7	-4.6	-16.4	-23.1	-36.2
10N01E02Q002M	251	32.1	-32.6	20.3	32.6	17.6	22.5	***	***	-6.4	29.1	21.4	13.2	-18.9
10N02E06B001M	405	26.0	-85.7	28.6	29.6	23.6	25.0	-8.1	15.6	1.7	23.9	20.5	13.2	-12.8
12N01W05B001M	411	49.5	-25.3	20.6	25.6	15.5	16.5	4.4	8.6	***	11.1	8.9	12.4	-37.2
10N02E09N001M	410	12.9	-63.7	23.0	28.0	17.1	23.2	-3.4	15.7	-11.3	25.6	16.2	8.3	-4.6
10N02E03R002M	420	12.2	-39.2	6.5	22.3	***	15.7	***	4.4	-36.7	22.0	5.4	-8.3	-20.5
11N02E20K004M	421	28.8	-31.6	29.5	32.9	26.8	29.1	20.9	24.4	17.1	28.9	23.3	23.5	-5.3

TABLE 7: CENTRAL YOLO REPRESENTATIVE MONITORING WELL GROUNDWATER ELEVATIONS

State Well Number	Representative Well Number	Measurable Objective	Minimum Threshold	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5 yr Fall Average	Distance to Measurable Objective
DWR assigned well number	*YSGA GSP Well Number*	*Groundwater Elevation*	*Groundwater Elevation*	*Groundwater Elevation, ft. MSL* **** represents no measurement. The 2019-23 average will be calculated excluding missing measurements.*									*Fall 2019-Fall 2023*	*5-year average minus MO*
08N02E15A002M	114	-25.1	-61.3	0.4	16.8	-9.6	10.0	-28.6	-15.8	-31.2	11.8	-31.2	-20.0	5.1
08N03E07N001M	132	-22.0	-78.0	***	***	***	***	-28.9	-7.5	-32.3	7.1	-16.0	-25.7	-3.7
09N03E33B002M	151	4.7	-35.3	3.6	15.0	-2.1	12.9	-4.2	11.4	-9.3	9.2	-4.0	-3.2	-8.0
08N02E18M002M	170	20.4	1.5	27.7	***	20.9	22.5	8.9	14.1	5.5	15.4	9.6	14.5	-5.8
08N01E07R001M	220	82.3	16.5	74.1	72.2	***	65.1	46.5	59.6	42.5	67.4	53.5	54.2	-28.1
08N01W09C001M	222	110.9	40.3	78.2	82.6	85.4	88.6	69.0	73.9	51.9	68.0	67.7	70.4	-40.5
08N01W13G003M	224	80.0	47.8	78.4	77.8	71.8	73.3	58.8	61.4	53.3	68.7	69.0	66.2	-13.7
08N01W20R005M	229	72.8	36.4	60.9	72.0	45.0	59.6	31.2	47.2	26.1	48.0	40.4	40.7	-32.1
10N01E34A003M	430	27.6	-47.4	28.0	35.5	18.6	25.9	***	11.1	***	***	9.4	18.7	-9.0
09N01E07D001M	231	111.1	68.3	104.7	104.5	99.2	97.2	76.5	93.0	75.7	96.5	99.5	91.1	-19.9
09N01E20E001M	233	104.8	67.1	106.0	105.0	105.7	98.9	91.7	94.7	85.7	99.6	104.4	98.7	-6.1
09N01E24D001M	234	52.2	7.6	49.5	47.3	45.3	40.7	29.1	36.4	27.4	43.4	38.7	38.0	-14.1
09N01E31D001M	235	104.6	68.3	106.1	100.7	101.8	92.6	70.9	79.0	64.8	84.3	91.5	87.0	-17.6
09N01W08Q001M	239	185.1	152.2	184.7	178.3	184.5	174.9	172.9	168.9	161.1	166.7	181.7	177.0	-8.1
09N01W21E001M	240	163.4	144.7	153.7	165.1	162.4	159.4	149.5	150.3	141.9	147.0	152.1	151.9	-11.4
09N02E07L001M	246	24.7	-45.4	18.4	28.2	***	23.4	-19.6	10.2	-26.8	20.4	5.0	-5.8	-30.4
09N02E32M001M	248	29.1	-7.0	27.1	32.7	21.6	27.2	-2.7	18.4	-18.1	24.4	6.2	6.8	-22.3
09N03E19R002M	250	6.7	-14.1	3.3	15.0	-0.6	12.9	-6.0	12.7	9.8	16.2	-3.7	0.6	-6.2
10N01E23Q002M	254	26.8	-43.0	31.7	37.7	23.0	29.6	-12.2	16.0	-25.0	25.6	18.1	7.1	-19.7
10N01E29K001M	256	77.8	58.4	81.8	80.8	80.2	79.5	77.2	79.4	77.5	83.2	81.5	79.6	1.8
10N01W08B001M	261	139.5	73.3	141.9	140.5	137.3	135.7	106.9	123.3	90.4	124.3	126.7	120.6	-18.9
10N01W21J001M	265	127.5	90.9	130.6	131.2	129.7	129.3	115.4	124.4	106.1	126.9	125.9	121.5	-6.0
10N01W32E001M	268	169.9	144.5	169.6	167.1	168.6	164.1	152.0	158.2	146.8	159.5	166.6	160.7	-9.2
10N01W35Q001M	269	120.5	93.0	124.0	116.2	123.3	110.0	104.8	113.4	98.8	117.1	120.6	114.3	-6.3
10N02W14A001M	275	137.8	91.1	138.4	138.8	137.2	134.1	104.8	125.4	91.3	128.6	129.7	120.3	-17.5
10N02W26P001M	279	241.7	212.7	219.7	221.4	211.2	***	***	207.7	207.0	208.5	***	212.6	-29.2
10N02E29A001M	406	35.7	9.9	35.9	37.4	***	***	***	26.5	23.7	26.9	26.6	28.7	-7.0
09N02E22H002M	400	22.9	-24.8	26.8	28.4	23.3	24.2	14.0	14.3	13.2	25.0	22.0	19.9	-3.0
10N02E36E001M	401	22.1	9.0	19.8	25.8	19.6	23.6	14.1	22.0	9.4	24.4	15.3	15.6	-6.5
09N01E26N001M	403	71.7	32.2	66.1	64.8	61.0	58.7	46.3	46.6	35.4	***	48.0	51.3	-20.4
09N01W23D001M	404	135.8	82.9	128.6	122.1	122.8	121.6	67.9	113.2	39.5	123.7	117.9	95.4	-40.4
08N01W22G500M	419	71.9	6.5	58.5	78.5	47.5	62.5	16.5	41.5	9.5	50.5	***	33.0	-38.9

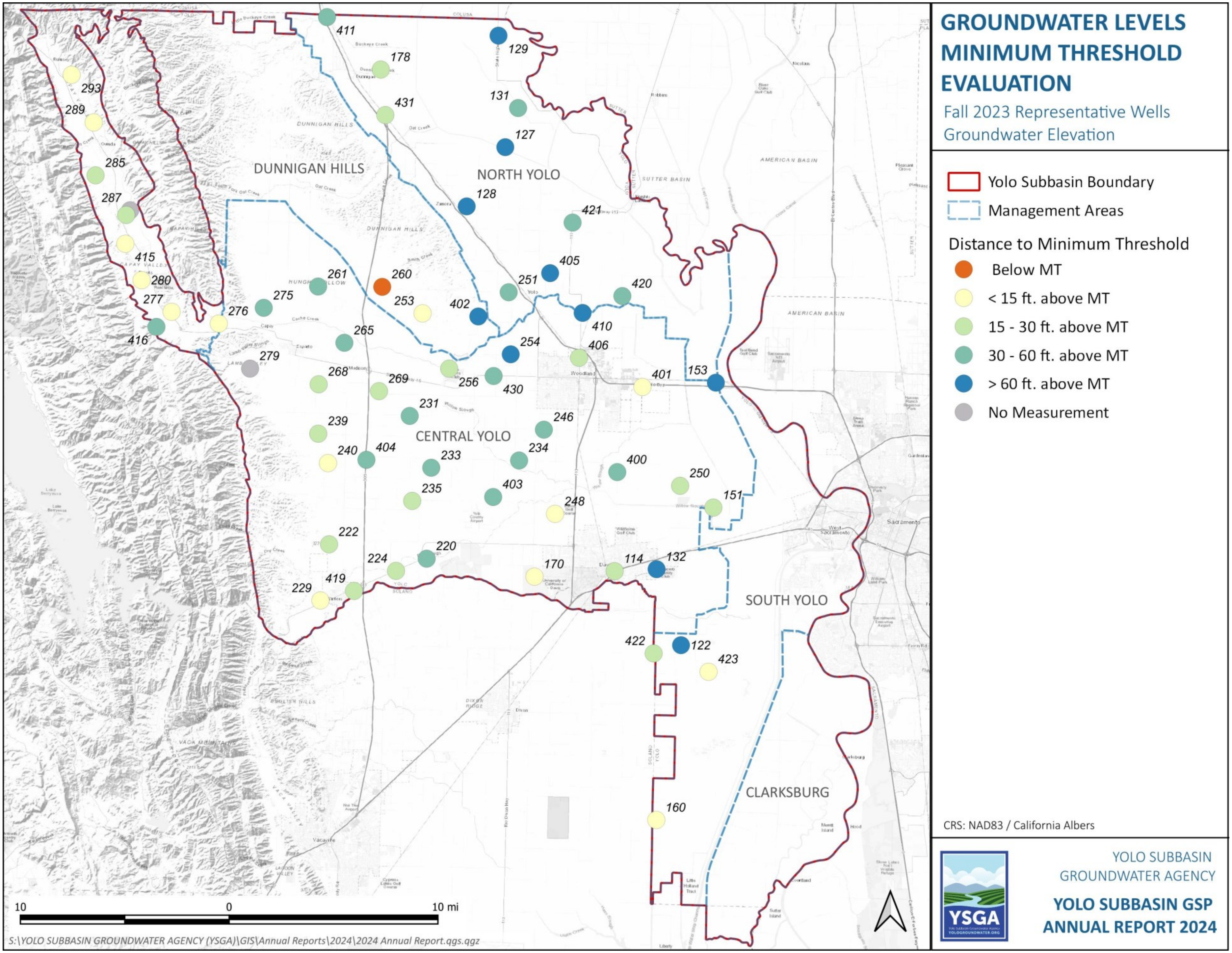
TABLE 8: SOUTH YOLO REPRESENTATIVE MONITORING WELL GROUNDWATER ELEVATIONS

State Well Number	Representative Well Number	Measurable Objective	Minimum Threshold	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5 yr Fall Average	Distance to Measurable Objective
DWR assigned well number	*YSGA GSP Well Number*	*Groundwater Elevation*	*Groundwater Elevation*	*Groundwater Elevation, ft. MSL *** represents no measurement. The 2019-23 average will be calculated excluding missing measurements.*									*Fall 2019-Fall 2023*	*5-year average minus MO*
08N03E32L001M	122	-1.9	-71.8	-56.5	8.8	-18.4	2.9	-31.1	-0.6	***	***	***	-35.3	-33.4
06N03E07M001M	160	9.9	-10.8	-2.0	12.2	-5.4	***	-7.0	4.7	-7.9	5.6	-6.4	-5.8	-15.6
08N03E31N001M	422	-7.0	-49.3	-9.0	2.9	-20.8	***	-34.2	-12.1	-40.3	0.8	-28.1	-26.5	-19.4
07N03E04Q001M	423	0.5	-27.1	-0.9	7.7	***	***	-7.7	7.4	-6.0	13.4	-14.4	-7.2	-7.8

TABLE 9: DUNNIGAN HILLS REPRESENTATIVE MONITORING WELL GROUNDWATER ELEVATIONS

State Well Number	Representative Well Number	Measurable Objective	Minimum Threshold	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5 yr Fall Average	Distance to Measurable Objective
DWR assigned well number	*YSGA GSP Well Number*	*Groundwater Elevation*	*Groundwater Elevation*	*Groundwater Elevation, ft. MSL *** represents no measurement. The 2019-23 average will be calculated excluding missing measurements.*									*Fall 2019-Fall 2023*	*5-year average minus MO*
10N01E18C001M	253	143.1	132.8	140.1	137.5	138.5	135.4	134.5	133.8	132.9	138.2	138.1	136.9	-6.2
10N01W02Q001M	260	128.3	73.6	86.0	91.0	79.8	78.4	46.2	71.6	46.1	73.2	73.0	66.2	-62.1
10N01E15D001M	402	17.5	-69.6	5.1	17.7	-2.3	7.4	-23.6	-9.6	-26.6	-7.0	-8.6	-11.2	-28.7

FIGURE 5: GROUNDWATER LEVELS MINIMUM THRESHOLD EVALUATION



4.3 GROUNDWATER QUALITY

Groundwater quality data for arsenic, boron, nitrate, and total dissolved solids (TDS) are summarized in Table 11, Figure 6, and Figure 7 below. Each figure visualizes measured values for each constituent in 2023 along with the percentage change in each constituent from 2021 to 2023 (where applicable). Groundwater quality measurements were aggregated from the SWRCB's Groundwater Ambient Monitoring and Assessment Program (GAMA) dataset[11]. Table 10 provides the sustainable management criteria for the water quality indicator as described in the Yolo Subbasin GSP.

YSGA plans to work with the technical team to revise the definition of undesirable results for degraded groundwater quality so that groundwater extractions and groundwater level minimum threshold exceedances are considered in the assessment of the undesirable results. Additionally, the YSGA will work with the technical team to evaluate whether all the water quality constituents of potential concern within the Subbasin should be incorporated into the GSP and have sustainable management criteria established.

TABLE 10: GROUNDWATER QUALITY SUSTAINABLE MANAGEMENT CRITERIA

Undesirable Result	Undesirable Result Criteria	Minimum Thresholds	Measurable Objectives	Interim Milestones
The point at which water quality is degraded to the extent of causing significant and unreasonable impacts from groundwater management actions in the Yolo Subbasin, that affect the reasonable and beneficial use of, and access to, groundwater by overlying users.	An undesirable result occurs when the minimum threshold criteria is exceeded in 50 percent or more of representative monitoring wells monitored for total dissolved solids.	A representative monitoring well violates the minimum threshold when the total dissolved solids concentration exceeds 1,000 ppm over a three (3) year rolling average.	A representative monitoring well violates the measurable objective when the total dissolved solids concentration exceeds 750 ppm over a three (3) year rolling average.	Interim milestones for the Degraded Water Quality are set equal to measurable objectives.

TABLE 11: WATER QUALITY EVALUATION

Constituent	Minimum Threshold	MCL/SMCL/NL[12]	Wells Sampled in WY 2023	# above MT	# above MCL/SMCL/NL
Arsenic	n/a	10 µg/L (MCL)	40	n/a	5
Boron	n/a	1 mg/L (NL)	8	n/a	1
Nitrate	n/a	10 mg/L (MCL)	122	n/a	12
TDS	1000 ppm	1000 ppm (SMCL)	25	0	0

[11] https://www.waterboards.ca.gov/gama/

[12] MCL – Maximum Contaminant Level; NL – Notification Level; SMCL – Secondary Maximum Contaminant Level

4.3.1 Arsenic

A total of 40 wells were measured for arsenic concentration in the Yolo Subbasin in 2023, and five wells exceeded the maximum contaminant level (MCL) of 10 µg/L. Of those five, three were in the Clarksburg Management Area, one was in the Dunnigan Hills Management Area, and one was within the Central Yolo Management Area (at the County central landfill). (Figure 6).

18 wells were measured for arsenic more than once between 2021 to 2023 and could be used to calculate percentage change in arsenic over that period. The largest single well increase was 59% from a well in the City of Davis, and 2 other wells within the City showed increases above 45%. None of these increases represents an exceedance of the MCL, as the most recent measured arsenic concentrations for each site are 4.1 µg/L, 7 µg/L, and 7.3 µg/L, respectively. The other major increase over this period did, however, translate to an exceedance of the arsenic MCL, as one of the wells in the Yolo Central Landfill area rose by 41% to a maximum of 14 µg/L in 2023 (Figure 7).

4.3.2 Boron

There is no established MCL for boron, but any measurement over 1 mg/L exceeds the California State Notification Level (NL). One well out of eight measured for boron in 2023 exceeded the notification level (Figure 6).

Three wells were measured for boron more than once between 2021 and 2023. A well in the City of Woodland was measured at 0.44 mg/L, which was over three times the level measured in 2022 but does not exceed the notification level (Figure 7).

4.3.3 Nitrate

122 wells were measured for nitrate at least once in 2023, and 12 of these wells exceeded the nitrate MCL of 10 mg/L. Wells that exceed the MCL are scattered in numerous places within the Yolo Subbasin, but many of them are clustered in rural areas on the outskirts of cities like Davis and Winters (Figure 6).

69 wells were measured for nitrate more than once between 2021 and 2023. It is difficult to determine a pattern in the rise and fall of nitrate concentrations within the Subbasin, as many wells with significant increases also have nearby wells with large decreases over the same period. The highest increases in nitrate concentrations were observed in the areas surrounding the City of Woodland and Esparto. Many wells in the Dunnigan area experienced declines in nitrate concentrations, as did several between Woodland and Davis (Figure 7).

4.3.4 Total Dissolved Solids

Of the 25 wells measured for TDS in the Subbasin during the 2023 Water Year, none exceeded the 1000 ppm TDS minimum threshold. All of the measured TDS concentrations were below the 750 ppm measurable objective in Water Year 2023, down from five that were above the measurable objective value in Water Year 2022 (Figure 6).

16 wells in the Subbasin were measured for TDS concentration more than once between 2021 to 2023 and could be used to calculate percentage change in TDS concentration over time. The largest TDS increase for a single well over the two-year period was 48%, and the largest decrease was -63%. The average percentage change throughout the whole Subbasin was an increase of about 4% (Figure 7).

FIGURE 6: WATER QUALITY – ARSENIC, BORON, NITRATE, AND TDS

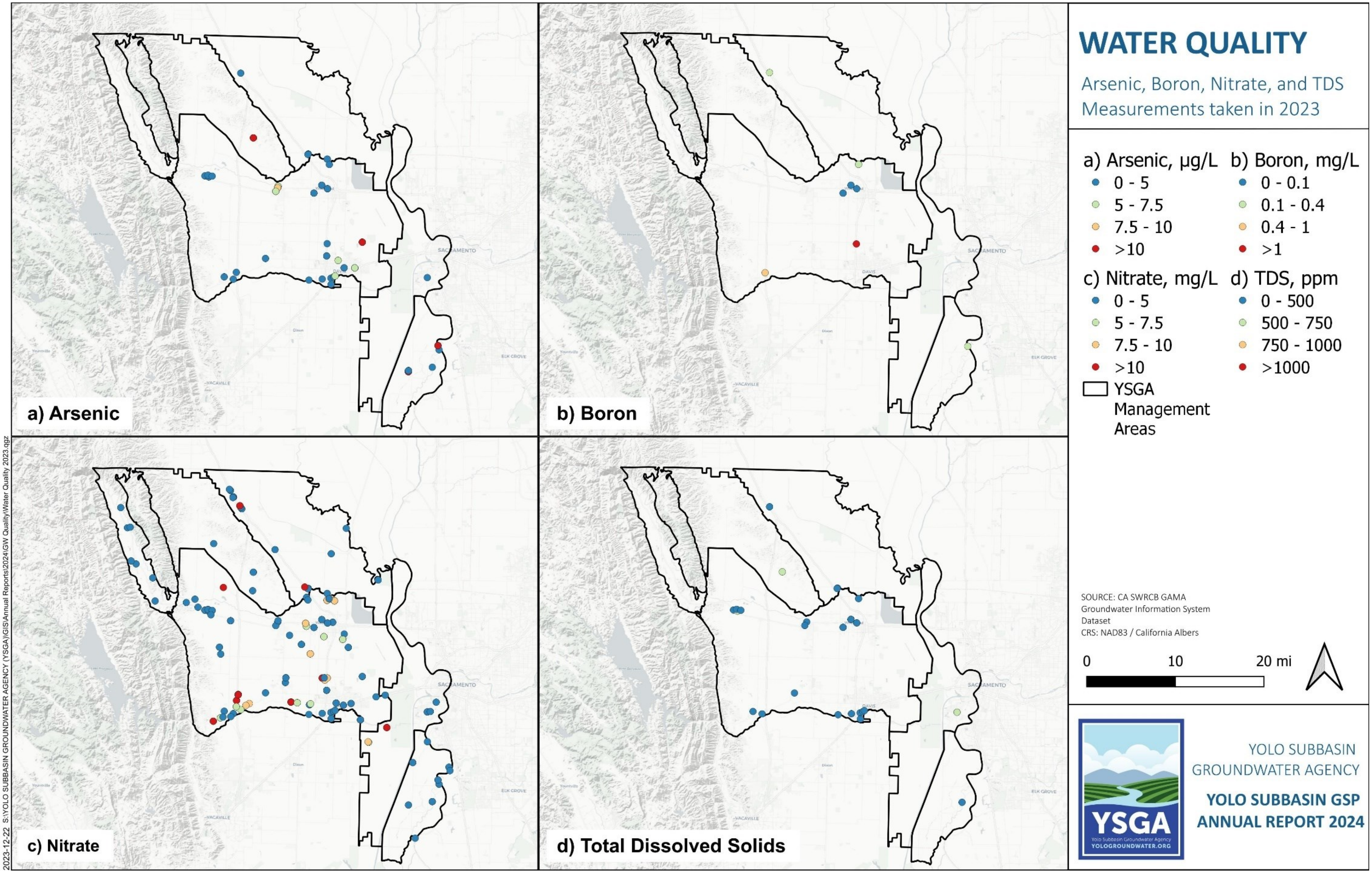
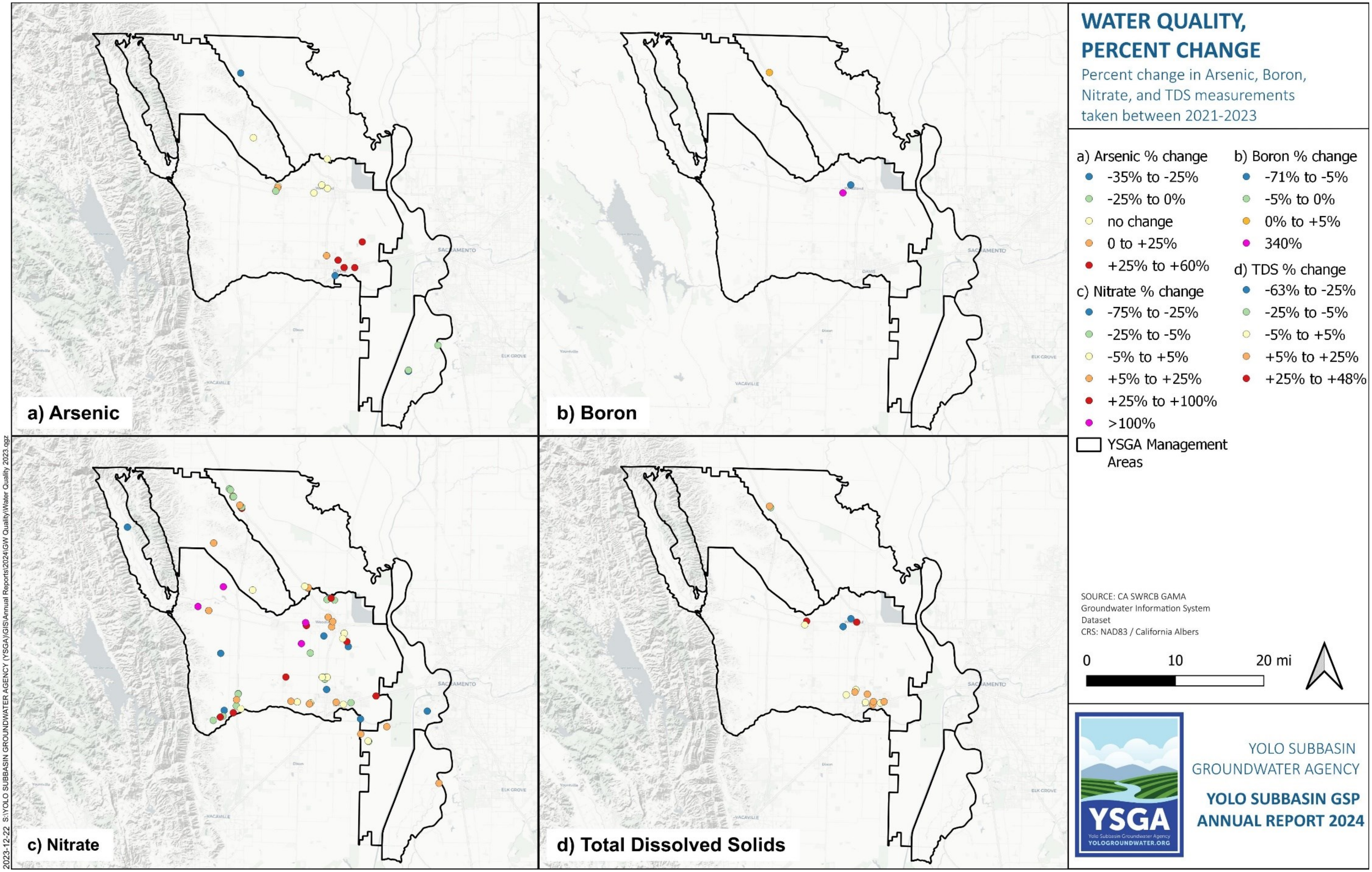


FIGURE 7: WATER QUALITY % CHANGE 2020-2023



4.4 LAND SUBSIDENCE

Land deformation occurs as both surface subsidence and surface uplifting, and the Yolo Subbasin experiences both processes. Historically, steady levels of subsidence have been documented in the eastern portion of the Central Yolo Management Area and almost the entire portion of the North Yolo Management Area. A slight amount of uplift has been observed in the western portion of the Central Yolo Management Area.

The source of the land subsidence data discussed below is the TRE Altamira InSAR Vertical Displacement dataset provided by DWR, available on SGMA Data Viewer[13]. This data uses radar data from the Sentinel-1 satellites to calculate changes in land surface elevation (known as vertical displacement). The reported statewide accuracy of the data is 18 mm, or 0.059 feet[14]. The dataset shows several pockets in the Yolo Subbasin where there are indications of subsidence and changes in the Subbasin's surface elevation.

Figure 8 shows the remotely sensed vertical displacement from Water Year 2023. A larger region of subsidence in the central portion of the Subbasin was newly detected in Water Year 2021. Deformation peaked in July 2022, with subsidence rates up to 0.4 ft/year in the areas of highest severity (County Road 95 between State Highway 16 and County Road 29, the southwestern base of the Dunnigan Hills, and the North Yolo Management Area east of the town of Dunnigan). Since July 2022, subsidence has largely stabilized, and the central portion of the Subbasin showed recovery (upward land movement) of approximately 0.1 feet in 2023.

Table 12 provides the sustainable management criteria for land subsidence designated in the Yolo Subbasin GSP. Land subsidence measurable objective values are to be evaluated against the rolling 3-year average vertical displacement. Figure 9 shows the calculated 3-year average vertical displacement between Water Years 2021 and 2023, and Figure 10 provides a comparison between this calculated value and the established measurable objective values. The newly observed region of subsidence in the center of the Subbasin, as well as the region east of Zamora, are the primary areas showing exceedance of the measurable objectives.

Minimum threshold values are evaluated against the rolling 5-year average vertical displacement. Figure 11 shows the calculated 5-year average vertical displacement between Water Years 2018 and 2023, and Figure 12 provides a comparison between this calculated value and the established minimum threshold values. The areas of highest severity (east of the town of Dunnigan, along the base of the Dunnigan Hills, and in the central portion of the Subbasin along Highway 16) are beginning to show exceedances of the minimum threshold values.

The YSGA will continue to monitor land subsidence in the coming years to differentiate whether the observed subsidence during the 2021-22 drought was elastic or inelastic. In addition, a ground-based GPS survey is scheduled for summer 2024 to provide on-the-ground confirmation of the InSAR data, and the YSGA will be soliciting technical assistance to revise the sustainable management criteria for land

[13] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer
[14] https://data.cnra.ca.gov/dataset/5e2d49e1-9ed0-425e-9f3e-2cda4a213c26/resource/a1949b59-2435-4e5d-bb29-7a8d432454f5/download/insar-data-accuracy-report-towill.pdf

subsidence in response to DWR's feedback on the GSP. The YSGA will work towards formally documenting the appropriate quantitative definition of undesirable results and re-evaluating the land subsidence minimum threshold to include a cumulative metric for evaluating significant and unreasonable impacts.

TABLE 12: LAND SUBSIDENCE SUSTAINABLE MANAGEMENT CRITERIA

Undesirable Result Description	Undesirable Result Criteria	Minimum Threshold*		Measurable Objective*	Interim Milestones
The point at which the rate and extent of subsidence in the Subbasin causes significant and unreasonable impacts to surface land uses or critical infrastructure.	An undesirable result occurs when the minimum threshold value is exceeded over 25 percent of the management or sub-MA in three (3) or more management or sub-MAs in the same reporting year.	Capay Valley	TBD	TBD	Interim milestones for Land Subsidence are set equal to measurable objectives that are generally equal to current levels of subsidence.
		Dunnigan Hills	1.8 cm/year	1.8 cm/year	
		East Central Yolo	2.5 cm/year	2.5 cm/year	
		West Central Yolo	1.8 cm/year	1.8 cm/year	
		South Yolo	0.0 cm/year	0.0 cm/year	
		North Yolo	3.0 cm/year	3.0 cm/year	
		Clarksburg	0.0 cm/year	0.0 cm/year	
**Minimum threshold values are based on a 5-year running average, while measurable objective values are based on a 3-year running average*					

FIGURE 8: VERTICAL DISPLACEMENT – WATER YEAR 2023

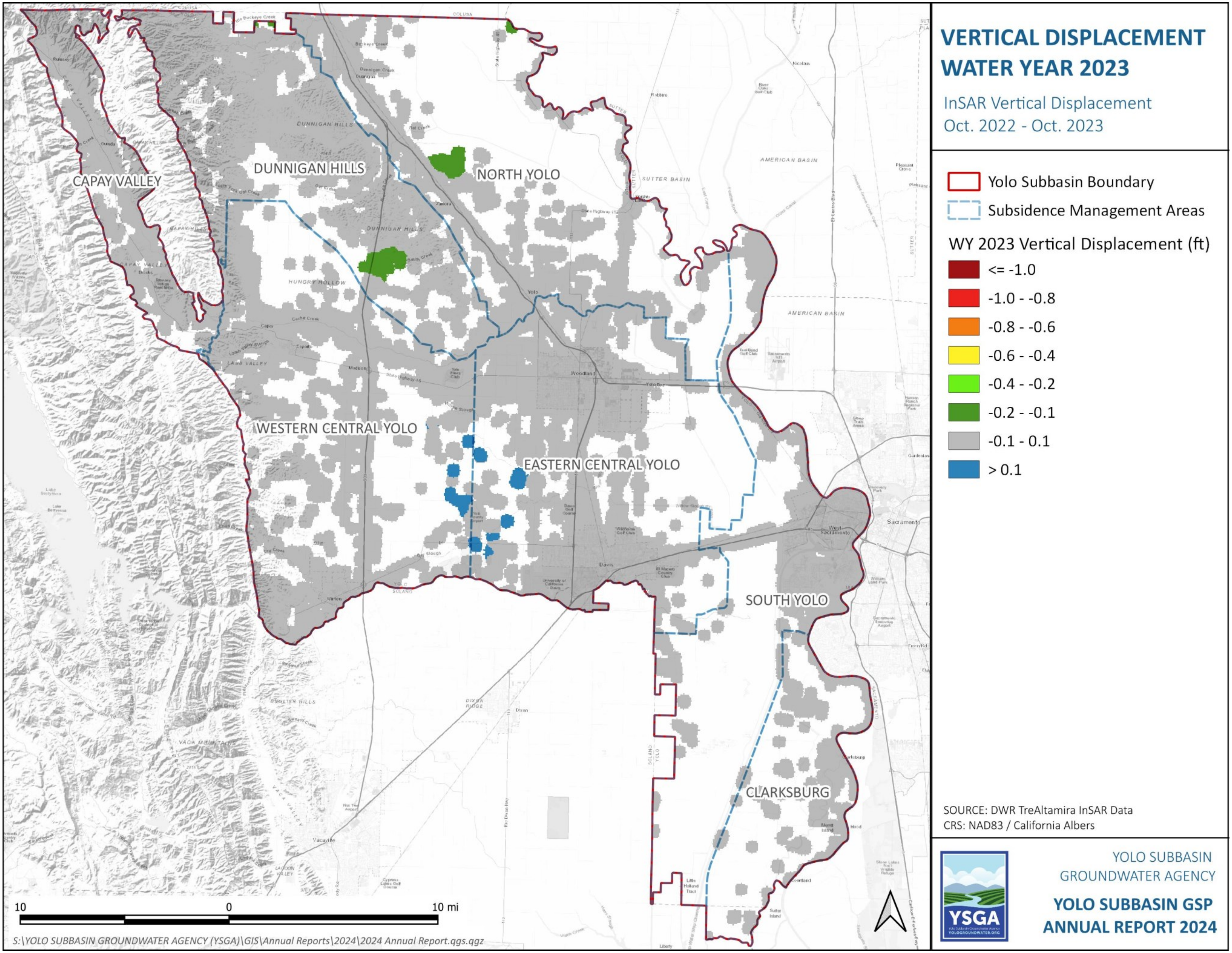


FIGURE 9: VERTICAL DISPLACEMENT – 3 YEAR AVERAGE

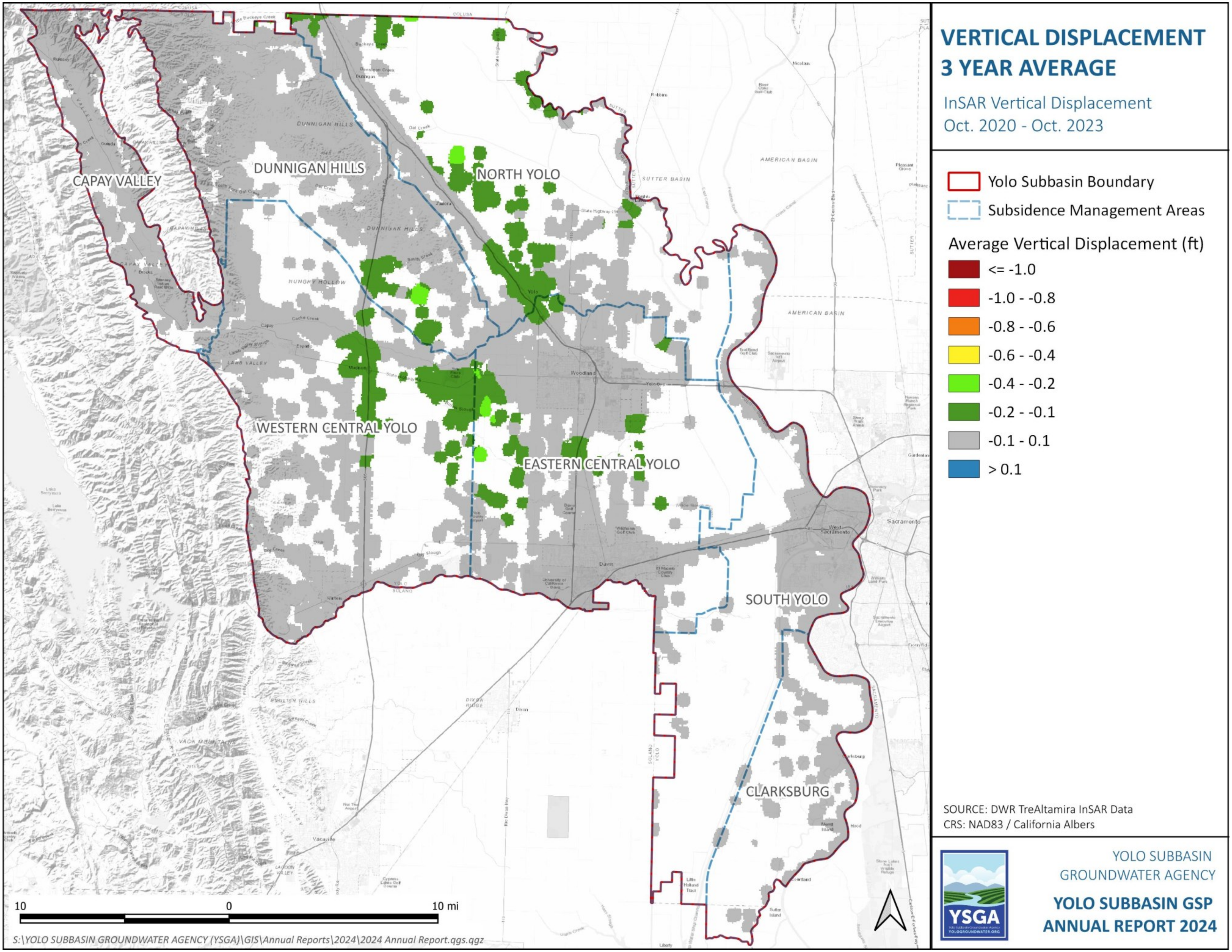


FIGURE 10: LAND SUBSIDENCE MEASURABLE OBJECTIVE EVALUATION

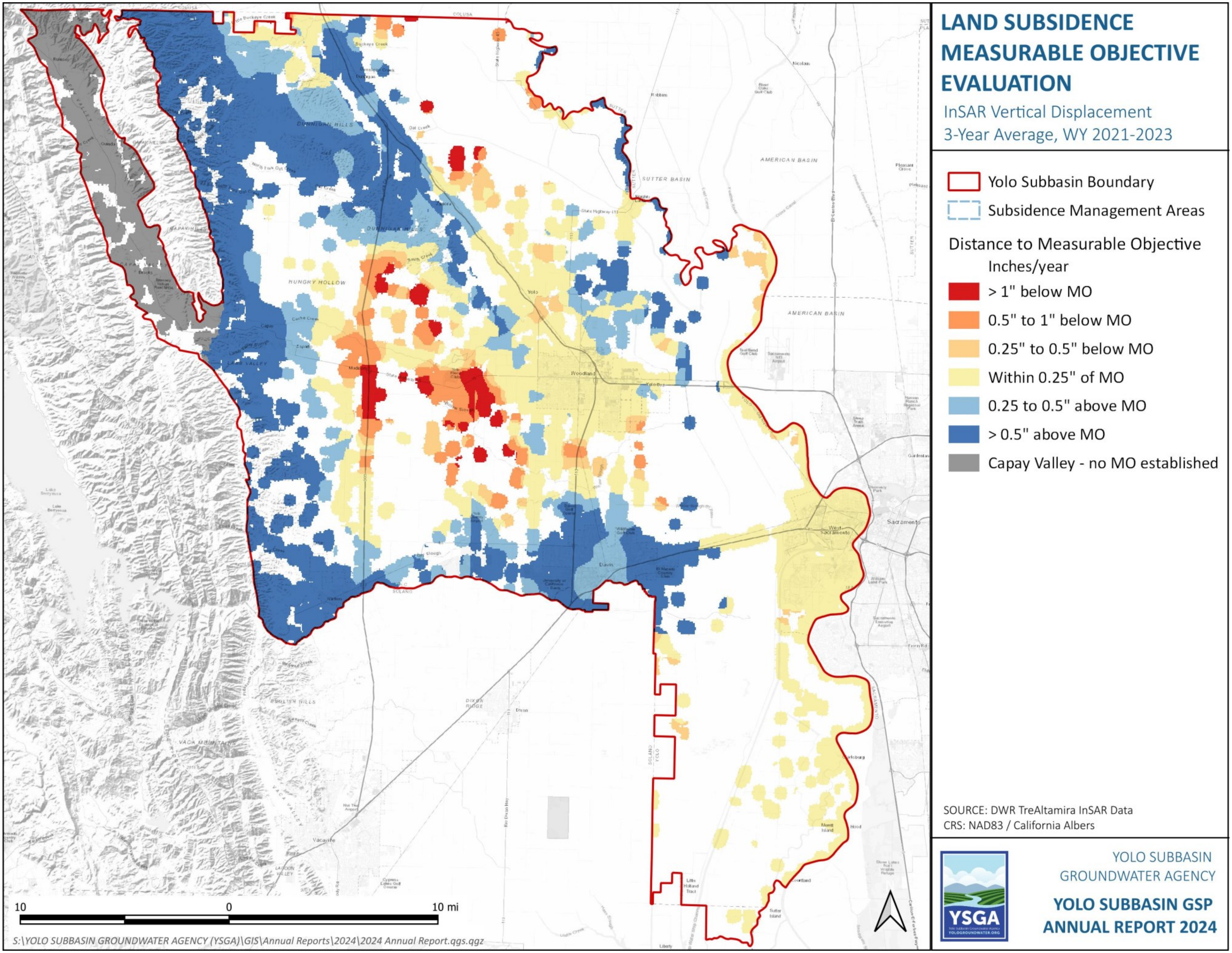


FIGURE 11: VERTICAL DISPLACEMENT – 5 YEAR AVERAGE

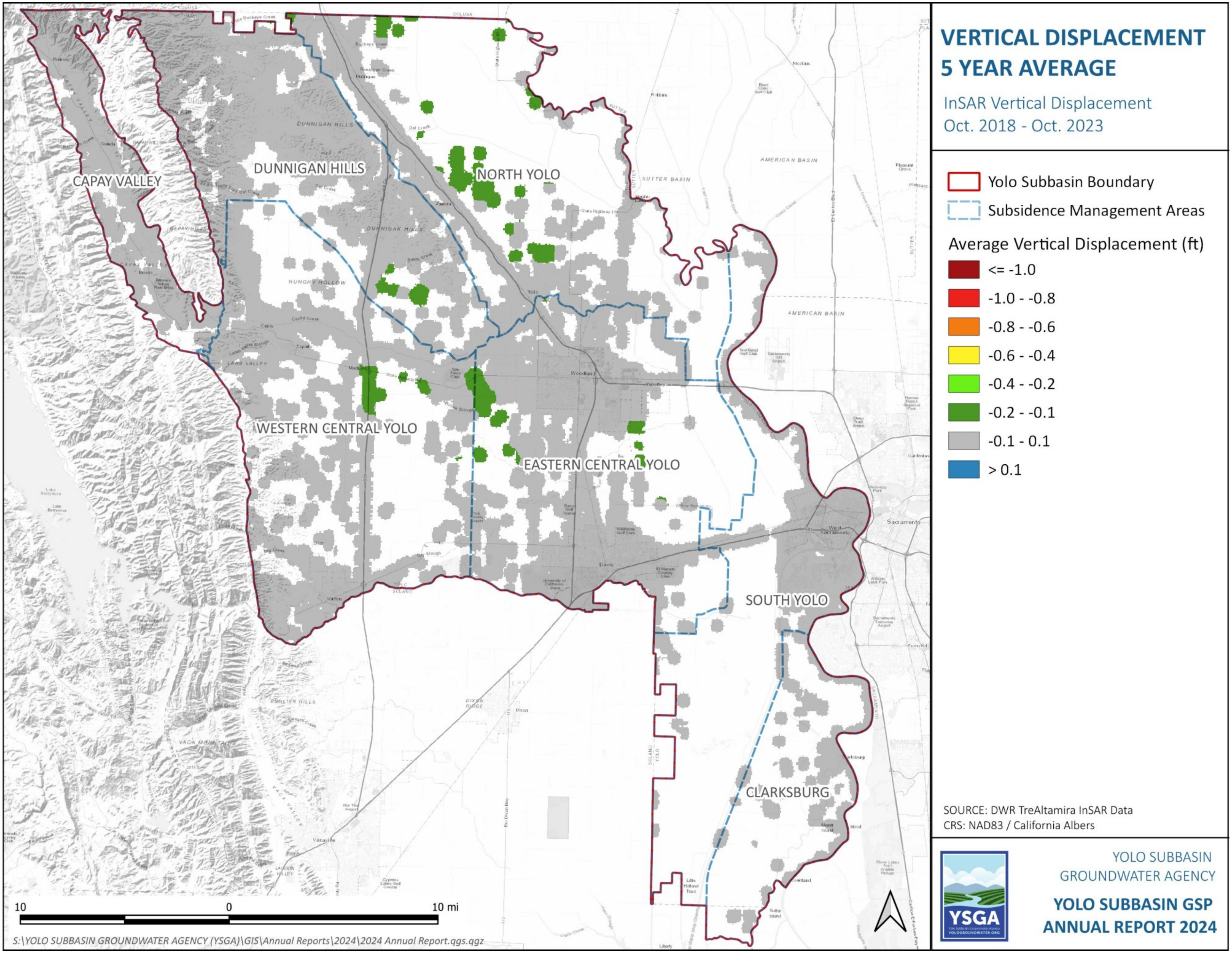
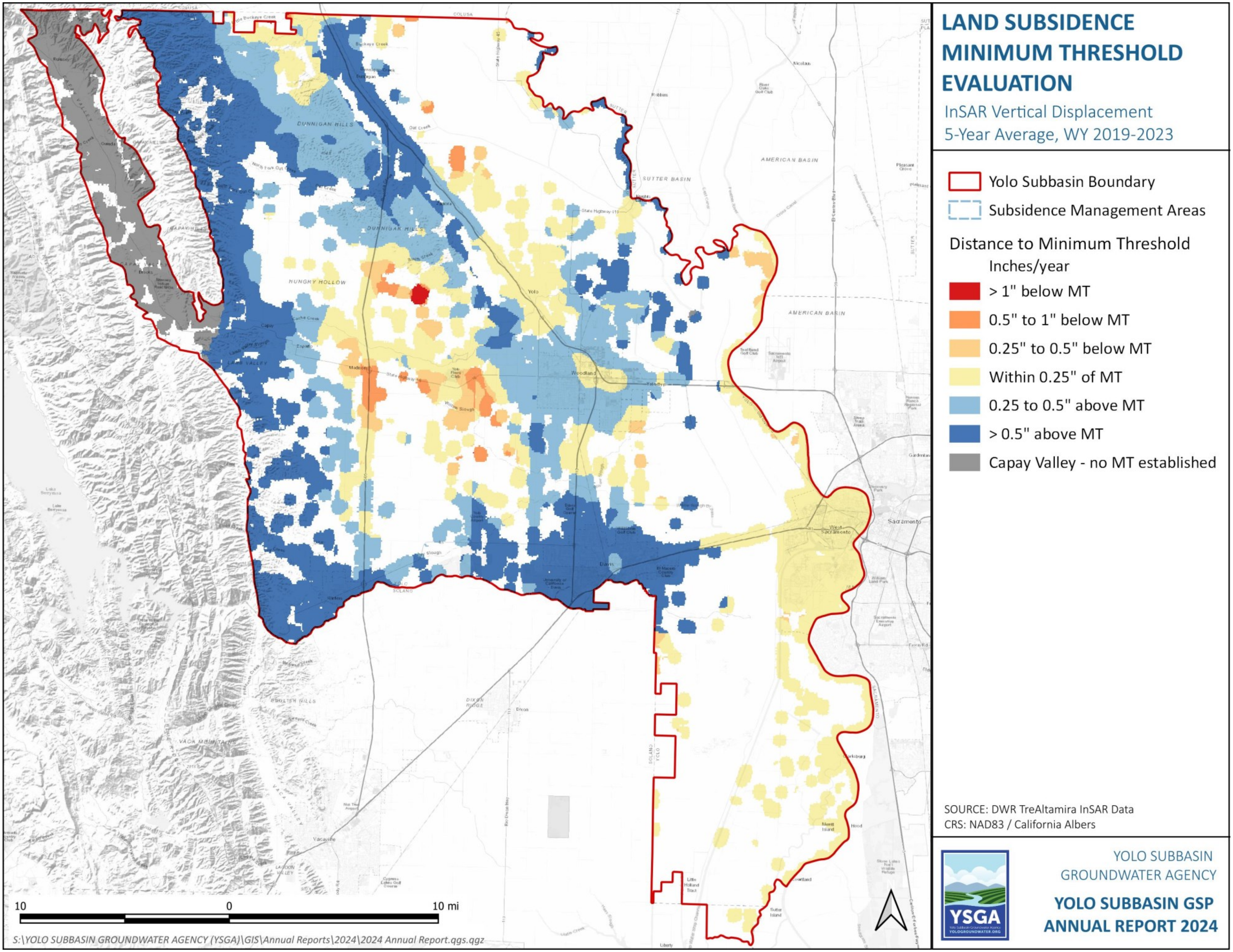


FIGURE 12: LAND SUBSIDENCE MINIMUM THRESHOLD EVALUATION



4.5 INTERCONNECTED SURFACE WATERS

The Yolo Subbasin GSP designates minimum thresholds for the depletion of major interconnected surface water bodies in the Yolo Subbasin as outlined in Table 13.

Groundwater levels in RMWs for Upper Cache Creek, Upper Sacramento River, Lower Sacramento River, and Putah Creek are compared to the minimum thresholds in Table 14. During the critical conditions of Water Year 2022, there was one minimum threshold exceedance at Upper Cache Creek (Well 287) and one exceedance at Putah Creek (Well 229). The groundwater elevation in Well 229 recovered above the minimum threshold following heavy rainfall in Water Year 2023. Well 287 was not measured in Fall 2023 due to pumping at the well, so its minimum threshold status is unknown.

Table 15 provides a comparison of representative groundwater levels around Lower Cache Creek to the minimum threshold value. Each well must remain below the minimum threshold value for seven years to violate its minimum threshold. Two wells (424 and 425) exhibited enough recovery in spring 2023 to no longer exceed the minimum threshold value. Three wells remain below the minimum threshold value in Water Year 2023 – two have exceeded for four years, and one has exceeded for three years.

Table 14 and Table 15 also provide a comparison of the five-year running average of spring groundwater elevations to the measurable objectives. Due to recent historic drought conditions in 2020-22, 5-year spring averages in all but one well are currently below the measurable objective. However, Spring 2023 levels in most wells recovered to, or close to, the measurable objective value. The individual hydrographs of each of these wells are provided in Attachment B.

TABLE 13: INTERCONNECTED SURFACE WATER SUSTAINABLE MANAGEMENT CRITERIA

<table>
<tr><th>Undesirable Result Description</th><th>Undesirable Result Criteria</th><th colspan="2">Minimum Thresholds</th><th>Measurable Objectives</th><th>Interim Milestones</th></tr>
<tr><td rowspan="5">The point at which significant and unreasonable impacts to the surface waters affect the reasonable and beneficial use of those surface waters by overlying users, including associated ecosystems.</td><td rowspan="5">An undesirable result occurs when the Minimum Threshold is exceeded in over 50 percent of the interconnected surface water representative monitoring wells in two (2) or more interconnected surface water MAs in the same reporting year.</td><td>Lower Cache Creek</td><td>The recurrence of the spring (March-May) average measurement for 1975 to present in at least one spring in every seven (7) years.</td><td rowspan="5">Equal to the average spring (March-May) groundwater elevation for Water Years 2000-2011 at the RMW. Performance of the Measurable Objective will be measured as the five (5) year running average of the maximum spring (March-May) groundwater elevation.</td><td rowspan="5">Set equal to measurable objectives that are generally equal to current conditions.</td></tr>
<tr><td>Upper Cache Creek</td><td rowspan="3">Equal to the minimum elevation for the period of record at the RMW, exceeded in 2 consecutive years.</td></tr>
<tr><td>Putah Creek</td></tr>
<tr><td>Lower Sacramento River</td></tr>
<tr><td>Upper Sacramento River</td><td>Exceedance of the historic minimum elevation in the period of record of each RMW plus 20 percent of the depth between the historic maximum and historic minimum elevation for the period of record of the RMW in 2 consecutive years.</td></tr>
</table>

TABLE 14: INTERCONNECTED SURFACE WATERS REPRESENTATIVE GROUNDWATER ELEVATIONS

ISW Management Zone	State Well Number	Representative Well Number	Measurable Objective Value	Minimum Threshold Value	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	5-year Spring Average	Distance to Measurable Objective
Upper Cache Creek	11N03W23L001M	287	298.7	287.6	298.5	301.0	298.9	298.7	298.2	***	285.9	298.6	286.0	301.6	***	300.0	1.3
Upper Cache Creek	11N03W33F001M	289	354.3	341.2	351.5	356.2	351.6	352.0	351.3	351.2	344.4	351.4	345.8	356.4	352.5	353.5	-0.8
Upper Cache Creek	12N03W20D001M	293	385.2	376.4	383.4	387.1	382.4	383.6	382.0	382.4	380.0	383.6	378.0	386.8	381.2	384.7	-0.5
Upper Sac River	10N02E03R002M	420	23.9	-39.2	-9.8	31.8	6.5	22.3	***	15.7	***	4.4	-36.7	22.0	5.4	19.2	-4.7
Upper Sac River	12N01E03R003M	427	29.3	-35.4	14.1	28.7	14.7	23.4	6.4	20.6	-26.7	18.6	-19.5	24.3	14.5	23.1	-6.2
Upper Sac River	11N02E20K004M	421	33.5	-31.6	25.7	33.4	29.5	32.9	26.8	29.1	20.9	24.4	17.1	28.9	23.3	29.7	-3.7
Lower Sac River	09N03E33B002M	151	15.7	-35.3	4.8	19.0	3.6	15.0	-2.1	12.9	-4.2	11.4	-9.3	14.1	-4.0	14.4	-1.3
Lower Sac River	10N02E36E001M	401	26.8	9.0	20.4	28.7	19.8	25.8	19.6	23.6	14.1	22.0	9.4	24.4	15.3	24.9	-2.0
Lower Sac River	08N04E19N001M	428	8.7	-1.3	3.3	11.2	3.5	7.5	2.0	6.9	2.0	7.1	1.4	10.0	3.7	8.6	-0.2
Putah Creek	08N02E18M002M	170	29.7	1.5	15.5	30.1	23.5	***	13.5	22.5	8.9	14.1	5.5	15.4	9.6	20.5	-9.1
Putah Creek	08N01W20R005M	229	91.6	36.4	44.7	75.4	60.9	72.0	45.0	59.6	31.2	47.2	26.1	48.0	40.4	60.5	-31.2
Putah Creek	08N01E17F001M	429	76.0	56.1	63.2	78.5	66.6	***	63.7	64.4	***	***	***	62.6	61.6	68.5	-7.5

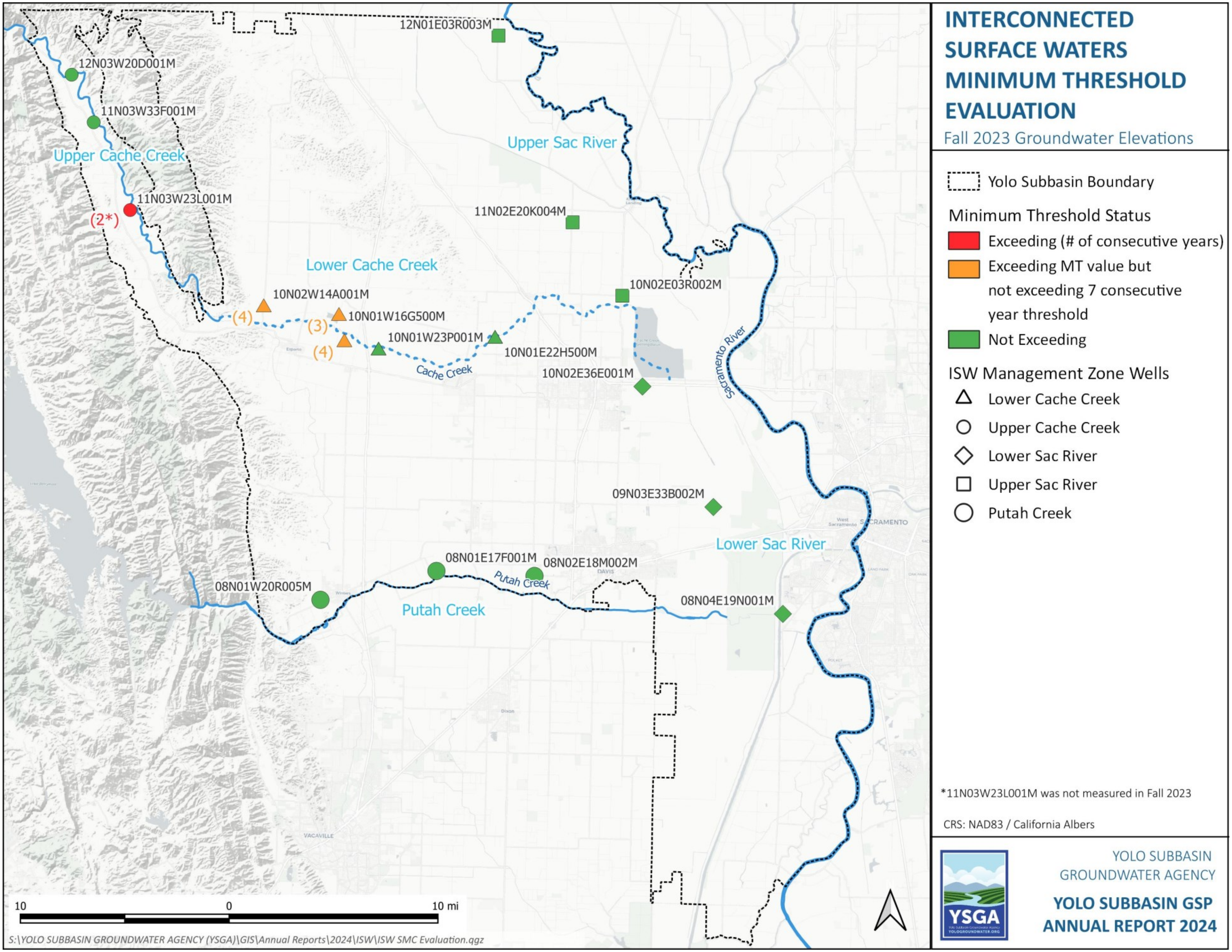
****Missing measurement. The 2019-23 average will be calculated excluding missing measurements.*

TABLE 15: LOWER CACHE CREEK REPRESENTATIVE GROUNDWATER ELEVATIONS

ISW Management Zone	State Well Number	Representative Well Number	Measurable Objective Value	Minimum Threshold Value	Fall 2018	Spring 2019	Fall 2019	Spring 2020	Fall 2020	Spring 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023	Years Below MT Value	5-year Spring Average	Distance to Measurable Objective
Lower Cache Creek	10N01W21J001M	265	132.7	131.6	127.5	137.0	130.6	131.2	129.7	129.3	115.4	124.4	106.1	126.9	125.9	4	129.8	-3.0
Lower Cache Creek	10N02W14A001M	275	145.4	143.2	136.0	148.7	138.4	138.8	137.2	134.1	104.8	125.4	91.3	128.6	129.7	4	135.2	-10.3
Lower Cache Creek	10N01W23P001M	424	115.8	116.7	113.4	118.4	***	112.2	111.8	115.7	106.3	114.1	***	116.8	112.9	0	115.5	-0.3
Lower Cache Creek	10N01E22H500M	425	61.2	55.1	52.8	65.5	53.1	57.3	54.4	50.1	38.4	41.2	***	58.8	58.6	0	54.6	-6.6
Lower Cache Creek	10N01W16G500M	426	138.0	132.6	129.6	139.5	133.0	133.0	129.5	130.2	102.7	123.2	102.8	127.1	125.8	3	130.6	-7.4

****Missing measurement. The 2019-23 average will be calculated excluding missing measurements.*

FIGURE 13: INTERCONNECTED SURFACE WATERS MINIMUM THRESHOLD EVALUATION



5. WATER BUDGET ASSESSMENT

An assessment of the Yolo Subbasin water budget was conducted using the YSGA Model developed by Stockholm Environment Institute (SEI). Additional details about the YSGA Model can be found in the Water Budget[15] and Model Documentation[16] Appendices to the Yolo Subbasin GSP.

This annual report contains estimated acre-feet values for four metrics: surface water diversions, groundwater extraction, total water use, and change in groundwater storage. The line-by-line water budget numbers are provided in Table 16. Values are reported in acre-feet (AF) and rounded to the nearest hundred AF. The following sections provide an explanation of the reasoning and methodology in providing these estimates, referencing the row number on the left of the table for ease of understanding. For further details on each calculation, please see the referenced section.

TABLE 16: WATER BUDGET SUMMARY

	Variable	WY 2019	WY 2020	WY 2021	WY 2022	WY 2023	See Text
1	Agricultural SW Diversion	466,700	482,900	334,300	185,700	472,300	5.4.2
2	Agricultural GW Extraction	256,300	214,700	341,400	308,800	230,300	5.5.2
3	Agricultural Managed Recharge	5,600	0	0	200	6,800	5.6.1
4	Agricultural Total Water Use	723,000	697,600	675,700	494,500	703,500	5.7
5	Urban SW Diversion	29,700	31,800	27,900	29,700	28,700	5.4.1
6	Urban GW Extraction	10,200	12,900	17,900	12,500	12,800	5.5.1
7	Urban Aquifer Storage	2,200	2,400	1,400	2,600	1,800	5.6.2
8	Urban Total Water Use	39,800	44,700	45,800	42,100	41,500	5.7
9	Total SW Diversion	496,000	514,800	362,200	215,400	502,000	5.4.3
10	Total GW Extraction	266,500	227,500	359,400	321,300	243,100	5.5.3
11	Total Managed Recharge	7,800	2,400	1,400	2,800	8,600	5.6
12	Total Water Use	762,800	742,300	721,500	536,700	745,100	5.7

5.1 ACCURACY ESTIMATE

Table 17 provides the estimated accuracy of each data source. To estimate changes in groundwater storage and other water budget components, several different data sources were compiled. Each of these data sources have some level of uncertainty. The table below qualitatively describes the estimated

[15] https://www.yologroundwater.org/files/cc7d08fed/Yolo+GSP_AppendixF.pdf
[16] https://www.yologroundwater.org/files/b90061148/Yolo+GSP_AppendixE.pdf

accuracy for the model inputs used for climate data, stream flows, surface water diversions, reservoir storage, and land use.

TABLE 17: DATA SOURCES AND ACCURACY

Variable	Data Source	Certainty
Climate	CIMIS[17], PRISM[18]	Medium
Stream Flows	USGS[19]	High
Surface Water Diversions	eWRIMS[20], Direct Reporting	Medium
Reservoir Storage	CDEC[21]	High
Groundwater Levels	YSGA	High
Land Use	See Section 5.3	Medium-Low

The largest source of uncertainty is land use data and irrigation applications. Assumptions using the best available data and methods were used to estimate land use in Water Years 2020, 2021, and 2022. Modeled water use estimates are highly sensitive to changes in land use and to assumptions about whether crops are fully irrigated or not. Conversations with growers and USDA staff in the first quarter of 2024, plus intensive investigation of OpenET[22], seem to confirm that there is a wide variation in water application on orchards and alfalfa. On many large orchards, less water is applied than the typical crop coefficient-based, full application rates would suggest. Irrigation of alfalfa is highly variable, depending on market demand and water availability.

In addition, there is significant uncertainty with estimating surface water diversions. Because the SWRCB's reporting deadline for Water Year 2023 was February 1, 2024, data for Water Year 2023 may be incomplete. Data for Water Year 2023 was last downloaded for this report on February 29, 2024. In addition, Water Year 2022 data was re-downloaded for this report to capture late reports, resulting in an additional 48,000 AF of surface water diversions than was reported in the Water Year 2022 Annual Report.

5.2 MODEL CALIBRATION

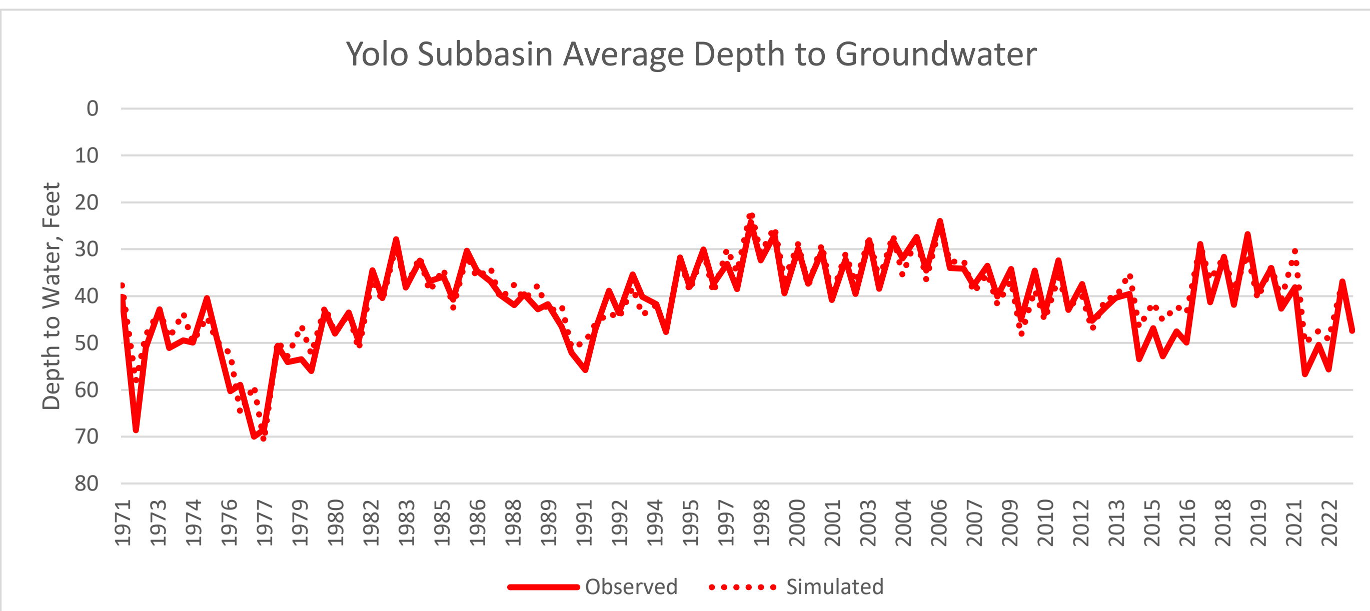
As part of this report, additional calibration was performed to improve model estimates relative to observed conditions. Before calibration, the model showed unexpected declines in groundwater storage and groundwater levels that were not reflective of reality. For this reason, the following adjustments were made to model parameters. Because of this additional calibration, numbers reported in this report differ from those reported in previous reports. Figure 14 provides the results of this calibration. Modeled groundwater levels track closely with the average groundwater level hydrograph provided in Figure 2.

[17] https://cimis.water.ca.gov/
[18] http://www.prism.oregonstate.edu/explorer/
[19] https://waterdata.usgs.gov/nwis/sw
[20] https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrims/
[21] https://cdec.water.ca.gov/
[22] https://etdata.org/

- Changes to land use:
    - Adjusted 'young perennial' classification based on the "Year Planted" field provided by LandIQ. Acreages were adjusted for each year going back to the first year that LandIQ data was incorporated into the model (2014) so as not to confuse differing crop acreage sources. Acreage figures were adjusted based on the age of the tree crop (less than 5 years old for almonds and walnuts, and less than 8 years old for pistachios), which was validated in conversations with LandIQ developers and orchard managers in the Subbasin. These orchards are immature and do not use as much water as fully developed tree crops.
    - Compared modeled ET estimates to ET estimates provided by OpenET for alfalfa, almonds, other deciduous, tomato, winter grain, and young perennial. OpenET was found to be significantly lower than modeled ET estimates for the alfalfa, almond, other deciduous, and young perennial categories. After discussions with local growers, they concurred that the OpenET values were likely more accurate. For this reason, irrigation management parameters were adjusted for alfalfa and orchards starting in 2018 to allow soil moisture to decrease below the management allowable depletion, resulting in reduced ET and modeled ET estimates closer to those of OpenET.

- Precipitation: During analysis of model results, it was observed that the model showed little groundwater level recovery during WY 2019. This was in contradiction to the large recovery seen in the observation wells. Analysis of the precipitation input data revealed that the PRISM data in the eastern portion of the Subbasin, for WY 2018 – WY 2022, were unusually dry when compared to nearby CIMIS data. For this reason, the model now uses CIMIS derived precipitation data for WY 2018 – WY 2022 in the eastern portion of the Subbasin.

FIGURE 14: OBSERVED VS SIMULATED AVERAGE GROUNDWATER LEVELS



5.3 LAND USE ESTIMATES

Water Year 2019 land use was modeled using DWR's 2019 Statewide Cropping[23] dataset. For Water Years 2020 and 2021, land use was modeled using GIS data from the County of Yolo[24], along with corrections from local agencies. 2022 land use was initially kept constant with 2021 land use; corrections were then provided by local agencies to reflect significant fallowing that occurred in 2022. 2023 land use data was purchased from LandIQ.

Table 18 provides the modeled acreage of each major land use type for 2019-2023. Land use is used to estimate actual agricultural evapotranspiration (ET_a) using the MABIA Method[25], which represents the amount of water consumed by crops.

TABLE 18: ESTIMATED LAND USE 2019-2023

	2019	2020	2021	2022	2023
	Acres	*Acres*	*Acres*	*Acres*	*Acres*
Native Vegetation & Fallow Land	**334,777**	**367,005**	**384,482**	**418,292**	**314,804**
Urban	**35,460**	**35,460**	**35,460**	**35,460**	**29,506**
Open Water	**5,372**	**5,372**	**5,372**	**5,372**	**5,372**
Total Irrigated Acres	**263,481**	**231,253**	**213,776**	**179,966**	**289,408**
Deciduous Fruits & Nuts	70,946	76,113	69,504	65,987	78,193
Field Crops	30,572	33,221	25,744	16,517	24,538
Grain	19,658	19,585	23,506	20,137	49,184
Managed Wetlands	55	55	55	55	55
Pasture	3,662	10,082	10,381	7,627	9,803
Rice	32,714	35,470	24,230	12,387	33,498
Subtropical	4,394	5,835	6,211	6,223	6,683
Truck Crops	41,137	30,035	33,930	30,812	43,799
Vine	20,340	20,857	20,215	20,221	18,971

5.4 SURFACE WATER DIVERSIONS

5.4.1 Urban Surface Water Diversions

Urban surface water diversions were reported directly by the following municipalities. The reported values were used to constrain urban surface water deliveries in the YSGA Model (Table 16, line 5).

- City of Davis
- City of Woodland and Woodland-Davis Clean Water Agency (WDCWA)
- City of West Sacramento
- University of California, Davis

[23] https://data.cnra.ca.gov/dataset/i15-crop-mapping-2019
[24] https://yodata-yolo.opendata.arcgis.com/search?groupIds=8880e638e44f4fab8b2aaca6633f2ced
[25] See https://www.yologroundwater.org/files/b90061148/Yolo+GSP_AppendixE.pdf#page=20

5.4.2 Agricultural Surface Water Diversions

To estimate surface water diversion in agricultural areas (Table 16, line 1), data reported from agricultural water purveyors was used with data extracted from eWRIMS. The reported values were used to constrain agricultural surface water deliveries in the YSGA Model. The following agricultural water purveyors provided estimates of surface water diversions for Water Years 2019 through 2023:

- Yolo County Flood Control & Water Conservation District
- Colusa Drain Mutual Water Company
- Dunnigan Water District
- Reclamation District (RD) 108
- RD 150
- RD 787
- RD 2035

The remainder of the agricultural surface water used in the Subbasin was estimated using the State Water Resources Control Board's eWRIMS database[26]. The eWRIMS database provides reported water use amounts for each SWRCB permit. The entities who had reported directly to the YSGA were removed from the total diversion amount to prevent double counting.

5.4.3 Total Surface Water Diversions

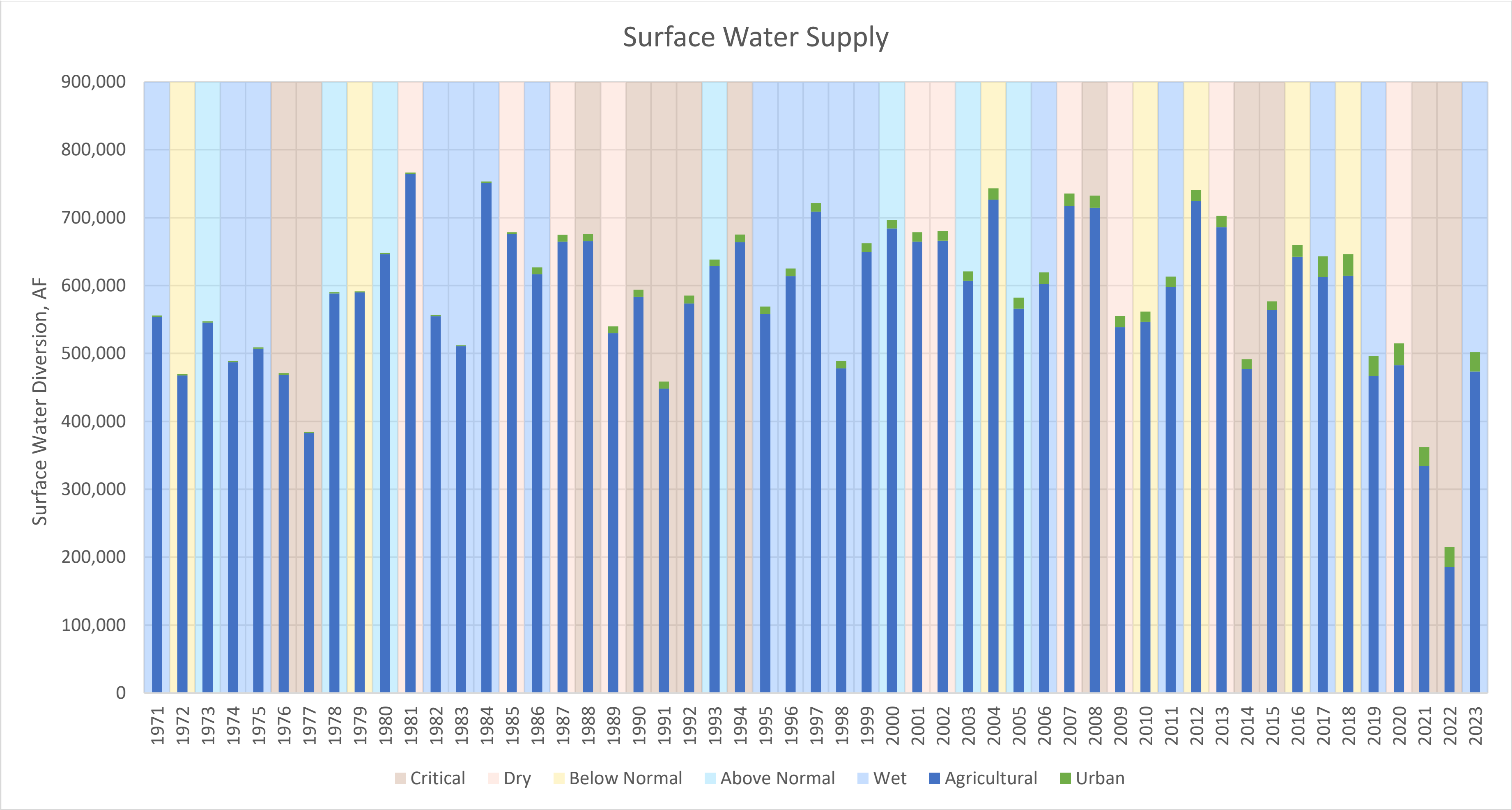
Total surface water diversions (Table 16, line 9) are modeled by the WEAP portion of the YSGA Model, using reported urban surface water diversions, reported agricultural surface water diversions, and agricultural surface water use from eWRIMS to constrain modeled water availability. Table 19 shows the surface water diversion in 2023 by source. Major storm events in Water Year 2019 provided increased reservoir storage, allowing for an additional 18,800 AF of surface water diversions going forward into Water Year 2020. However, critical Water Year 2021 brought historic drought conditions, leading to curtailments and a significant reduction (approximately 153,000 AF) in surface water diversions. Water Year 2022's critical conditions worsened drought conditions and reduced available surface water diversions by approximately another 147,000 AF from 2021. In Water Year 2023, wet conditions led to plentiful surface water supply, returning to normal diversion amounts of approximately 500,000 AF.

TABLE 19: WY 2023 SURFACE WATER SUPPLY BY SOURCE

Surface Water Source	Water Use (Acre-feet)	Methods Used to Determine
Central Valley Project	131,300	Self-reported by member agencies
State Water Project	0	
Managed Local Supplies	370,700	Self-reported by member agencies and EWRIMS
Local Imported Supplies	0	
Recycled Water	0	
Other	0	
TOTAL	502,000	

[26] https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrims/

FIGURE 15: ANNUAL SURFACE WATER SUPPLY



5.5 GROUNDWATER EXTRACTION

5.5.1 Urban Groundwater Extraction

Extraction of groundwater for urban delivery was reported directly by the following entities, representing most urban water purveyors (Table 16, line 6). This number may be slightly under-reported due to the YSGA's inability to collect data from smaller urban water suppliers in the Subbasin.

- City of Davis
- City of Woodland
- City of Winters
- University of California, Davis
- Esparto Community Services District (CSD)
- California American Water Company, Dunnigan

Pump-to-waste was reported separately by the Cities of Davis, Woodland, and Winters. For the purposes of this report, pump-to-waste was modeled as additional groundwater extraction.

5.5.2 Agricultural Groundwater Extraction

Agricultural groundwater extraction is not directly measured in the Yolo Subbasin. Groundwater extraction, shown in Table 16, line 2, is modeled by the YSGA model using land use estimates, estimated crop water demand, irrigation efficiency, and available surface water supplies. The model uses precipitation, existing soil moisture, and irrigation efficiency to calculate total agricultural water demand from agricultural ET_a. Finally, groundwater extraction is determined by subtracting available surface water diversions (line 1) from the total agricultural water demand.

5.5.3 Total Groundwater Extraction

Total groundwater extraction (Table 16, line 10) is found by adding urban groundwater extraction (line 6) and agricultural groundwater extraction (line 2).

As an estimate of the Subbasin's condition relative to the GSP's sustainability goal, annual groundwater extraction can be compared to the sustainable yield. Sustainable yield represents the amount of groundwater that can be withdrawn annually without causing undesirable results. The estimated annual pumping in the Subbasin varies widely over the historical period, from 197-519 TAF/year. Note that SGMA does not incorporate sustainable yield estimates directly into sustainable management criteria. "Basinwide pumping within the sustainable yield estimate is neither a measure of, nor proof of, sustainability. Sustainability under SGMA is only demonstrated by avoiding undesirable results for the six sustainability indicators" (DWR 2017).

The GSP lists the sustainable yield of the Yolo Subbasin as approximately 346,000 AF. Figure 16 presents the annual groundwater extraction estimates from Table 16 relative to the sustainable yield of 346 TAF. Table 20 provides the extraction estimates by water use sector, and Figure 17 provides a spatial visualization of estimated groundwater pumping by MODFLOW cell.

FIGURE 16. ANNUAL GROUNDWATER EXTRACTION

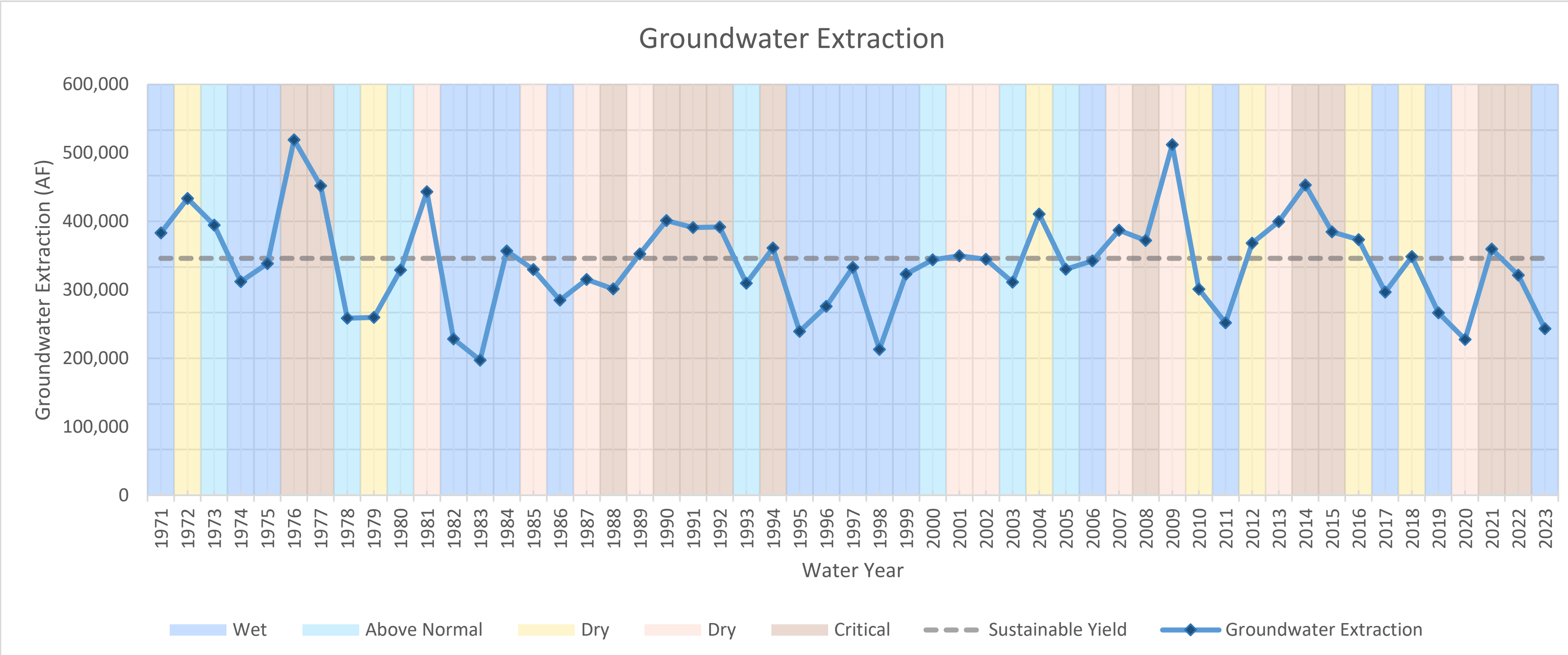


TABLE 20: WY 2023 GROUNDWATER EXTRACTION BY SECTOR

Sector	Groundwater Extraction (Acre-feet)
Urban	12,800
Industrial	0
Agricultural	230,300
Managed Wetland	0
Managed Recharge	0
Native Vegetation	0
Other	0
TOTAL	243,100

FIGURE 17: WATER YEAR 2023 GROUNDWATER EXTRACTION

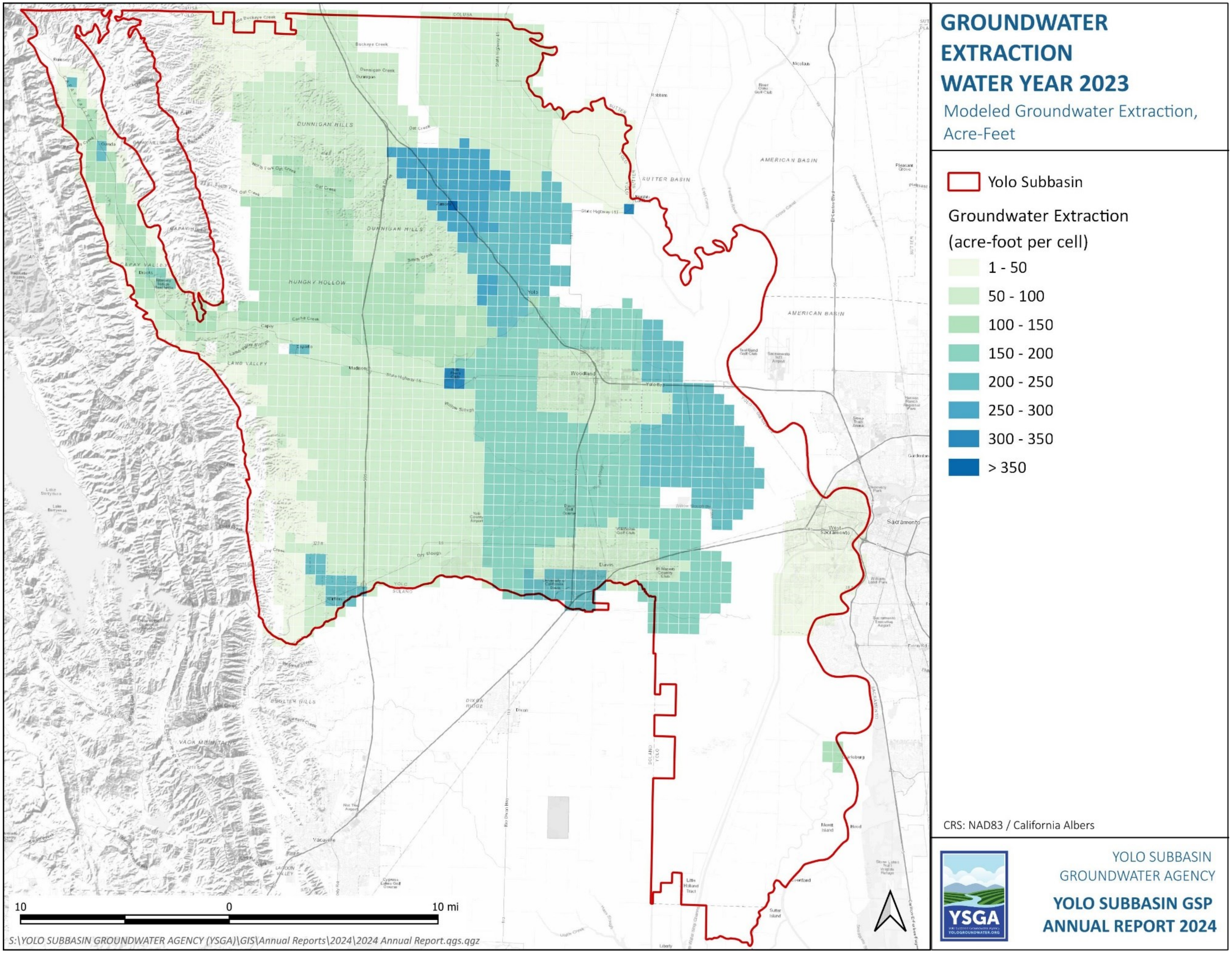
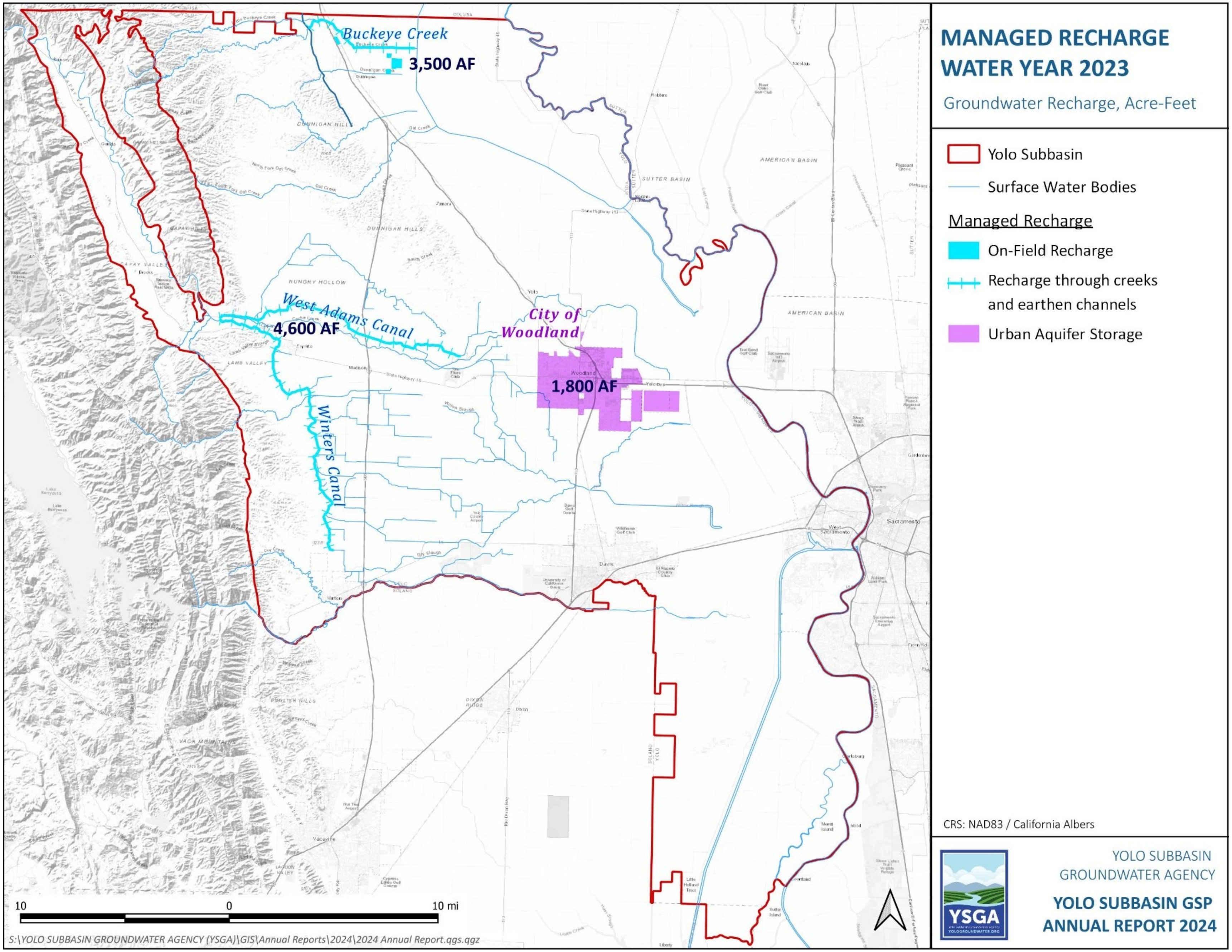


FIGURE 18: WATER YEAR 2023 MANAGED RECHARGE



5.6 MANAGED RECHARGE

During Water Year 2023, managed groundwater recharge projects were implemented by Dunnigan Water District, Yolo County Flood Control & Water Conservation District (YCFC&WCD), and the City of Woodland. The locations of these projects are shown in Figure 18.

5.6.1 Agricultural Managed Recharge

Due to surface water availability, Dunnigan Water District and YCFC&WCD were able to conduct groundwater recharge during the winter. Dunnigan Water District recharged 3,548 AF of water purchased from the Tehama-Colusa Canal. The water recharged through the gravel channel of Buckeye Creek and was also applied to farmers' fields. YCFC&WCD recharged 4,604 AF of water from Cache Creek using the earthen Winters and West Adams canals.

5.6.2 Urban Managed Recharge

The City of Woodland injects surface water into the aquifer using aquifer storage and recovery (ASR) wells; this water is accounted for in line 7 of Table 16. Water recovered from the aquifer using the ASR wells is included within line 6. During Water Year 2023, the City injected 1,800 AF of surface water.

5.7 TOTAL WATER USE

Total water use (Table 16, line 12) is estimated at the Yolo Subbasin scale as the sum of surface water diversions (line 12) and groundwater extraction (line 13). Water use in 2023 (745 TAF) displays an increase from 2022, but is similar to use in 2019-21. Table 21 and Table 22 summarize total water use by source and by sector for Water Year 2023.

TABLE 21: WATER USE BY SOURCE

Water Source Type	Water Use (Acre-feet)
Groundwater	243,100
Surface Water	502,000
Recycled Water	
Reused Water	
Other	
TOTAL	745,100

TABLE 22: WATER USE BY SECTOR

Water Use Sector	Water Use (Acre-feet)
Urban	41,500
Industrial	
Agricultural	703,500
Managed Wetlands	
Managed Recharge	8,600
Native Vegetation	
Other	
TOTAL	745,100

5.8 CHANGE IN GROUNDWATER STORAGE

Estimates of changes in groundwater storage for Water Years 2019-2023 are included in this section. Changes in groundwater storage were modeled by the MODFLOW portion of the YSGA model. Changes in groundwater storage over time are the aggregate (net) outcome of the individual inflows and outflows from the aquifer. Table 23 shows the results of this analysis as changes in groundwater water storage.

TABLE 23: ESTIMATED GROUNDWATER EXTRACTION AND CHANGE IN GROUNDWATER STORAGE

Water Year	2019	2020	2021	2022	2023
Groundwater Extraction, AF	266,500	227,500	359,400	321,300	243,100
Difference to Sustainable Yield, AF	80,000	118,500	-13,400	24,700	102,900
Estimated Change in Storage, AF	+51,000	-120,000	-247,100	-171,200	+279,200

Figure 19 and Figure 20 show the cumulative monthly, and annual incremental change in modeled groundwater storage values, from WY 1971 onwards along with the corresponding Water Year type. Subbasin groundwater storage tracks wet and dry years consistently over the 50+ years of modeling. In deep droughts (1976-1977 and 2020-2022 for example) and in extended droughts (late 1980's and 2011-2015), groundwater storage trends downwards. In wet years, Subbasin groundwater storage has historically recovered, and showed recovery in WY 2023 after three years of dry conditions; although not back to pre-drought WY 2019 conditions. Successive wet years in the past such as WY 1994-WY 1997 showed substantial positive impacts on groundwater storage. It is worth noting that in the past 23 years, as many as 16 have been years with below-normal or lower precipitation.

Figure 21 provides a map of estimated change in storage at the Yolo Subbasin level. Estimates are provided for each MODFLOW cell, which each have an area of 1/4 square mile. In much of the Subbasin, there is a marked improvement in groundwater storage in WY 2023 compared to WY 2022. The largest gains are in western portions of the Subbasin, with modest gains in the eastern parts of the Subbasin. In the Zamora area, the model shows a loss in groundwater storage. This aligns with the estimates of groundwater extraction provided in Figure 17, in which Zamora is one of the regions with the highest extraction.

FIGURE 19. CUMULATIVE CHANGE IN GROUNDWATER STORAGE

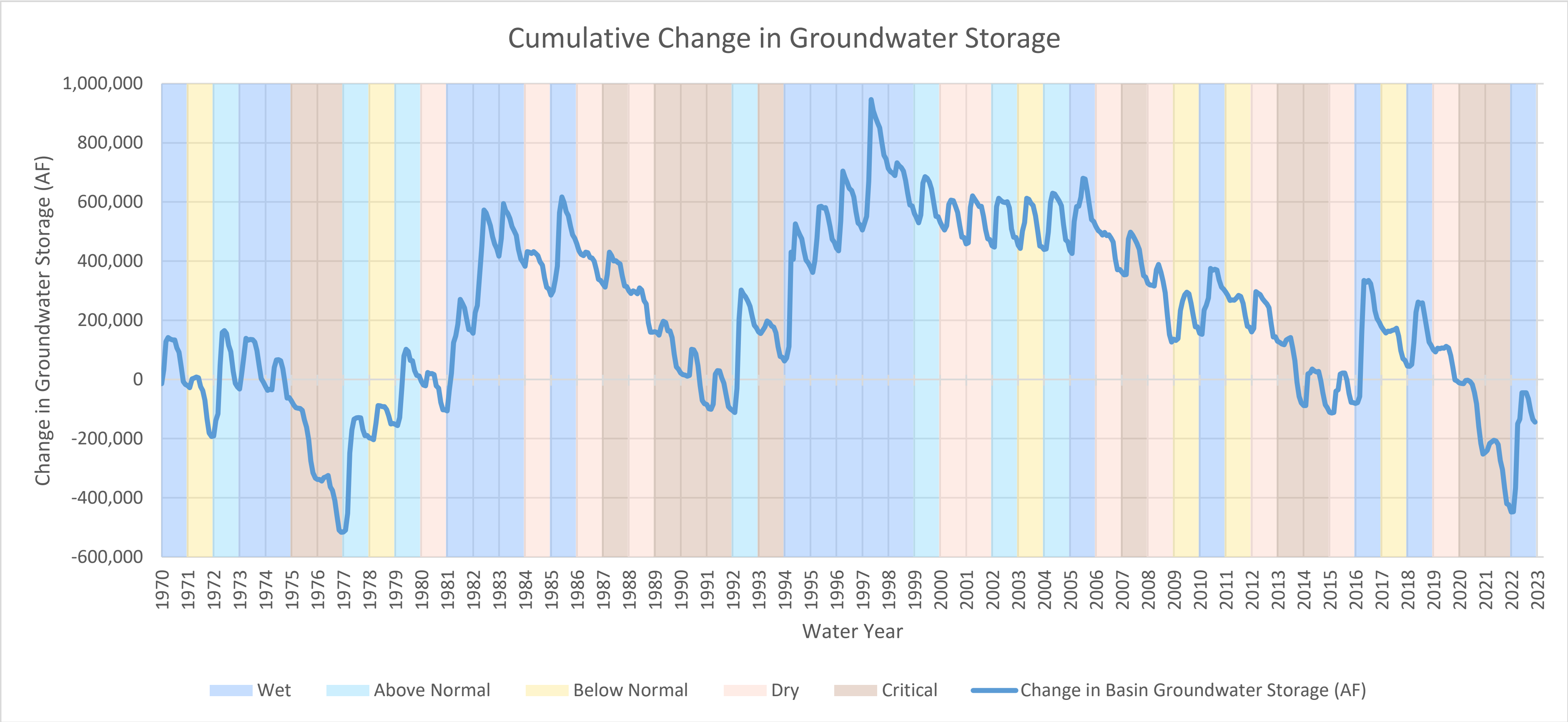


FIGURE 20. ANNUAL CHANGE IN GROUNDWATER STORAGE

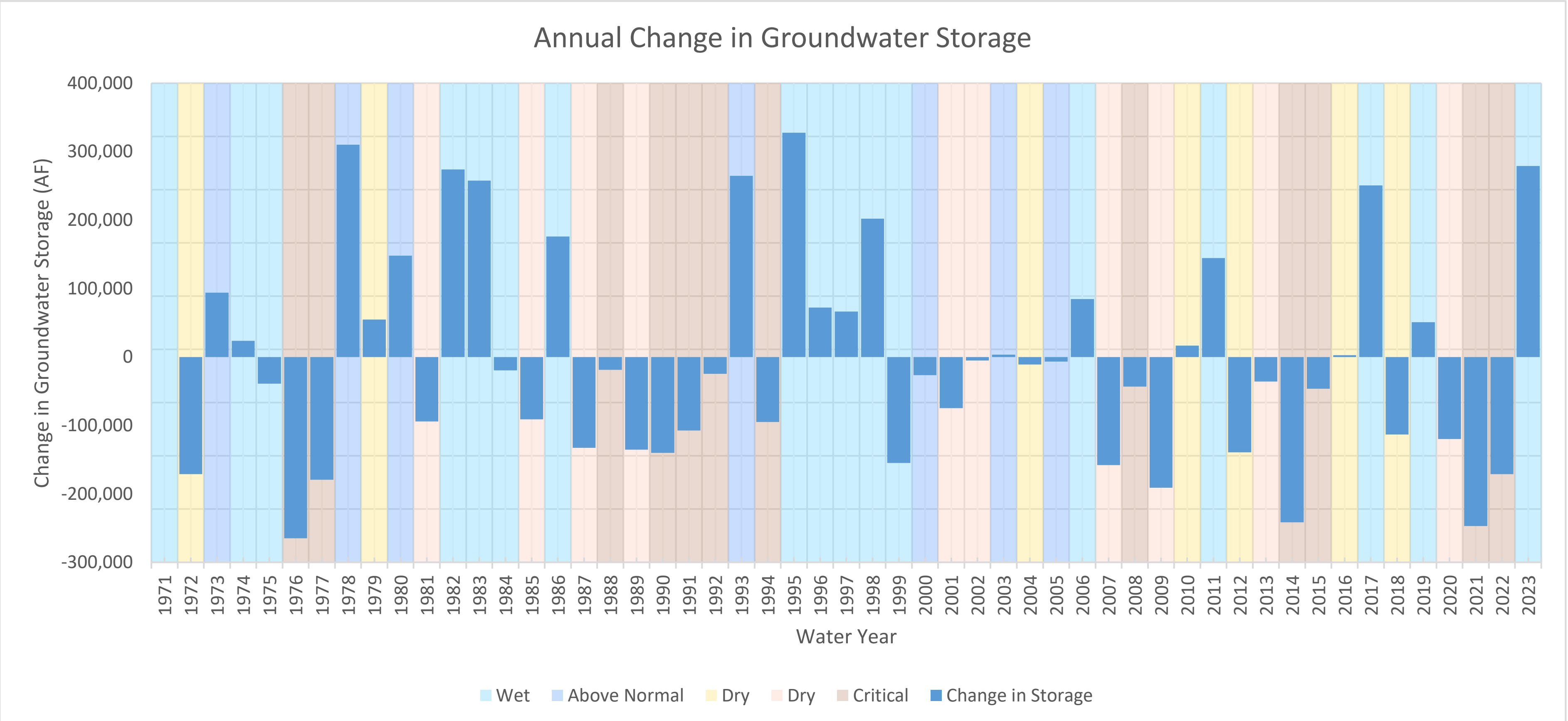
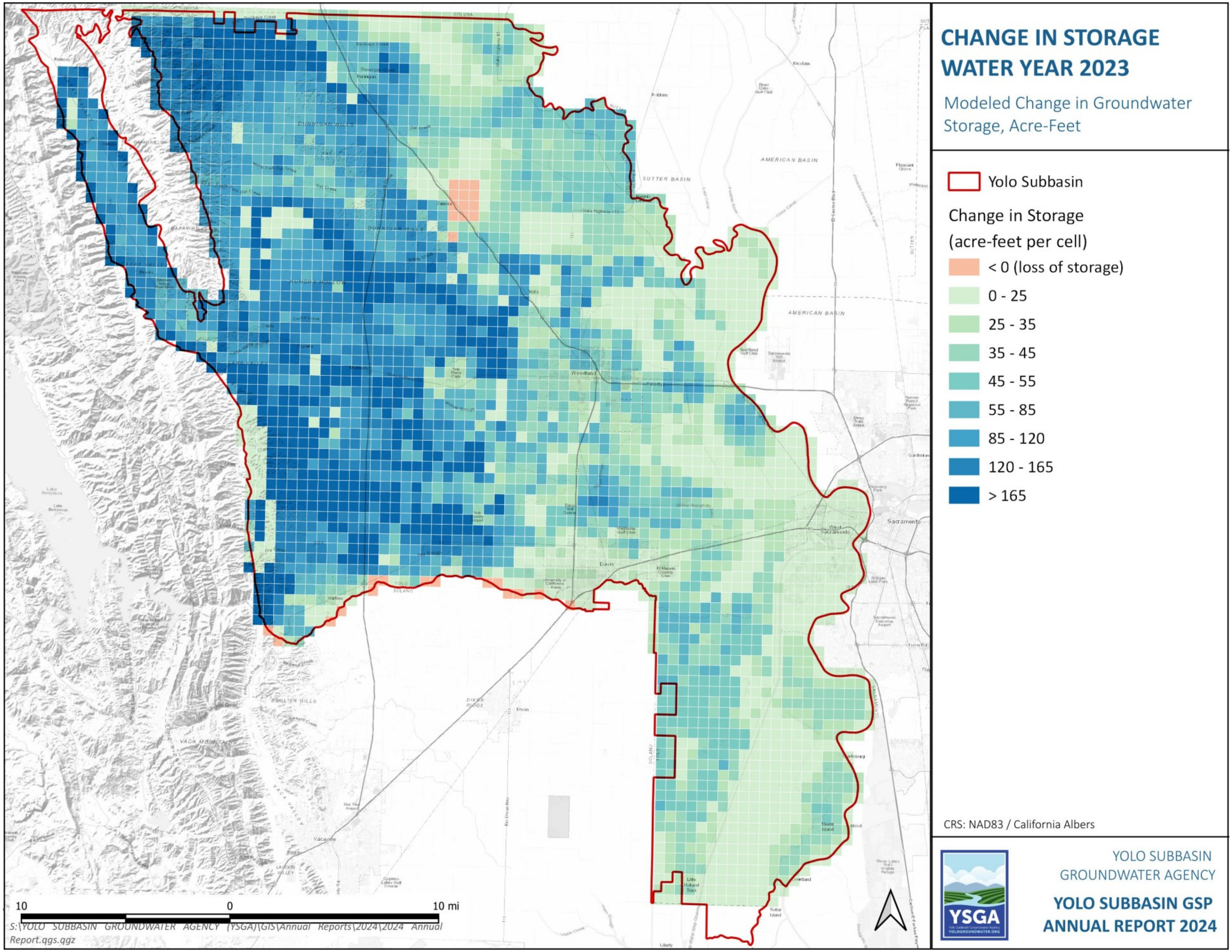


FIGURE 21. CHANGE IN GROUNDWATER STORAGE – WATER YEAR 2023

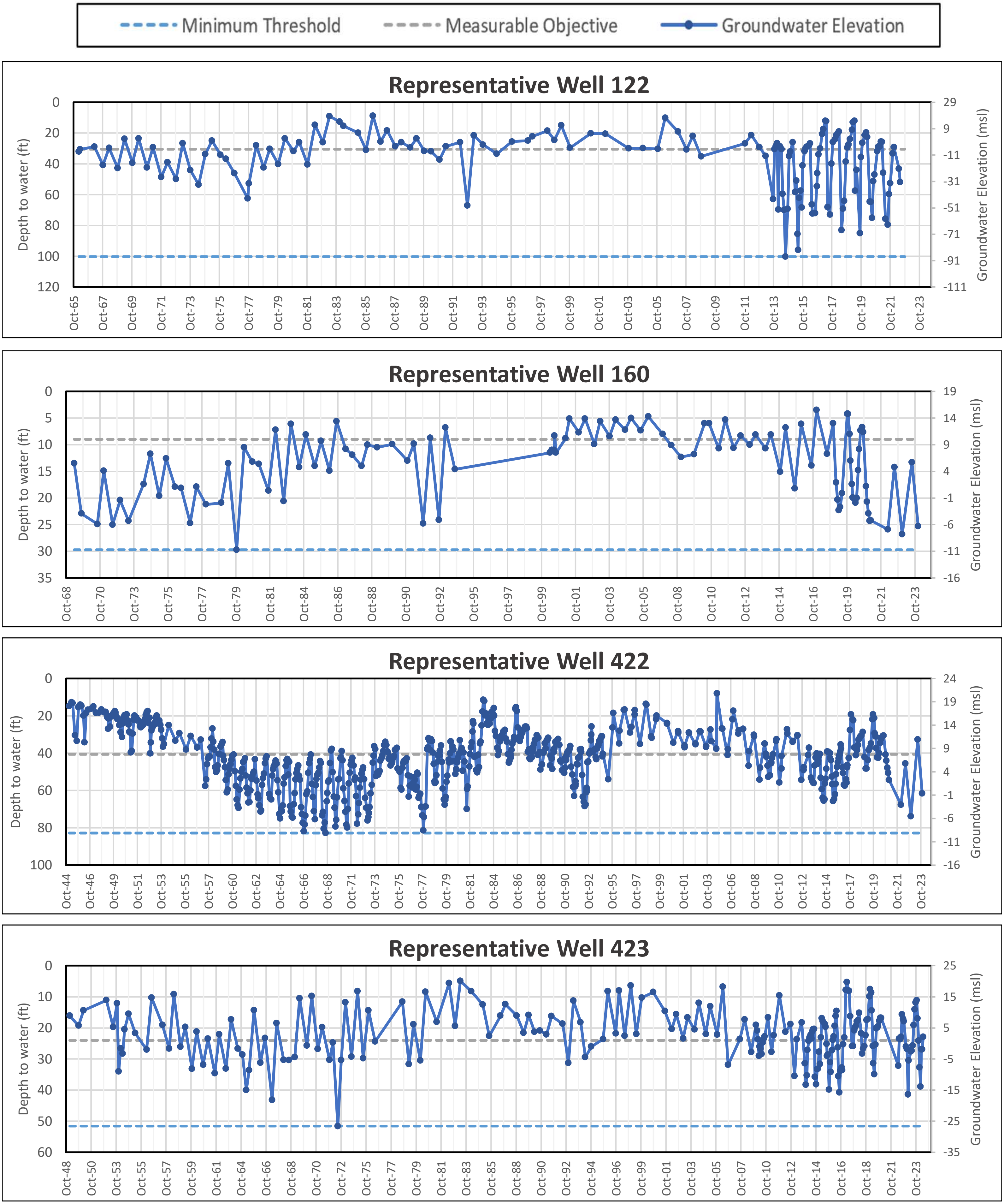


YOLO SUBBASIN GSP ANNUAL REPORT 2024

ATTACHMENT A

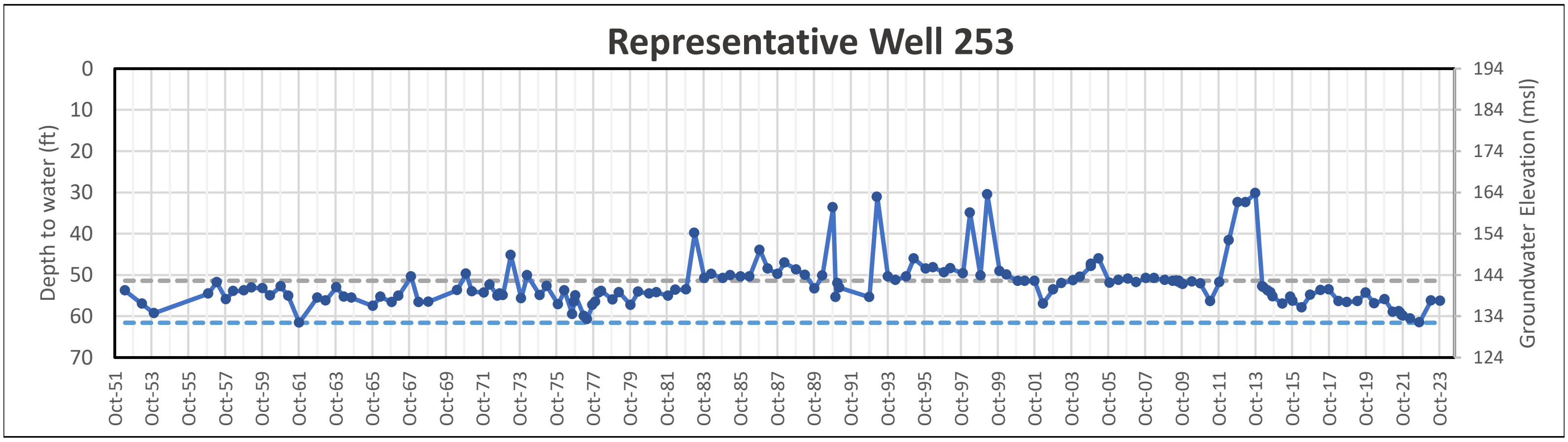
GROUNDWATER ELEVATION REPRESENTATIVE WELL HYDROGRAPHS

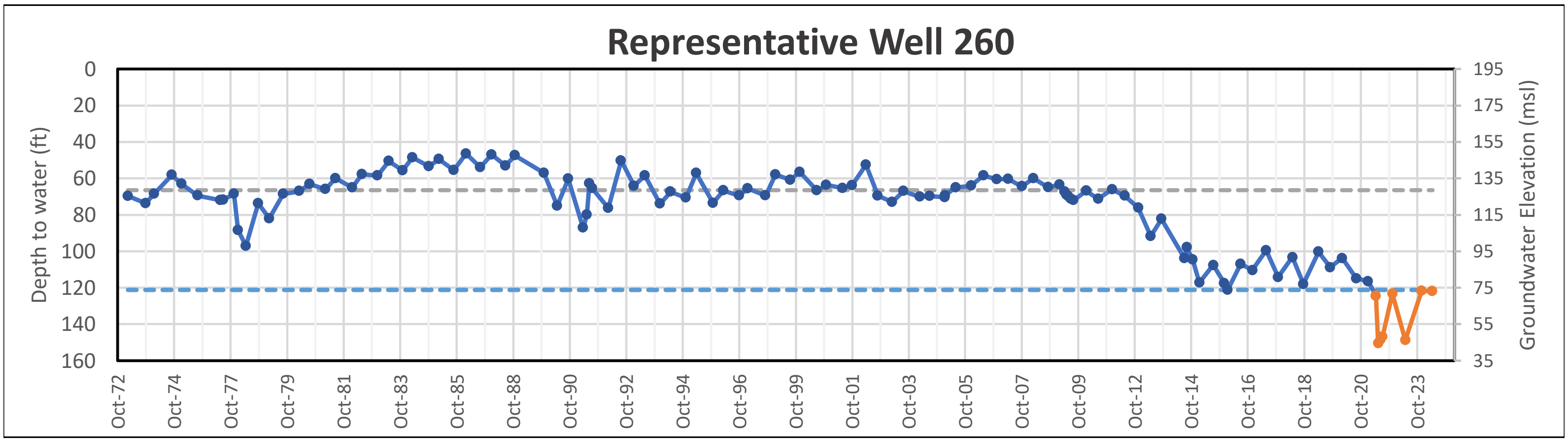
SOUTH YOLO REPRESENTATIVE HYDROGRAPHS

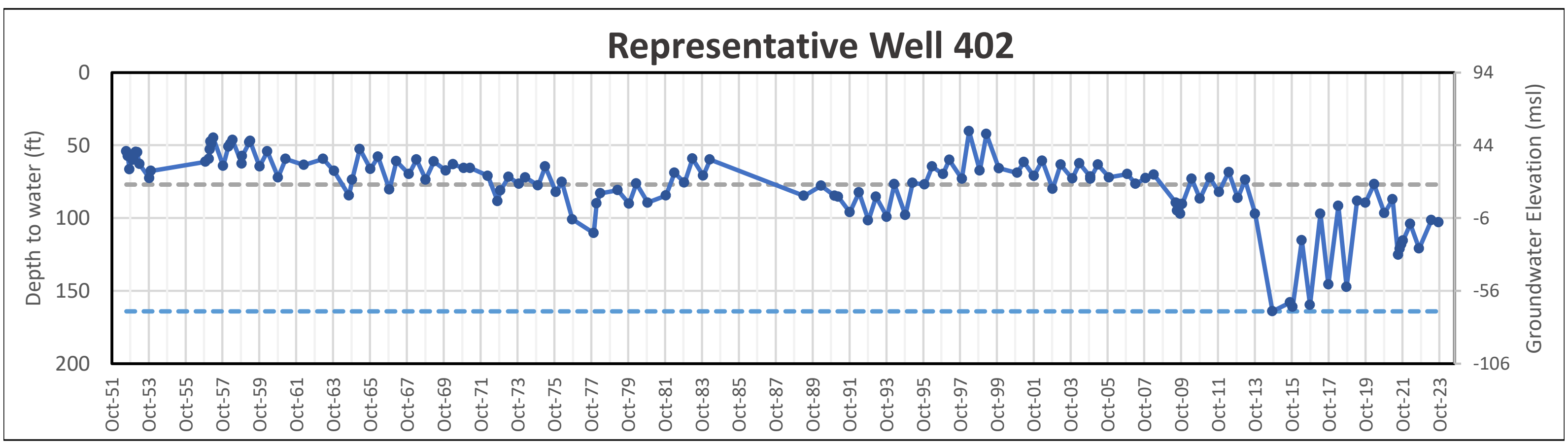


DUNNIGAN HILLS REPRESENTATIVE HYDROGRAPHS

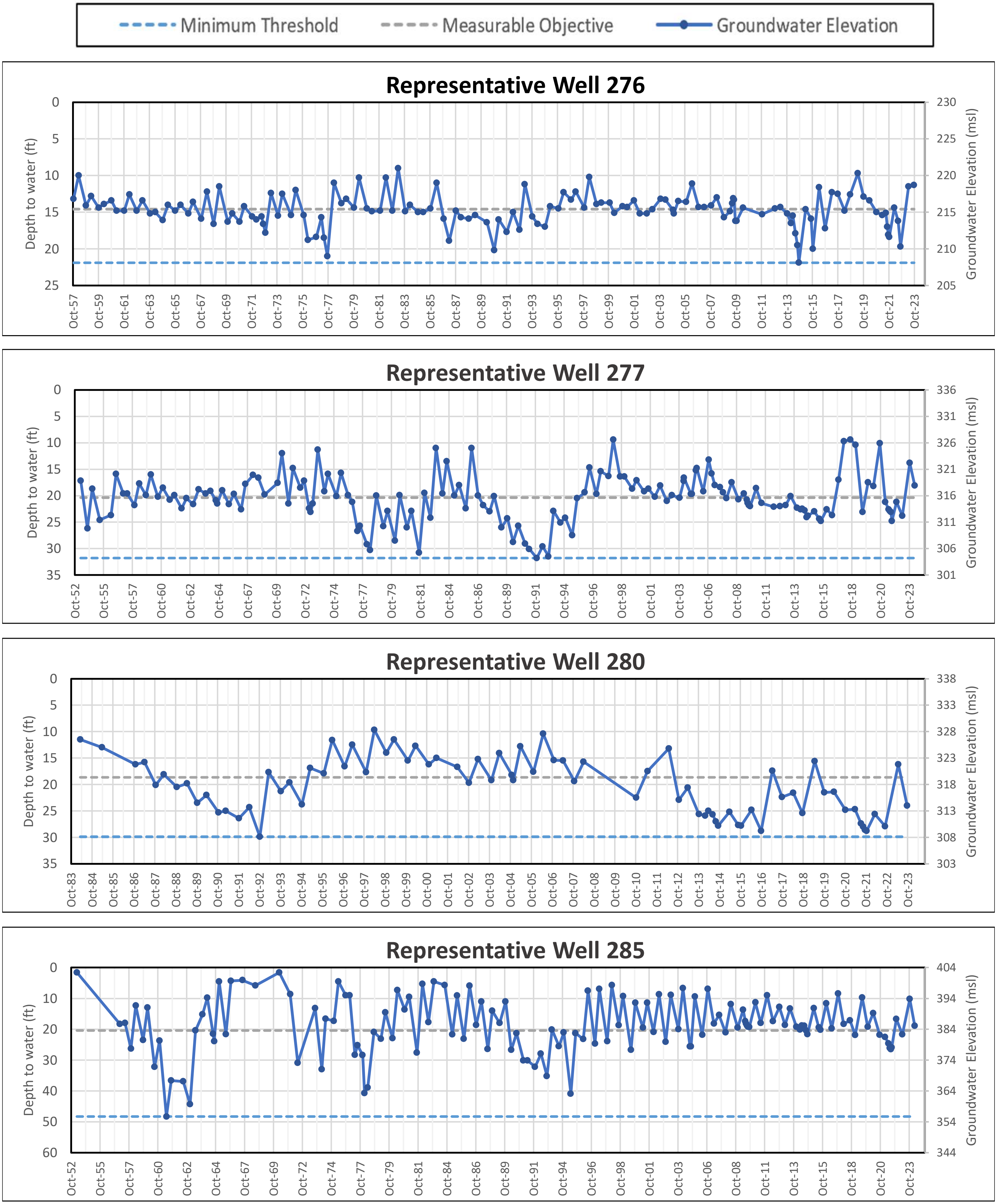
Minimum Threshold | Measurable Objective | Groundwater Elevation





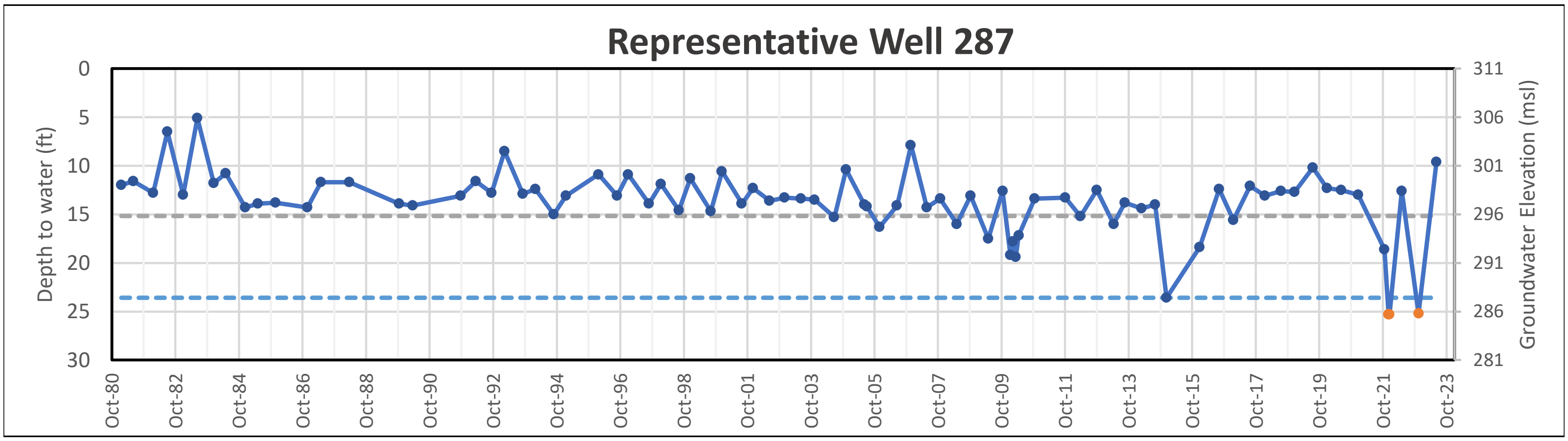


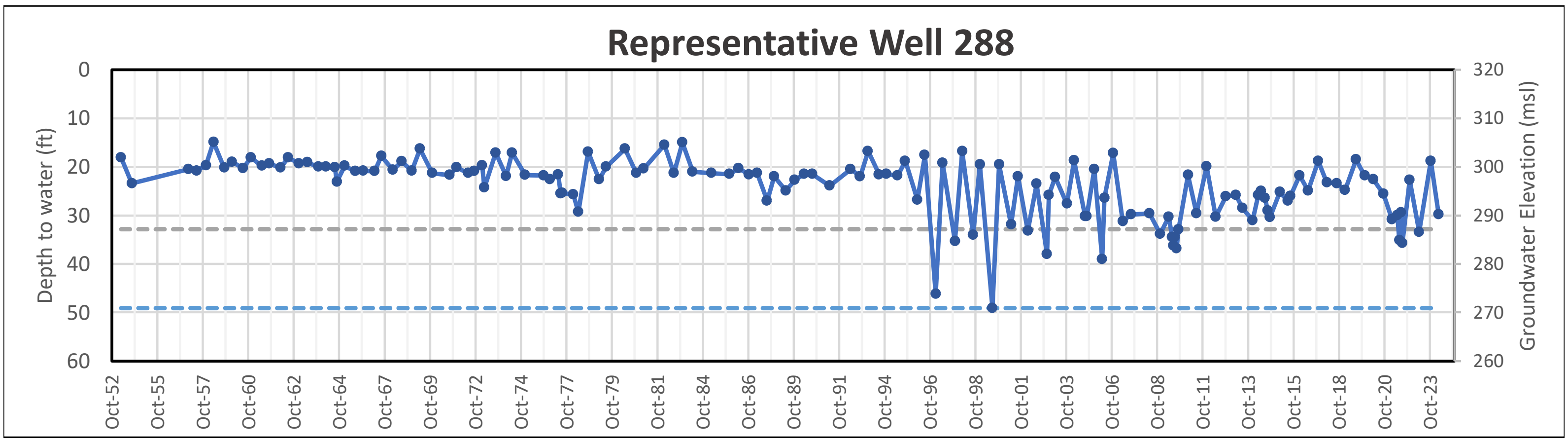
CAPAY VALLEY REPRESENTATIVE HYDROGRAPHS

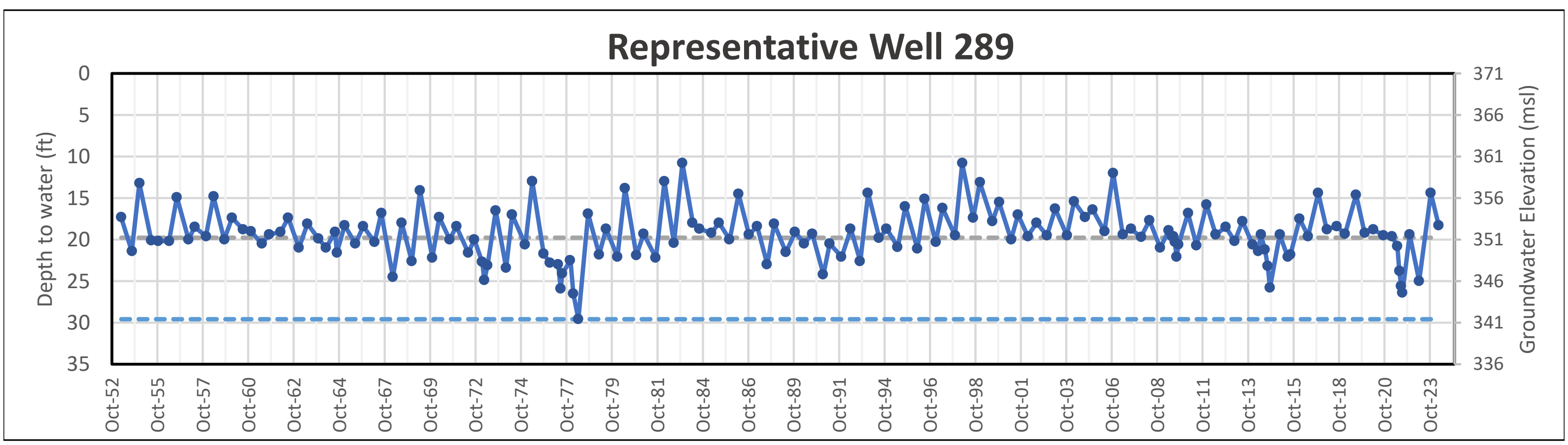


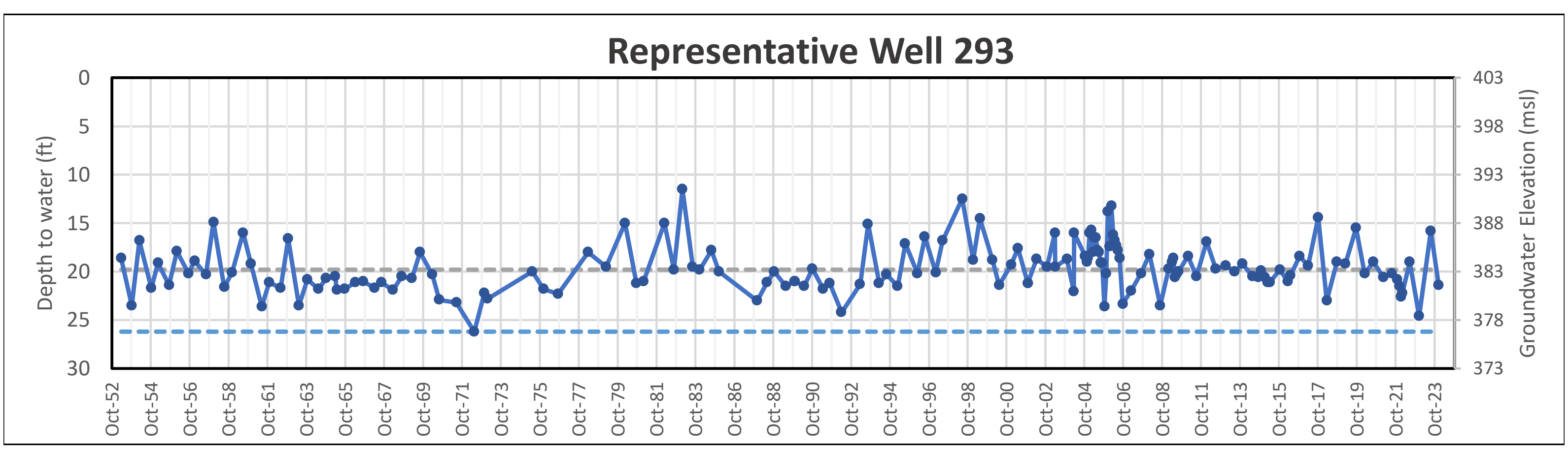
CAPAY VALLEY REPRESENTATIVE HYDROGRAPHS

Minimum Threshold — Measurable Objective — Groundwater Elevation

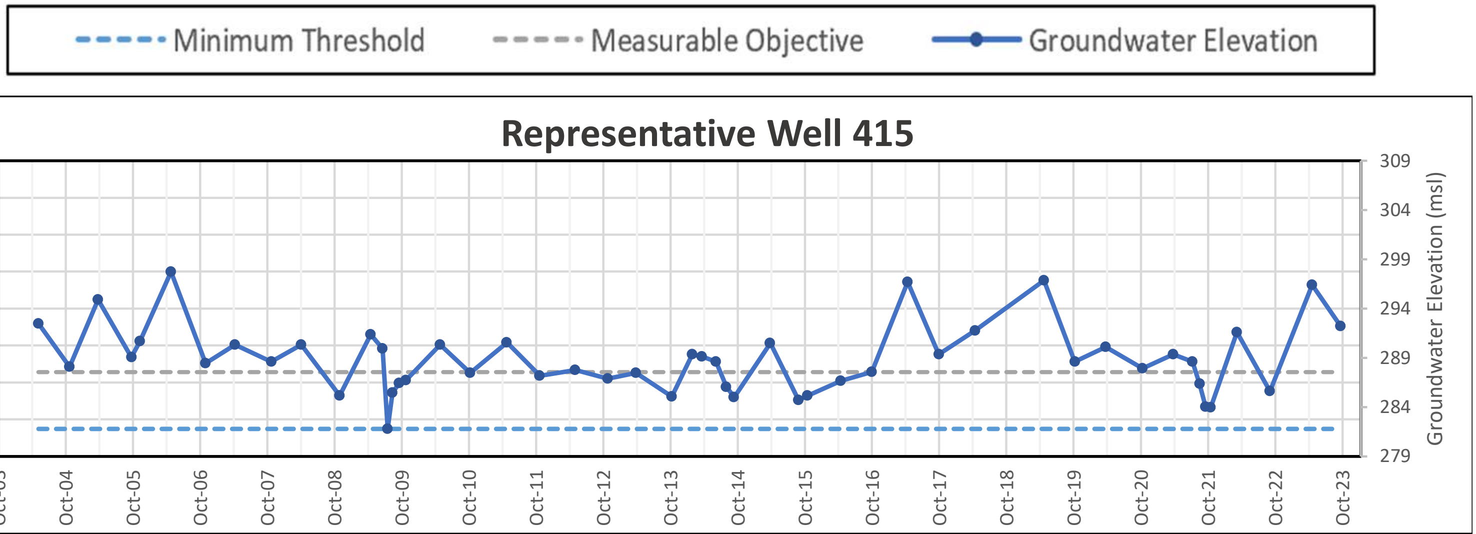


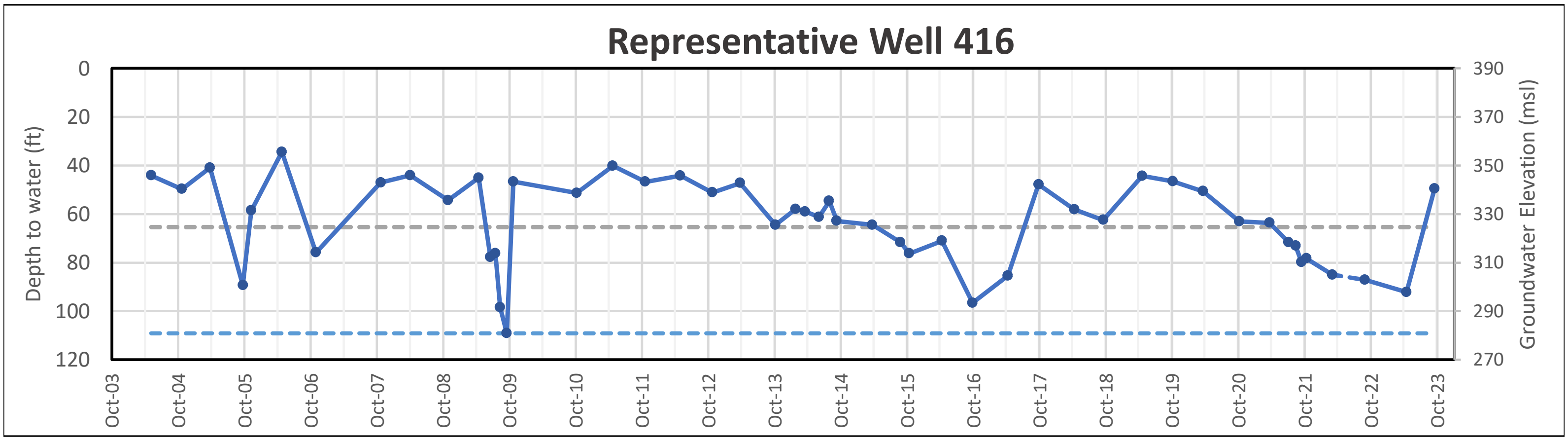






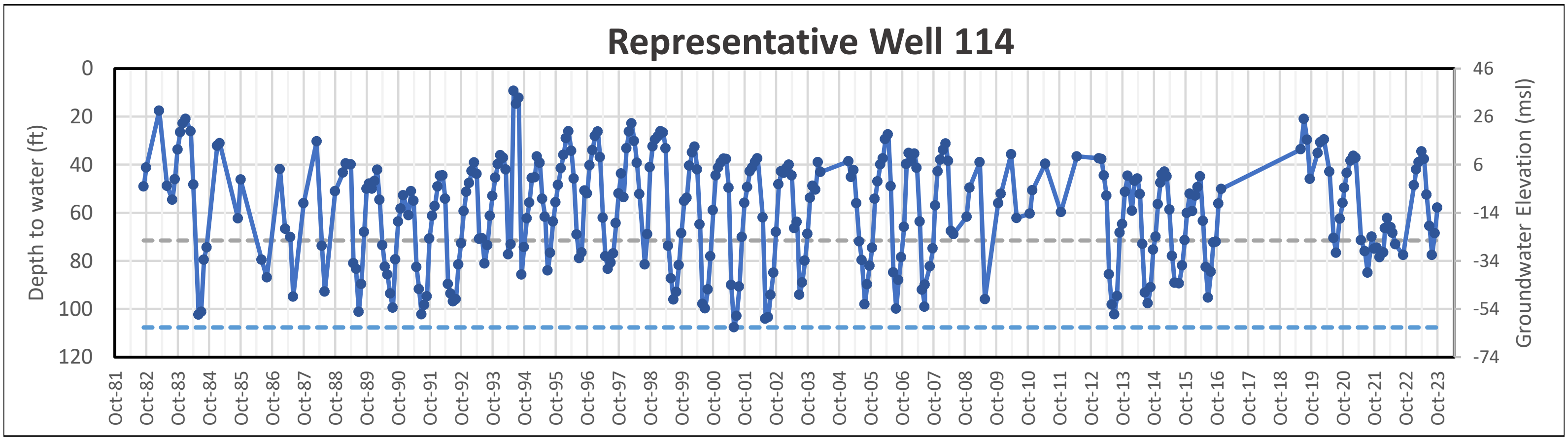
CAPAY VALLEY REPRESENTATIVE HYDROGRAPHS

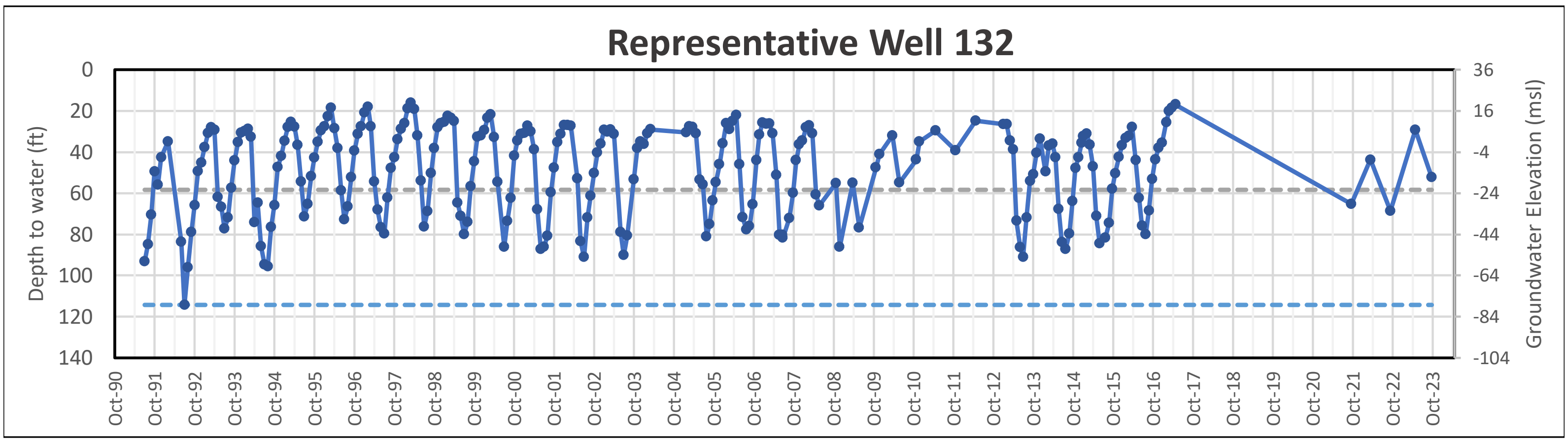


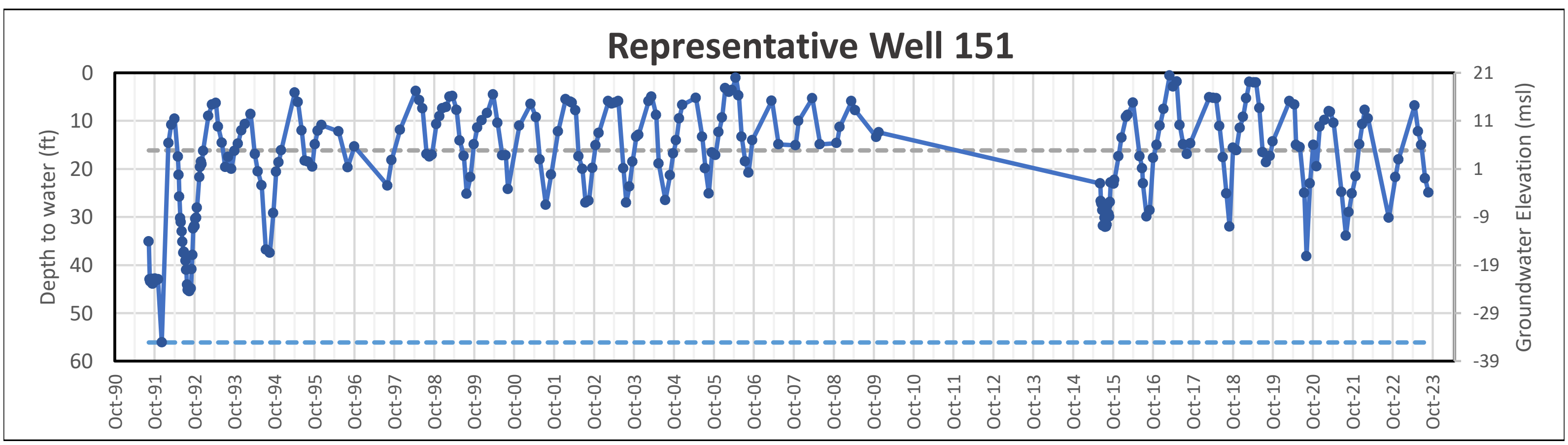


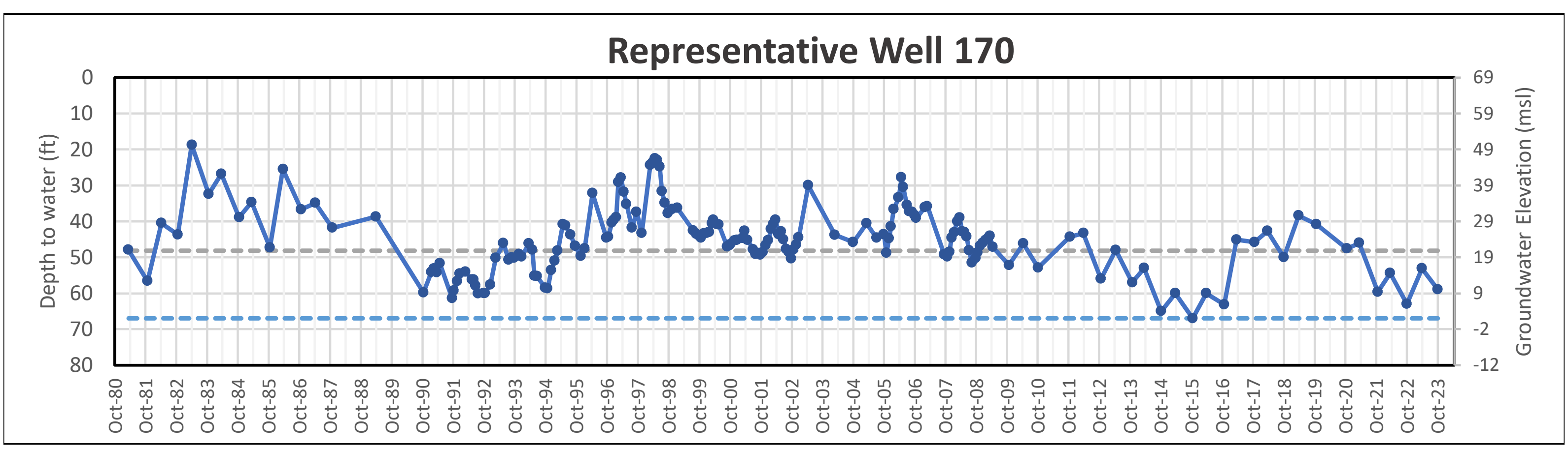
CENTRAL YOLO REPRESENTATIVE HYDROGRAPHS

Minimum Threshold — Measurable Objective — Groundwater Elevation

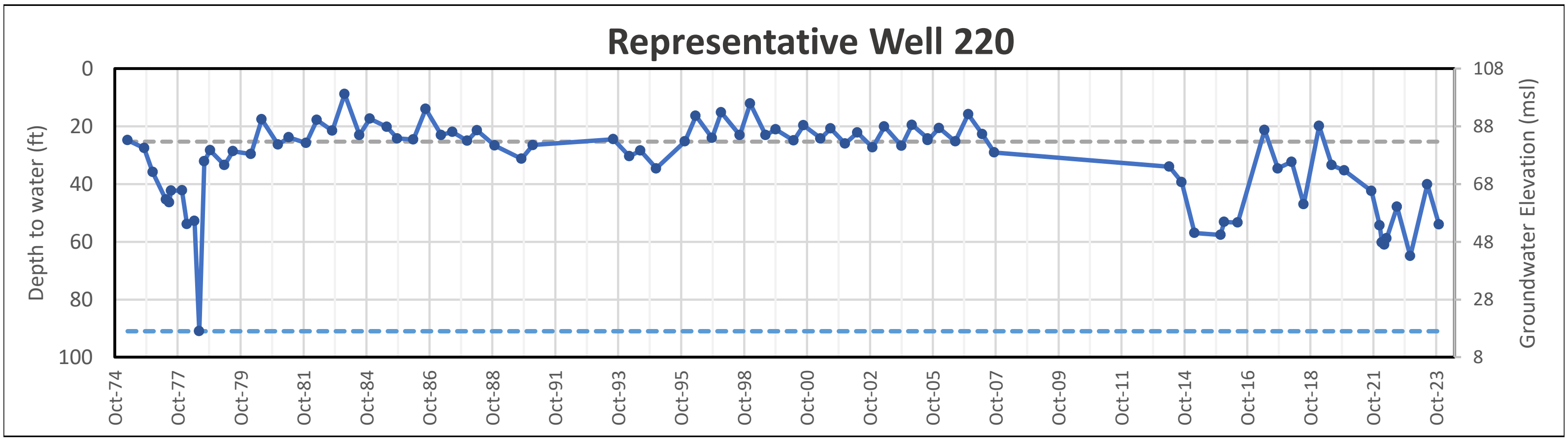


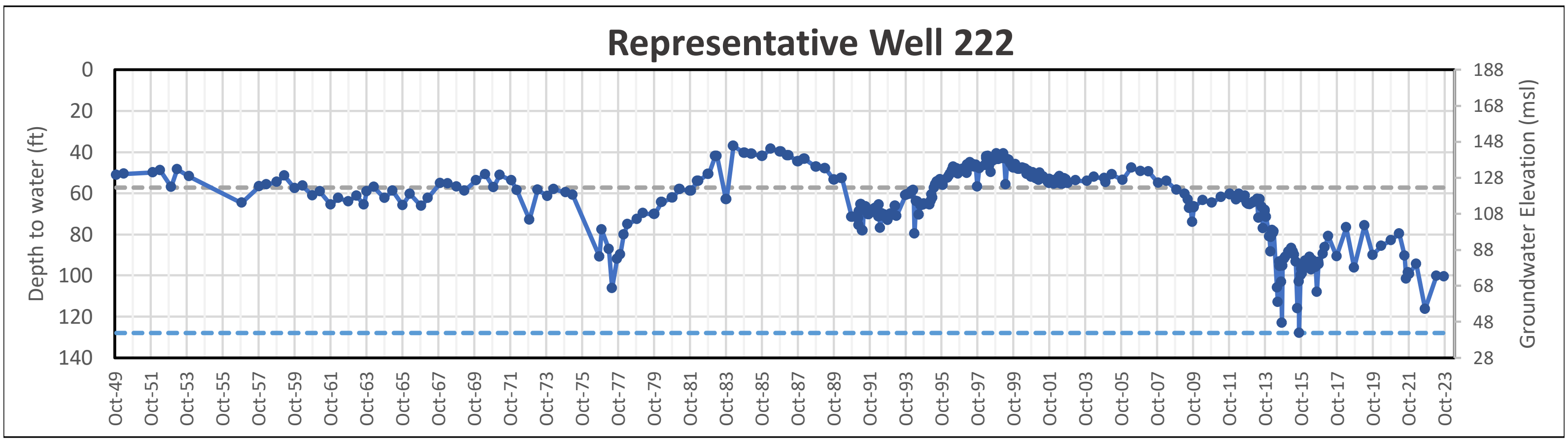


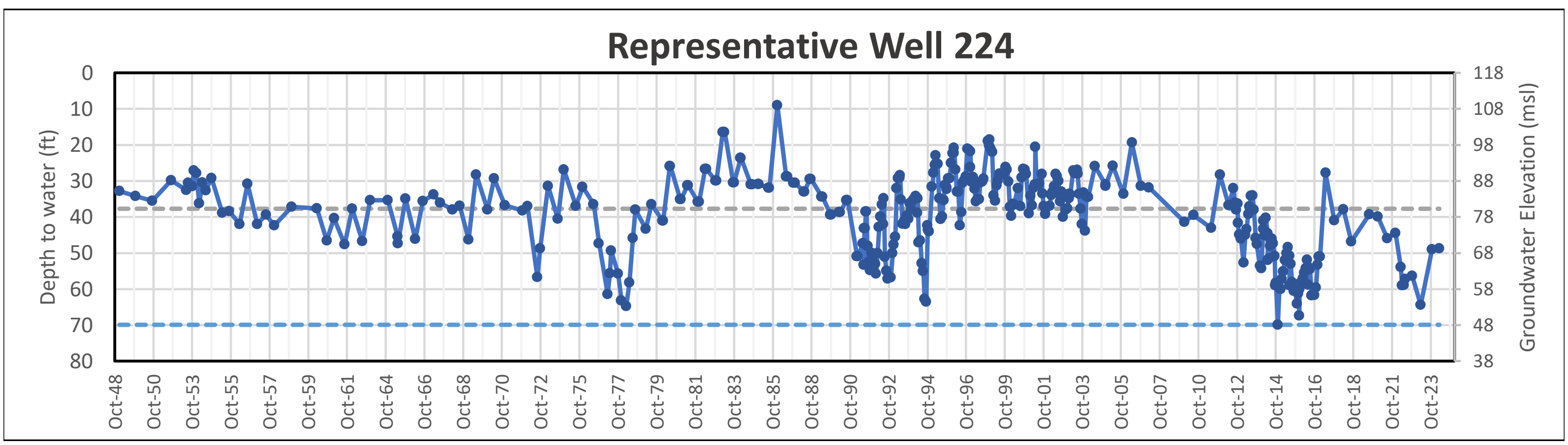


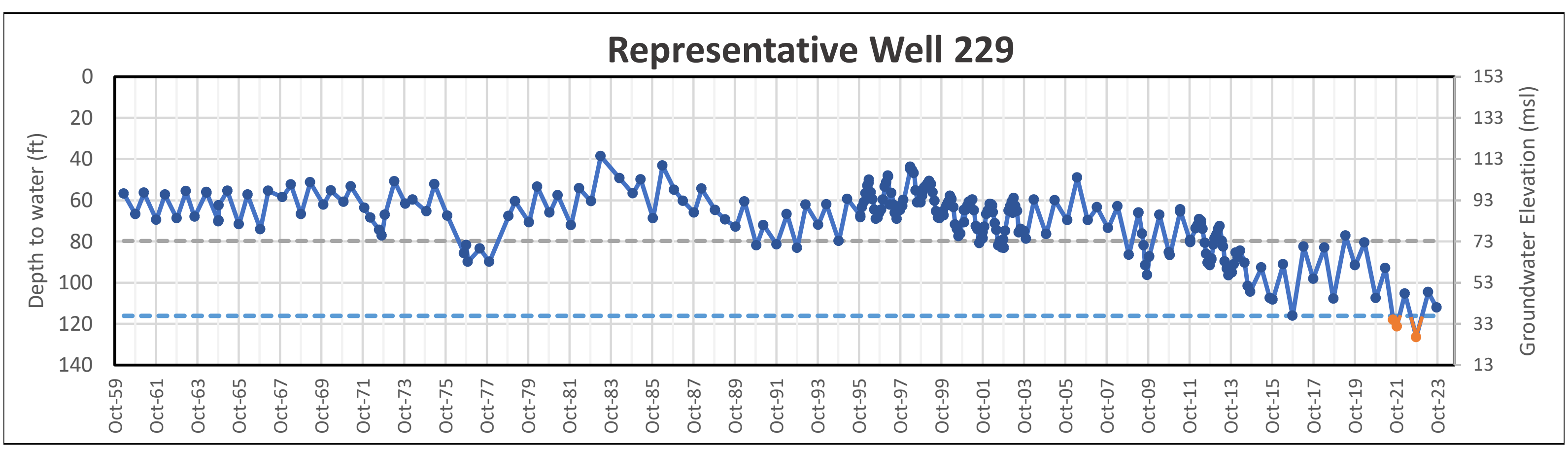



Minimum Threshold
Measurable Objective
Groundwater Elevation

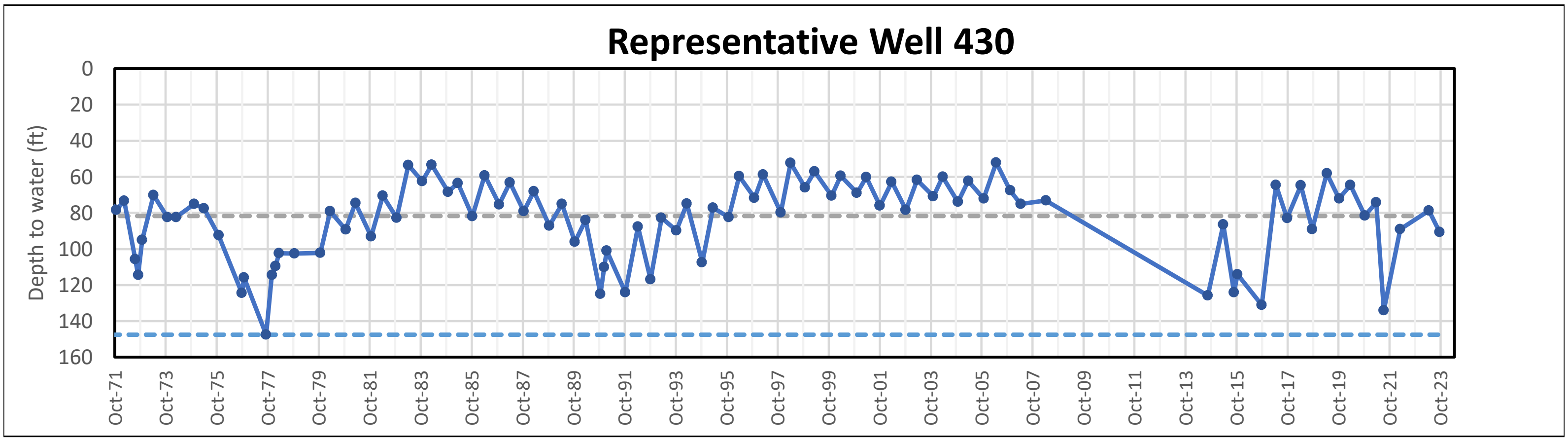

Representative Well 220
Depth to water (ft)
Groundwater Elevation (msl)


Representative Well 222
Depth to water (ft)
Groundwater Elevation (msl)


Representative Well 224
Depth to water (ft)
Groundwater Elevation (msl)


Representative Well 229
Depth to water (ft)
Groundwater Elevation (msl)


Minimum Threshold
Measurable Objective
Groundwater Elevation


Representative Well 430
Depth to water (ft)
0
20
40
60
80
100
120
140
160
Oct-71
Oct-73
Oct-75
Oct-77
Oct-79
Oct-81
Oct-83
Oct-85
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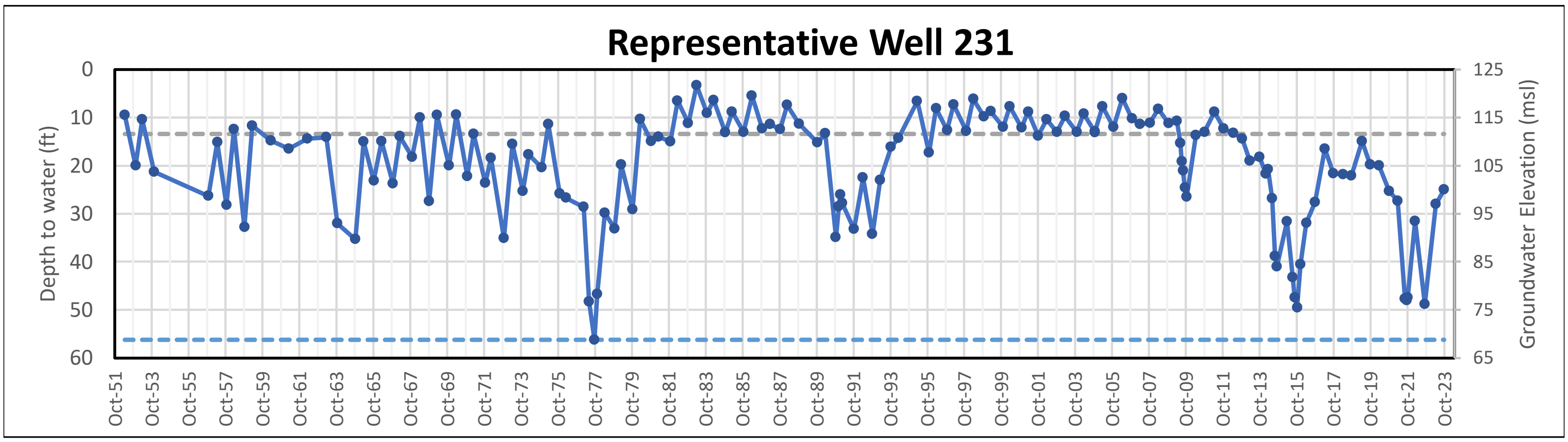
Oct-23


Representative Well 231
Depth to water (ft)
0
10
20
30
40
50
60
Groundwater Elevation (msl)
125
115
105
95
85
75
65
Oct-51
Oct-53
Oct-55
Oct-57
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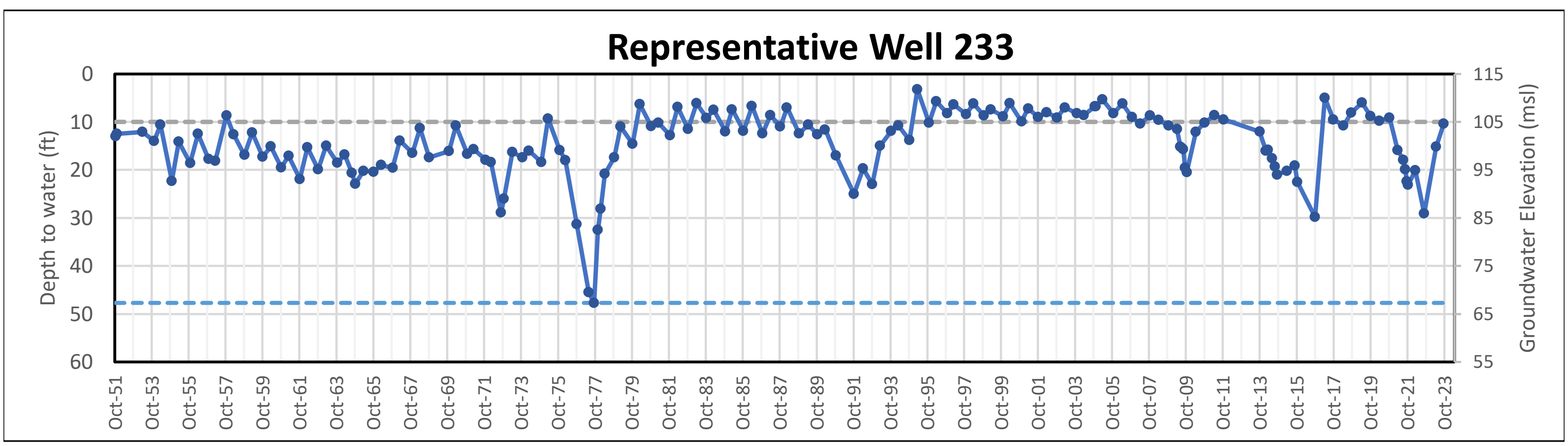
Representative Well 233
Depth to water (ft)
0
10
20
30
40
50
60
Groundwater Elevation (msl)
115
105
95
85
75
65
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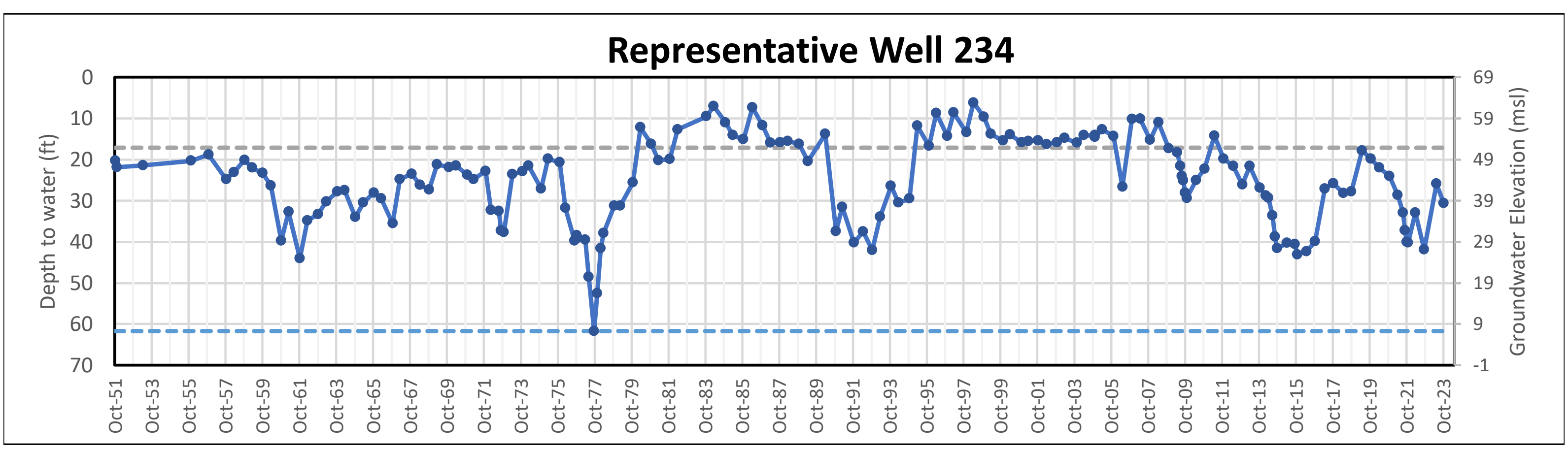
Representative Well 234
Depth to water (ft)
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10
20
30
40
50
60
70
Groundwater Elevation (msl)
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49
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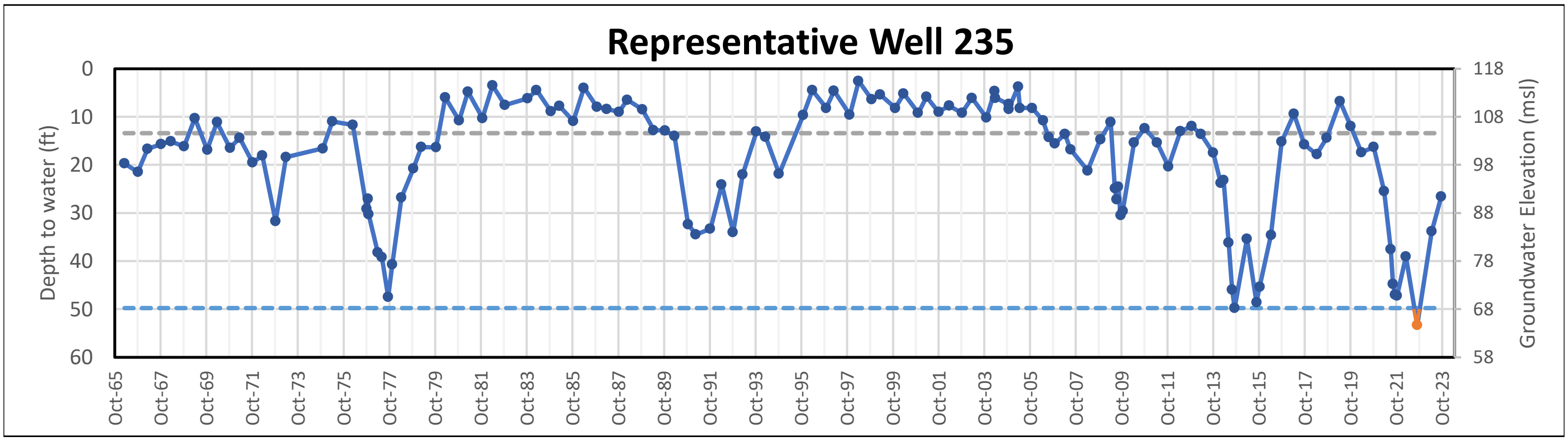
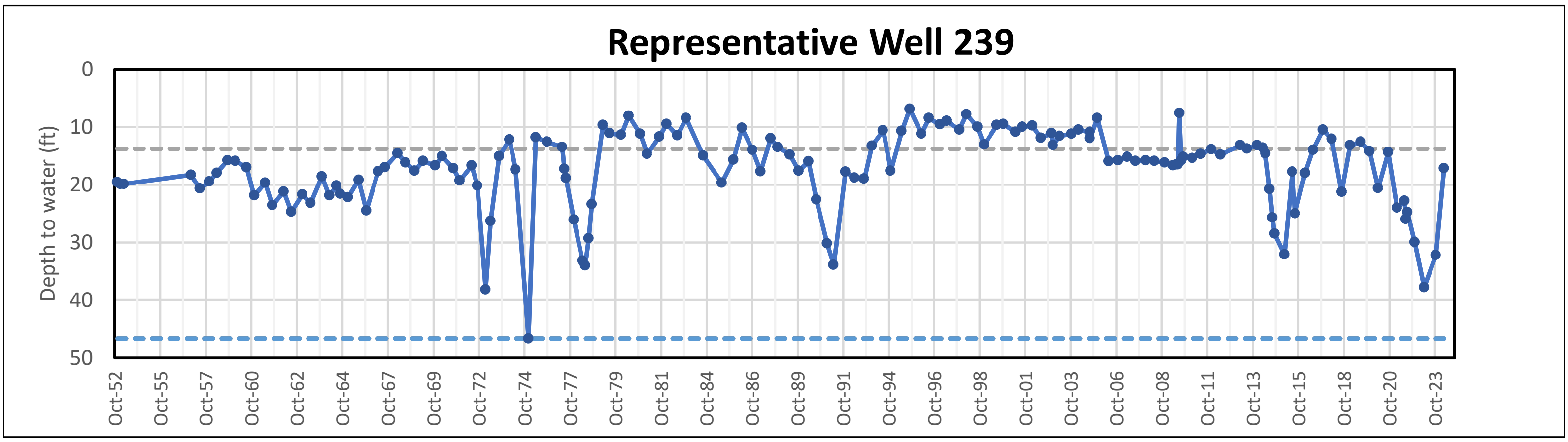
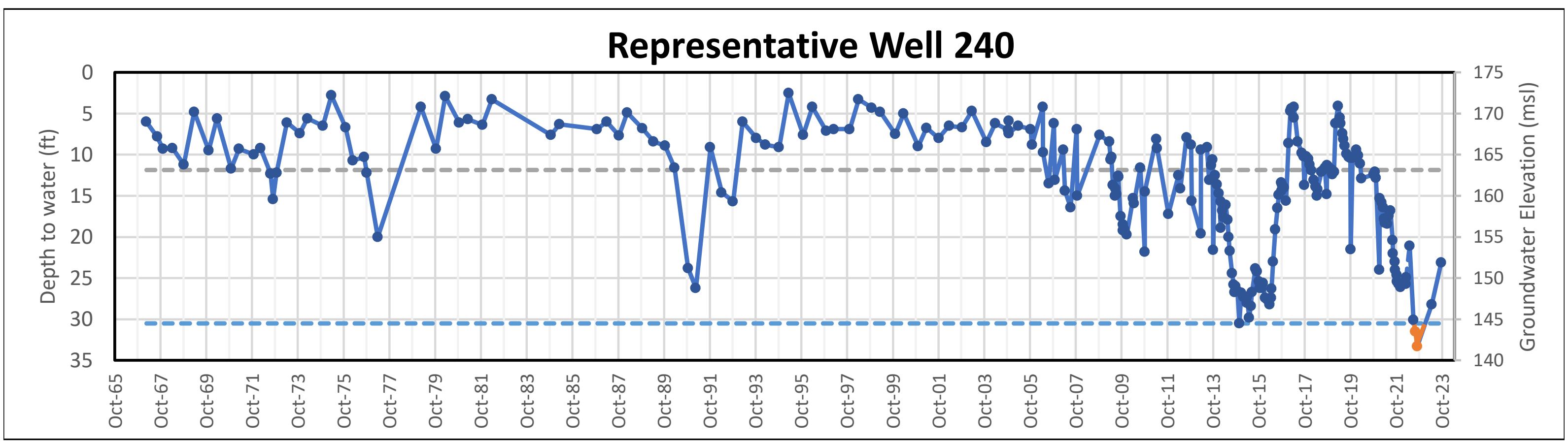
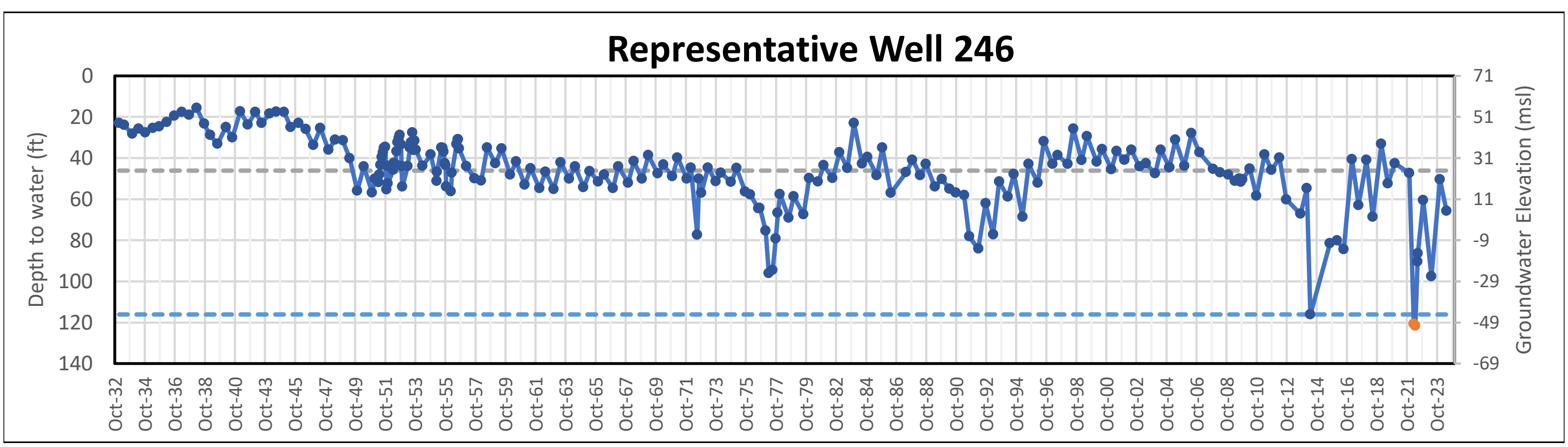
Oct-23

Minimum Threshold — Measurable Objective — Groundwater Elevation



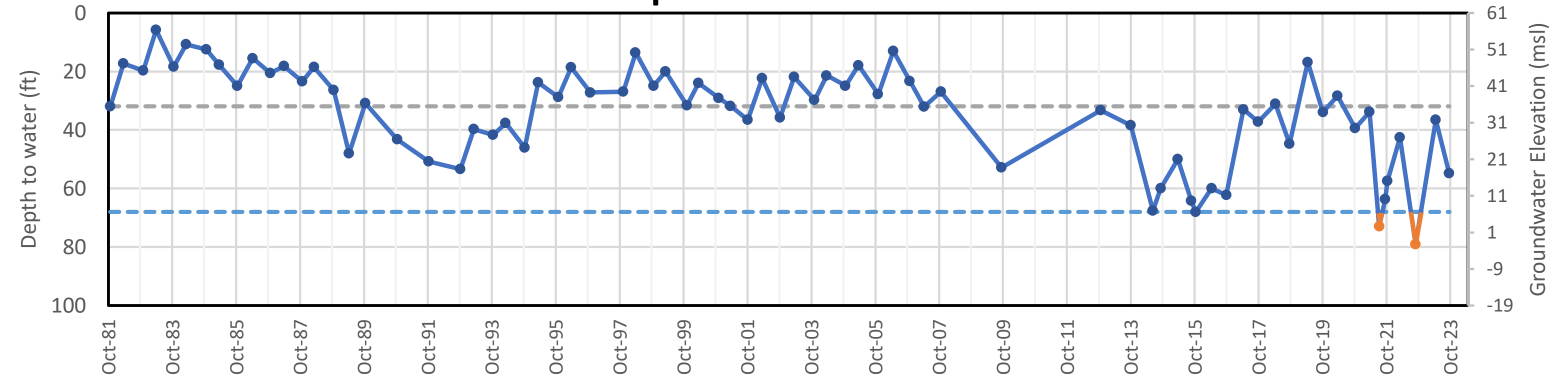




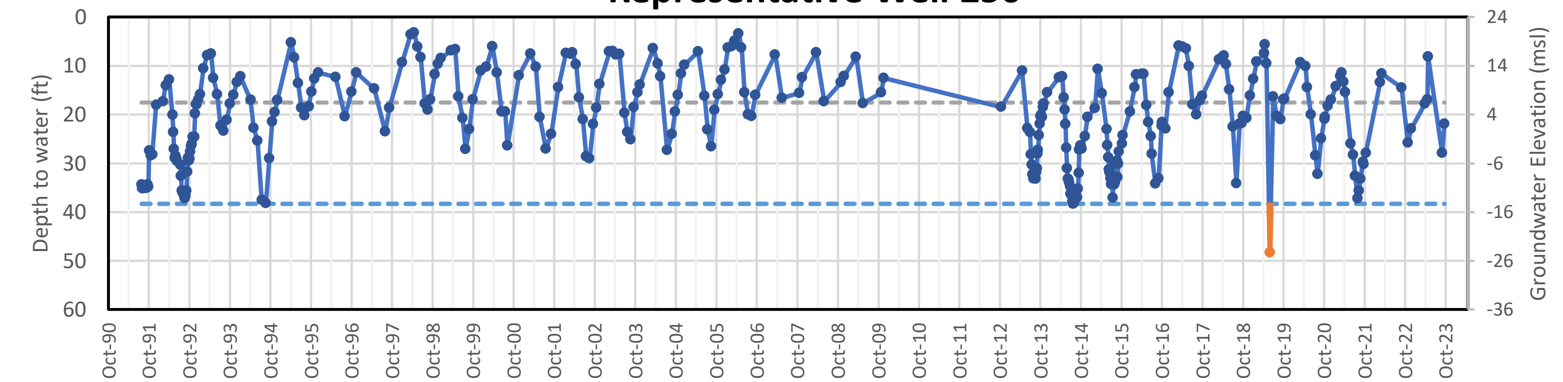


Minimum Threshold | Measurable Objective | Groundwater Elevation

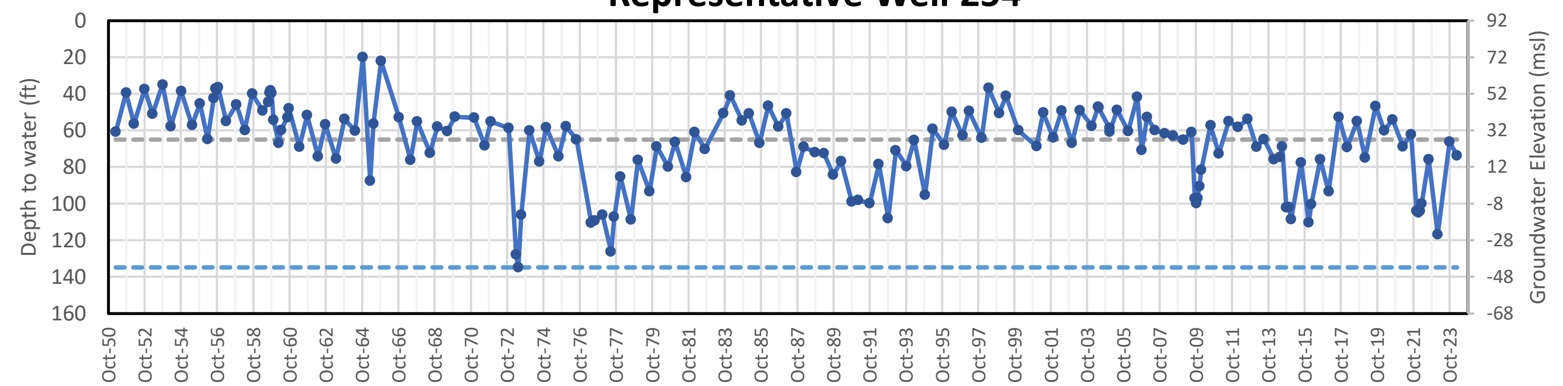
Representative Well 248



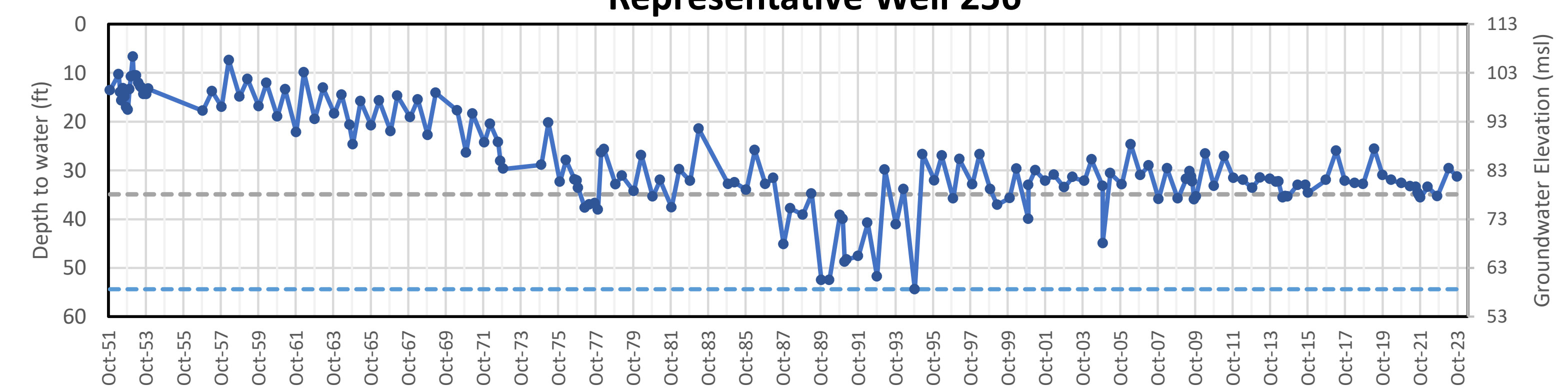
Representative Well 250



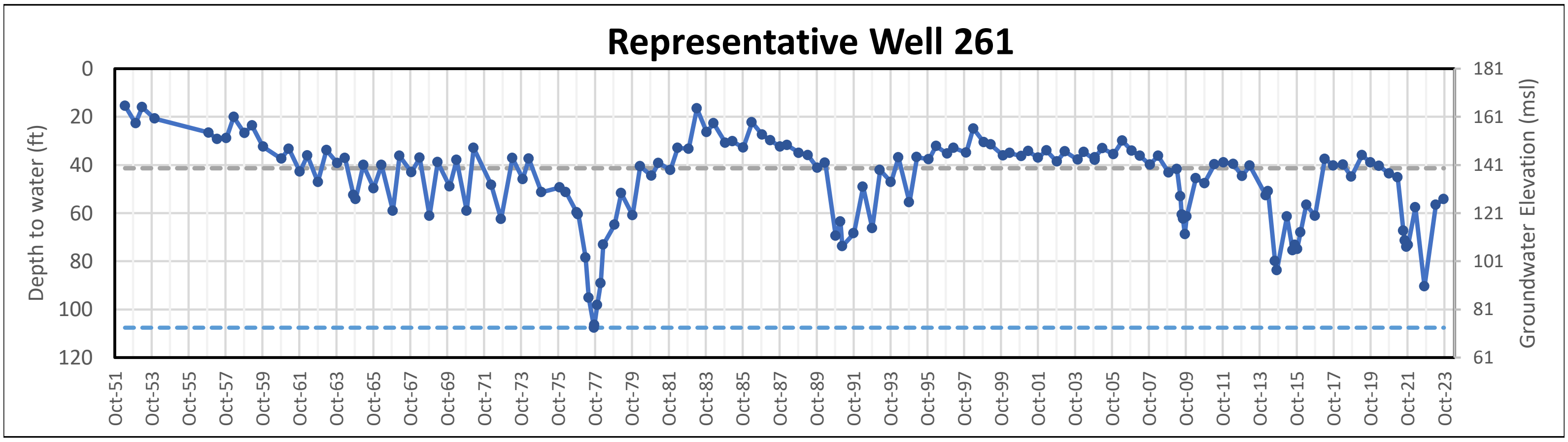
Representative Well 254

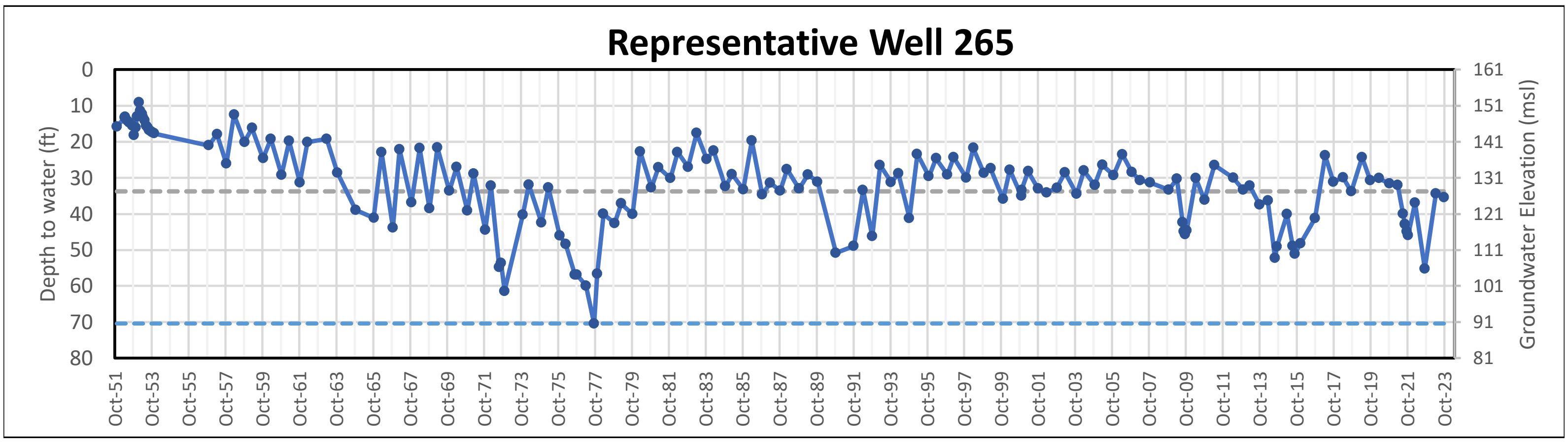


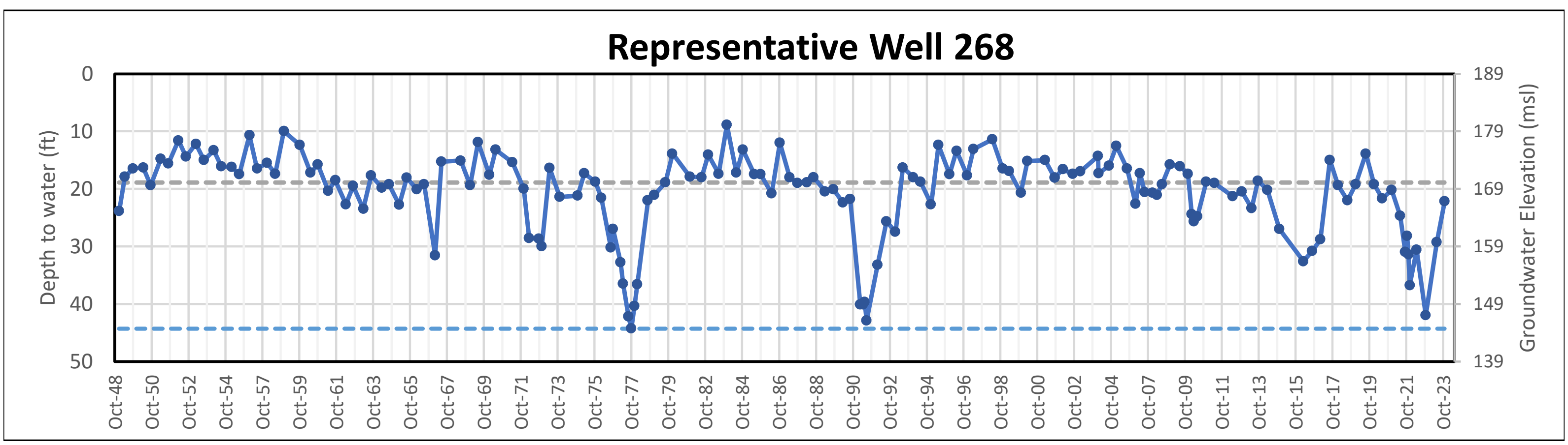
Representative Well 256

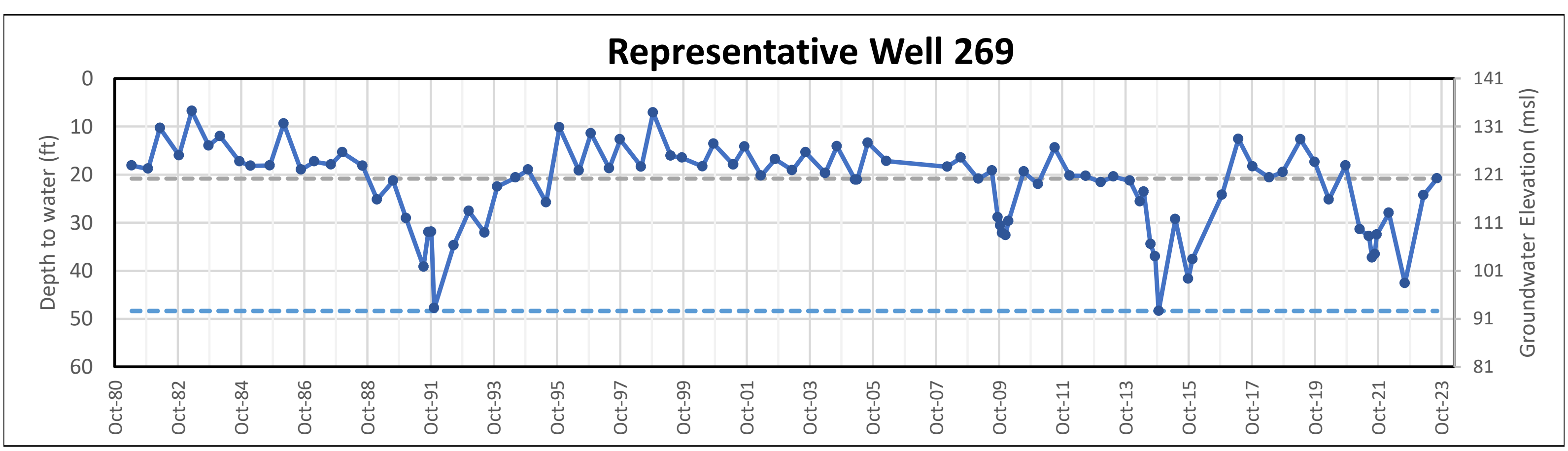


CENTRAL YOLO REPRESENTATIVE HYDROGRAPHS

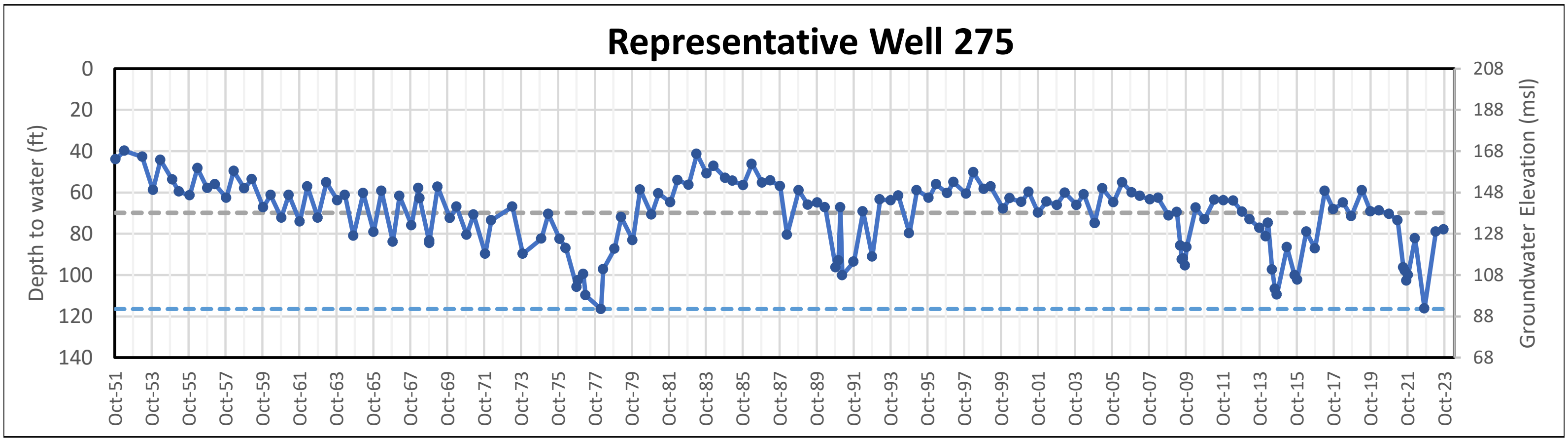


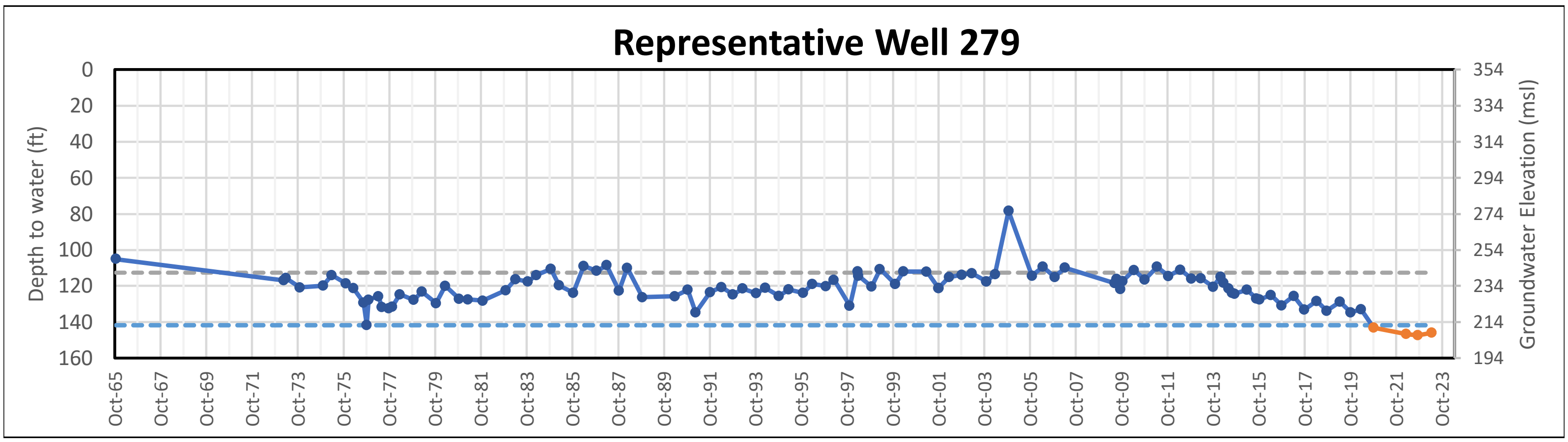


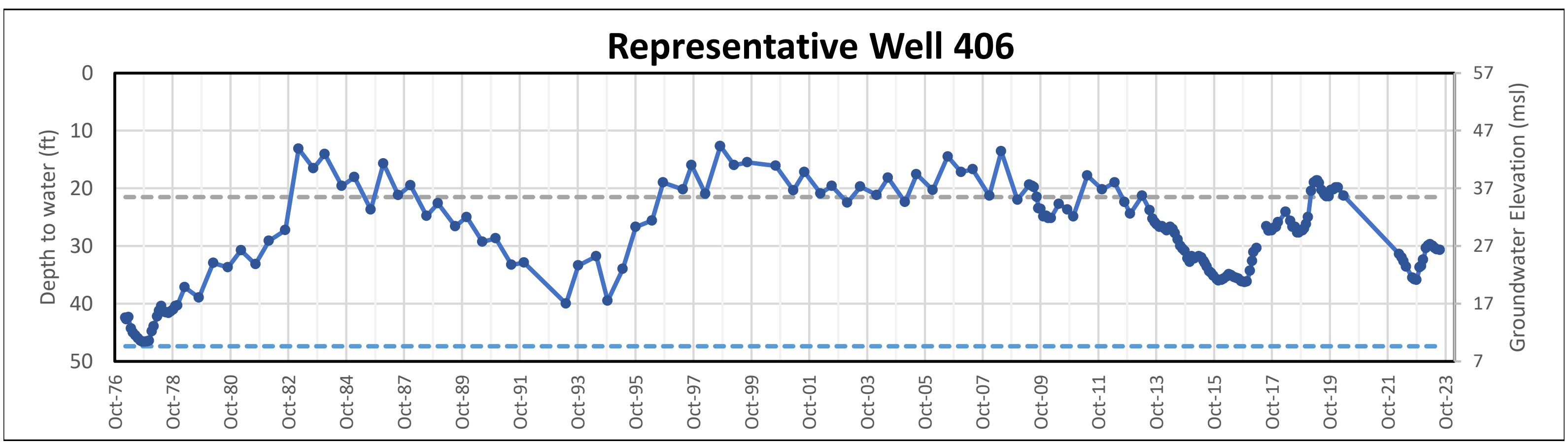


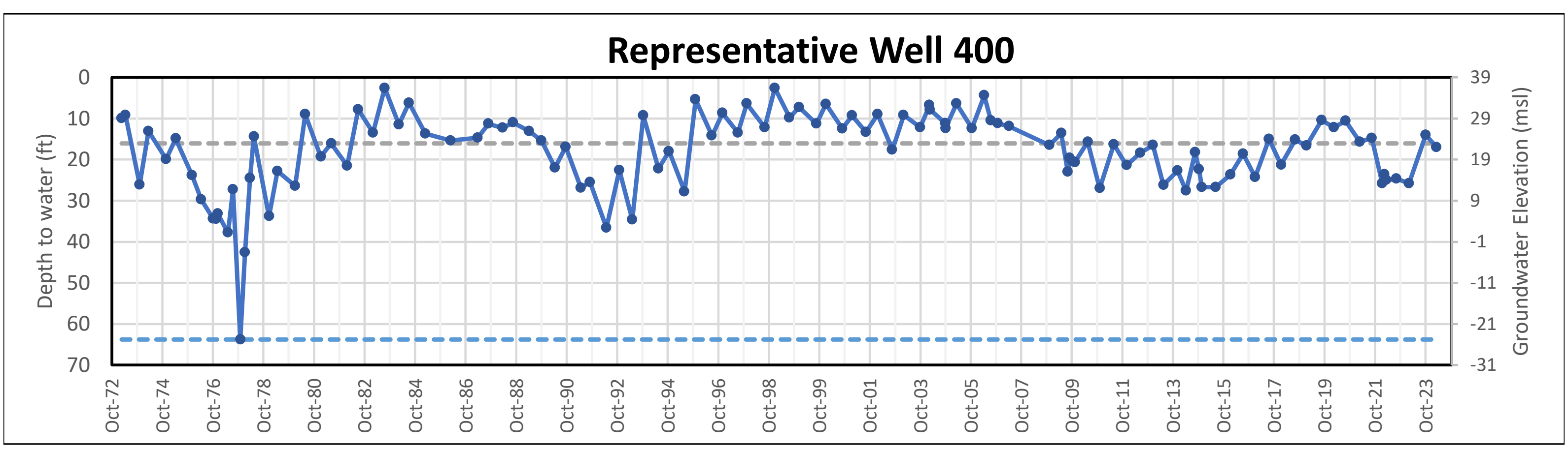


Minimum Threshold | Measurable Objective | Groundwater Elevation

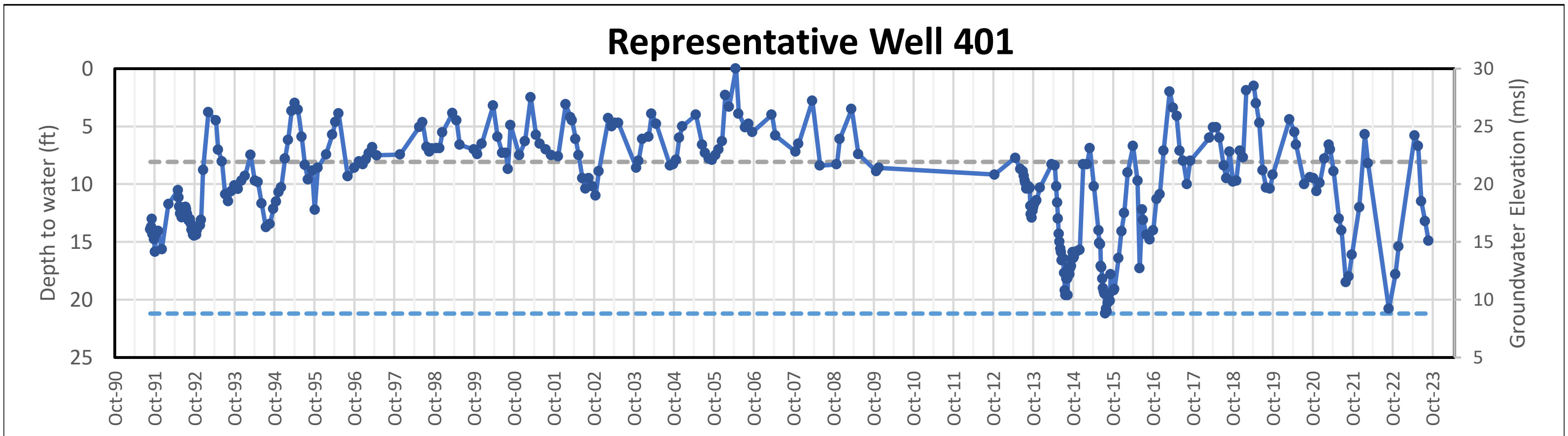


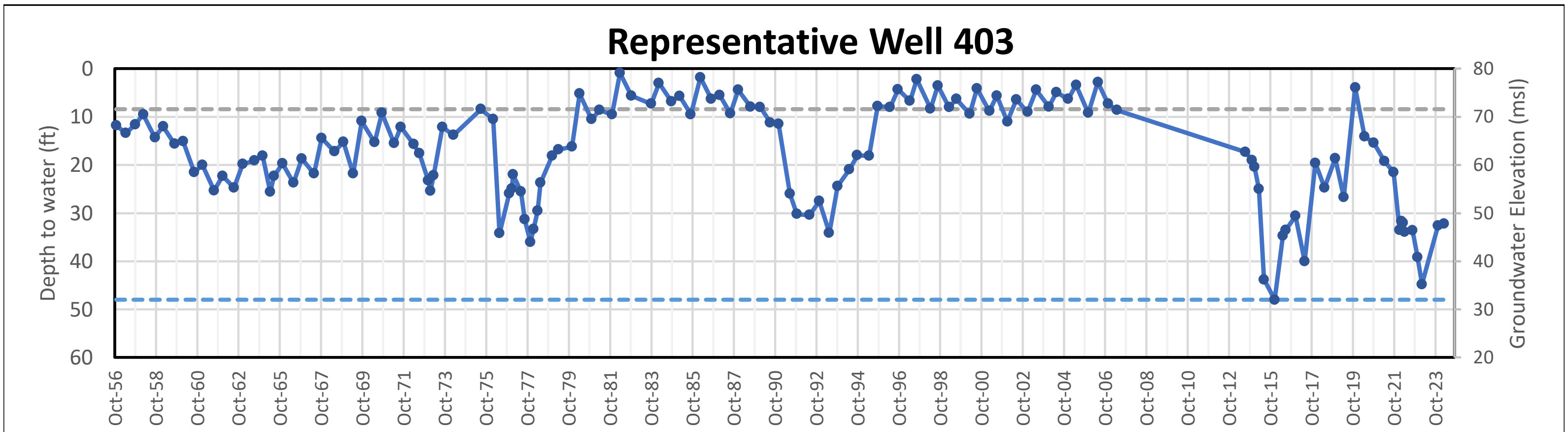


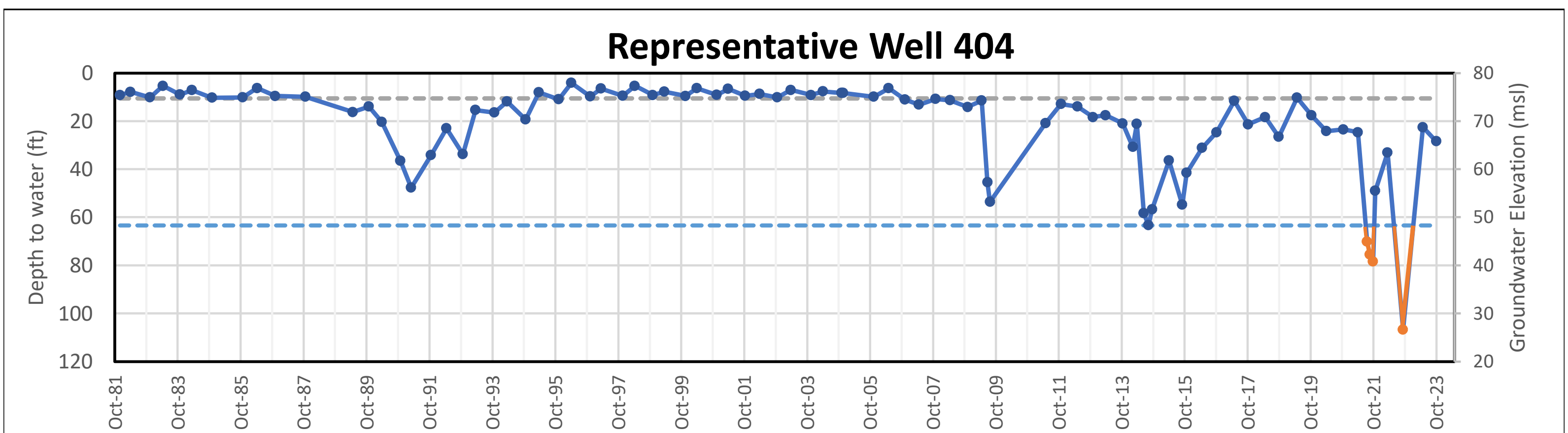


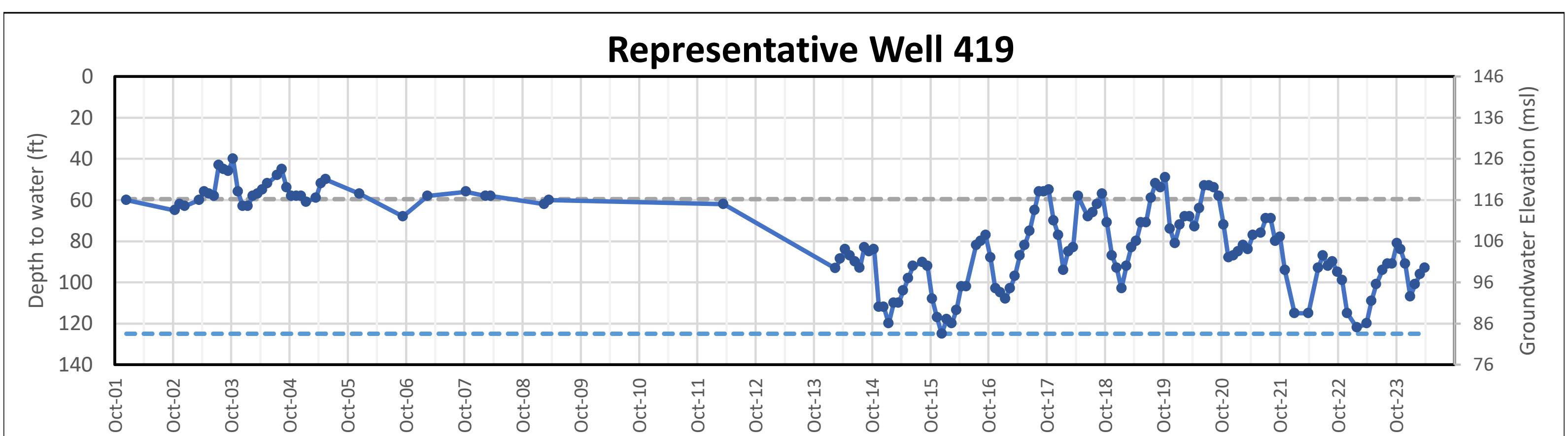


Minimum Threshold | Measurable Objective | Groundwater Elevation



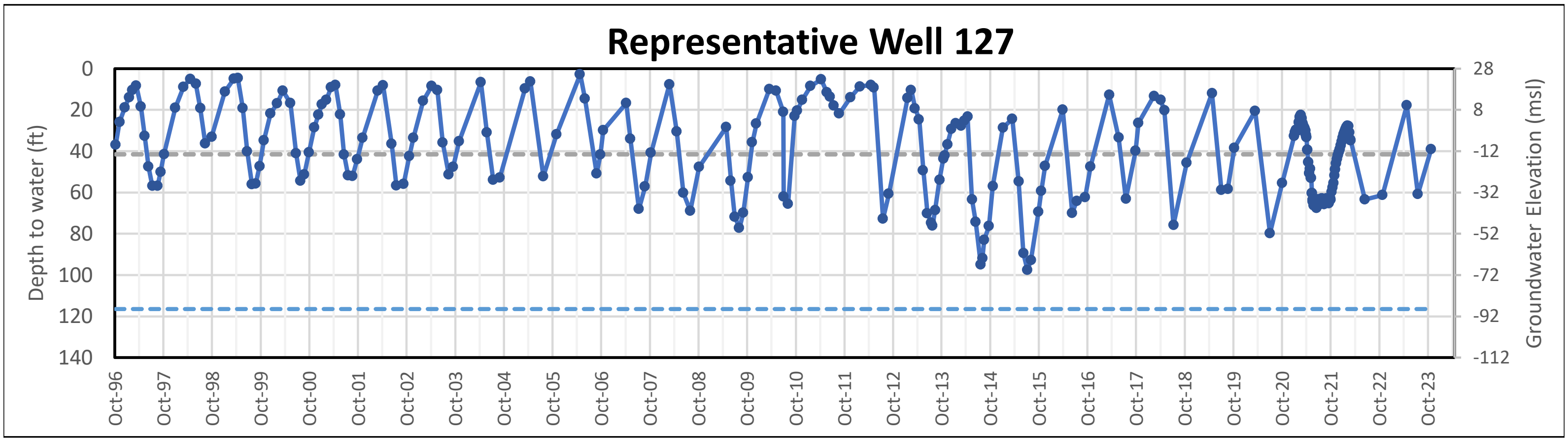


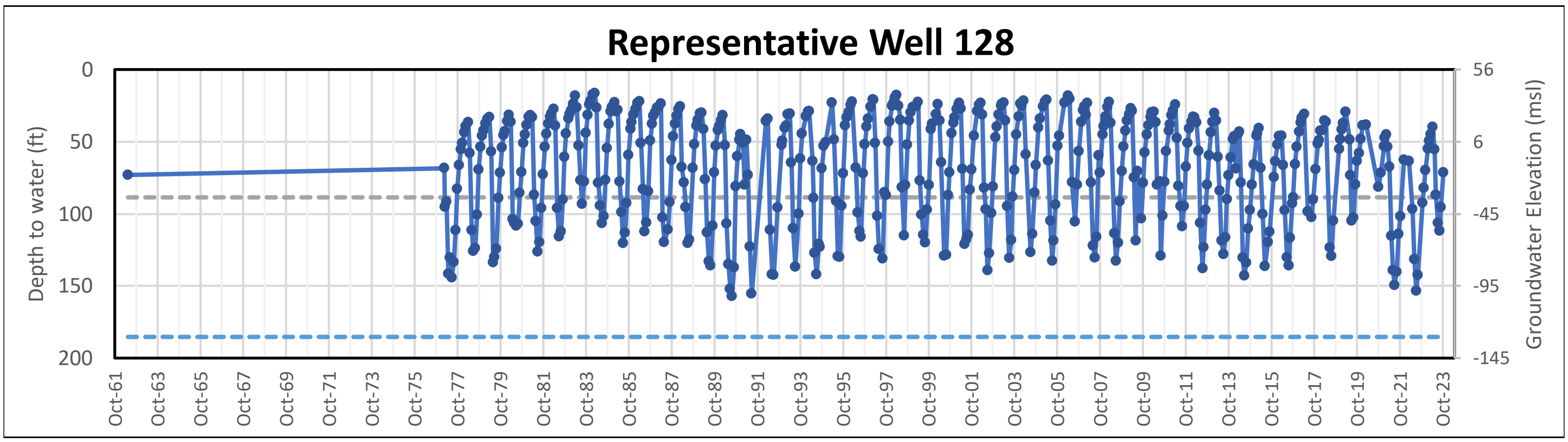


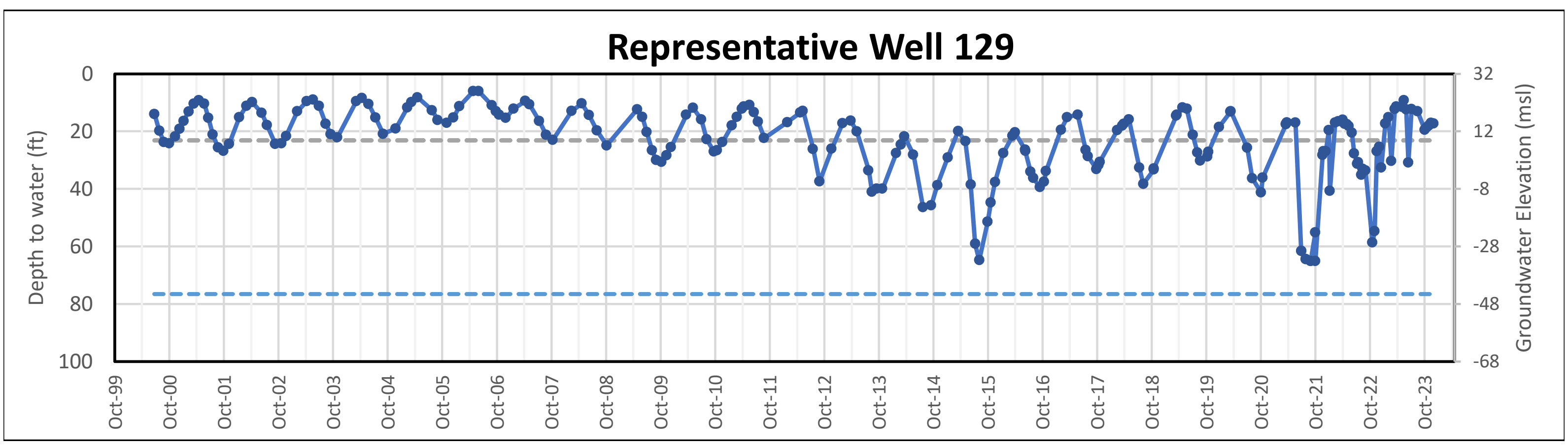


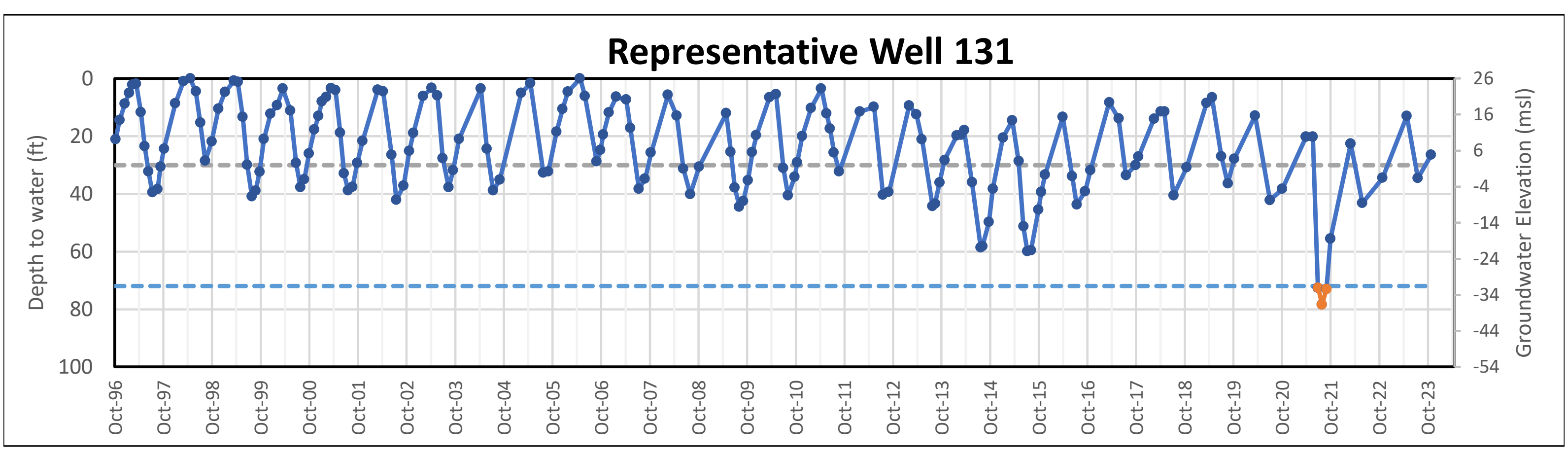
NORTH YOLO REPRESENTATIVE HYDROGRAPHS

Minimum Threshold — Measurable Objective — Groundwater Elevation

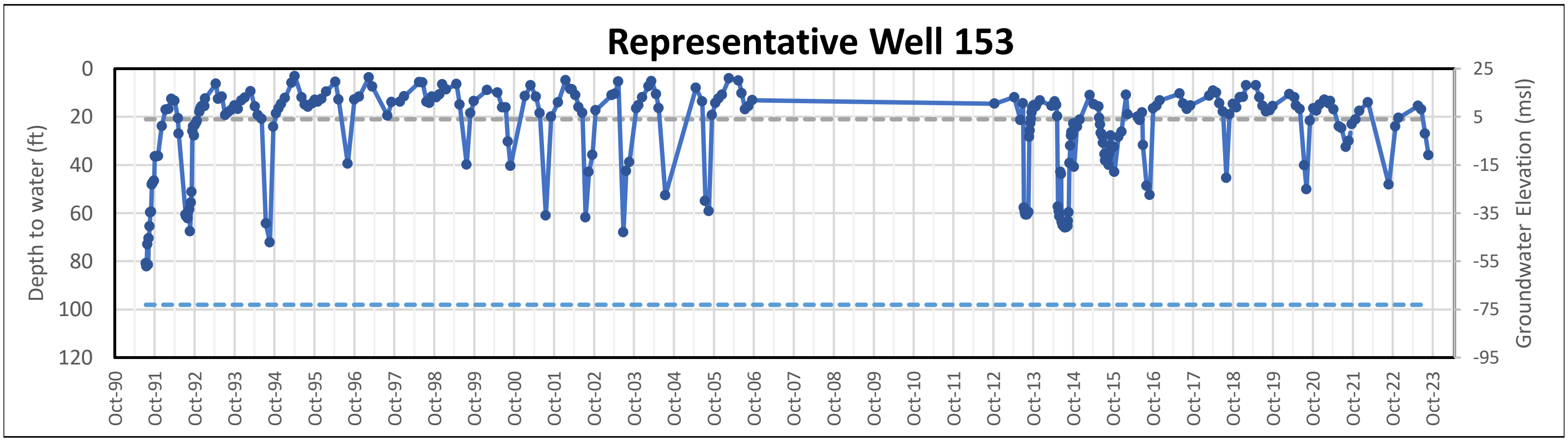


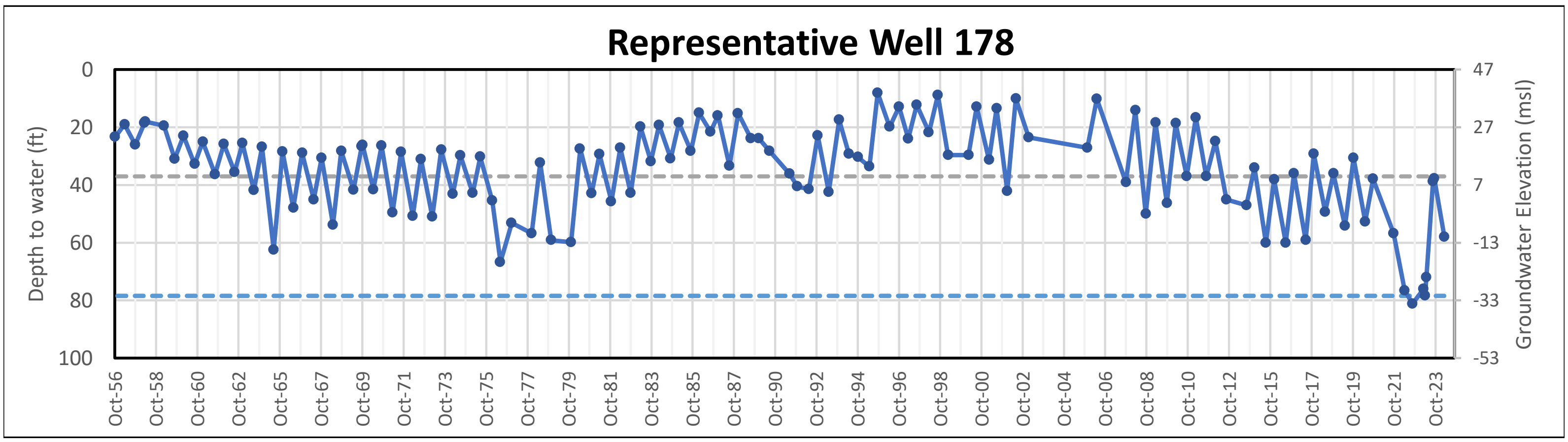


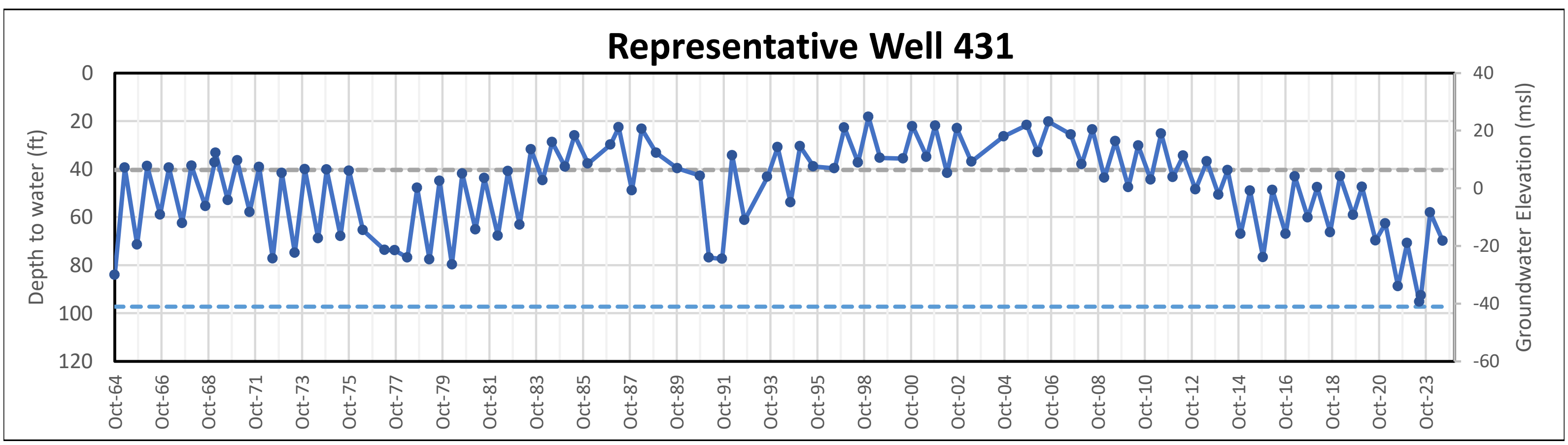


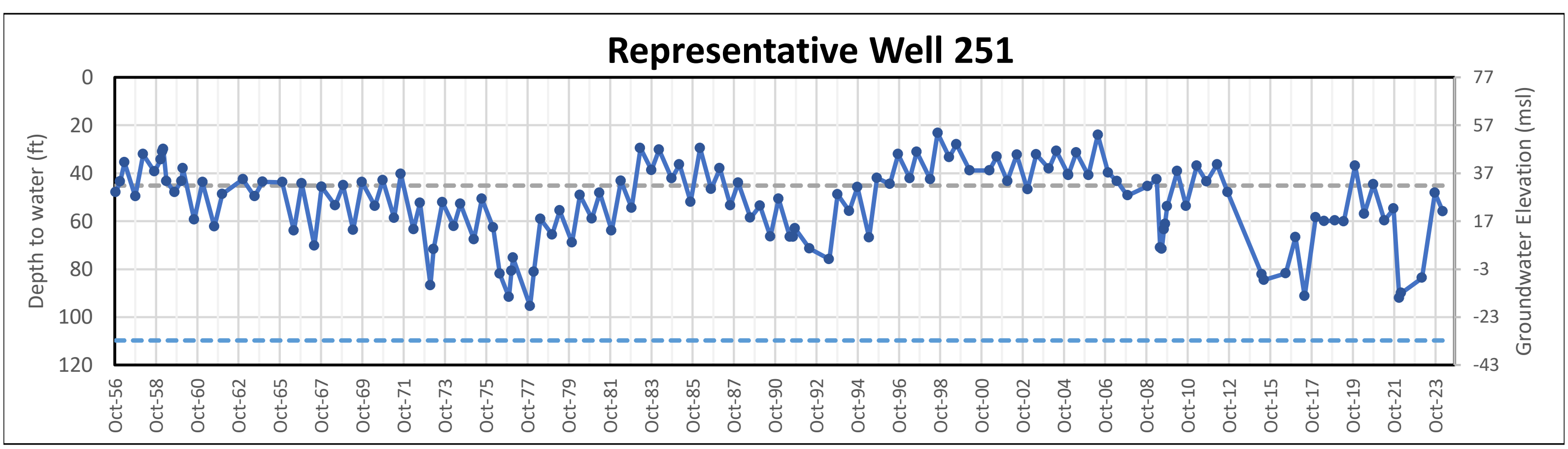



Minimum Threshold
Measurable Objective
Groundwater Elevation


Representative Well 153
Depth to water (ft)
Groundwater Elevation (msl)
0 20 40 60 80 100 120
25 5 -15 -35 -55 -75 -95
Oct-90 Oct-91 Oct-92 Oct-93 Oct-94 Oct-95 Oct-96 Oct-97 Oct-98 Oct-99 Oct-00 Oct-01 Oct-02 Oct-03 Oct-04 Oct-05 Oct-06 Oct-07 Oct-08 Oct-09 Oct-10 Oct-11 Oct-12 Oct-13 Oct-14 Oct-15 Oct-16 Oct-17 Oct-18 Oct-19 Oct-20 Oct-21 Oct-22 Oct-23


Representative Well 178
Depth to water (ft)
Groundwater Elevation (msl)
0 20 40 60 80 100
47 27 7 -13 -33 -53
Oct-56 Oct-58 Oct-60 Oct-62 Oct-65 Oct-67 Oct-69 Oct-71 Oct-73 Oct-75 Oct-77 Oct-79 Oct-81 Oct-83 Oct-85 Oct-87 Oct-90 Oct-92 Oct-94 Oct-96 Oct-98 Oct-00 Oct-02 Oct-04 Oct-06 Oct-08 Oct-10 Oct-12 Oct-15 Oct-17 Oct-19 Oct-21 Oct-23

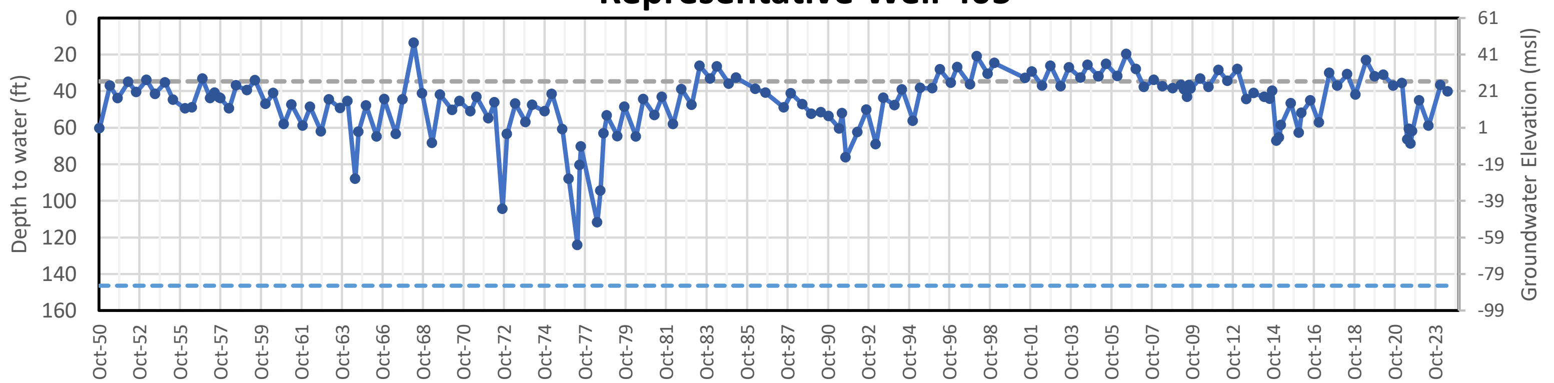

Representative Well 431
Depth to water (ft)
Groundwater Elevation (msl)
0 20 40 60 80 100 120
40 20 0 -20 -40 -60
Oct-64 Oct-66 Oct-68 Oct-71 Oct-73 Oct-75 Oct-77 Oct-79 Oct-81 Oct-83 Oct-85 Oct-87 Oct-89 Oct-91 Oct-93 Oct-95 Oct-98 Oct-00 Oct-02 Oct-04 Oct-06 Oct-08 Oct-10 Oct-12 Oct-14 Oct-16 Oct-18 Oct-20 Oct-23


Representative Well 251
Depth to water (ft)
Groundwater Elevation (msl)
0 20 40 60 80 100 120
77 57 37 17 -3 -23 -43
Oct-56 Oct-58 Oct-60 Oct-62 Oct-65 Oct-67 Oct-69 Oct-71 Oct-73 Oct-75 Oct-77 Oct-79 Oct-81 Oct-83 Oct-85 Oct-87 Oct-90 Oct-92 Oct-94 Oct-96 Oct-98 Oct-00 Oct-02 Oct-04 Oct-06 Oct-08 Oct-10 Oct-12 Oct-15 Oct-17 Oct-19 Oct-21 Oct-23

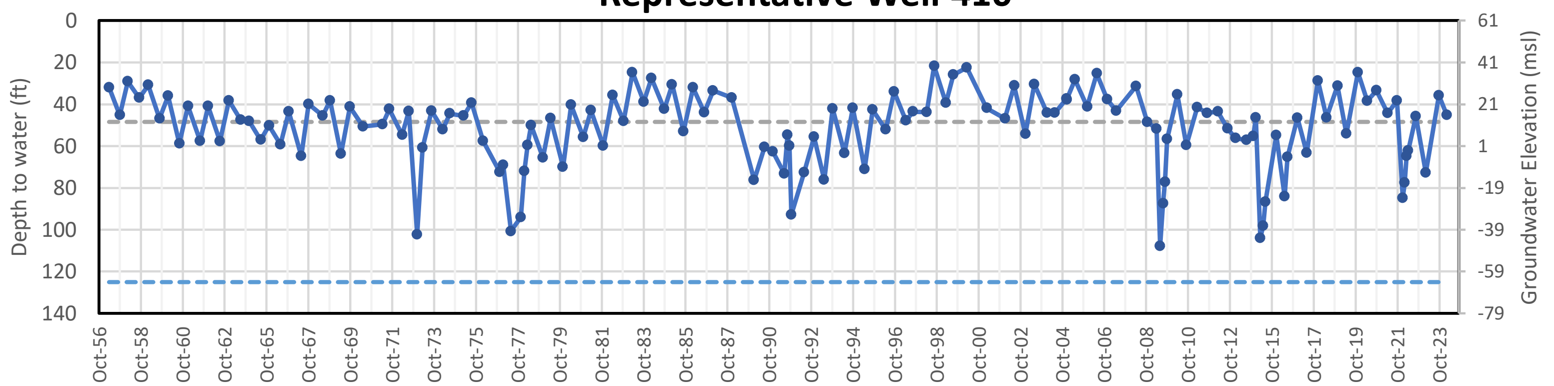
NORTH YOLO REPRESENTATIVE HYDROGRAPHS

Minimum Threshold | Measurable Objective | Groundwater Elevation

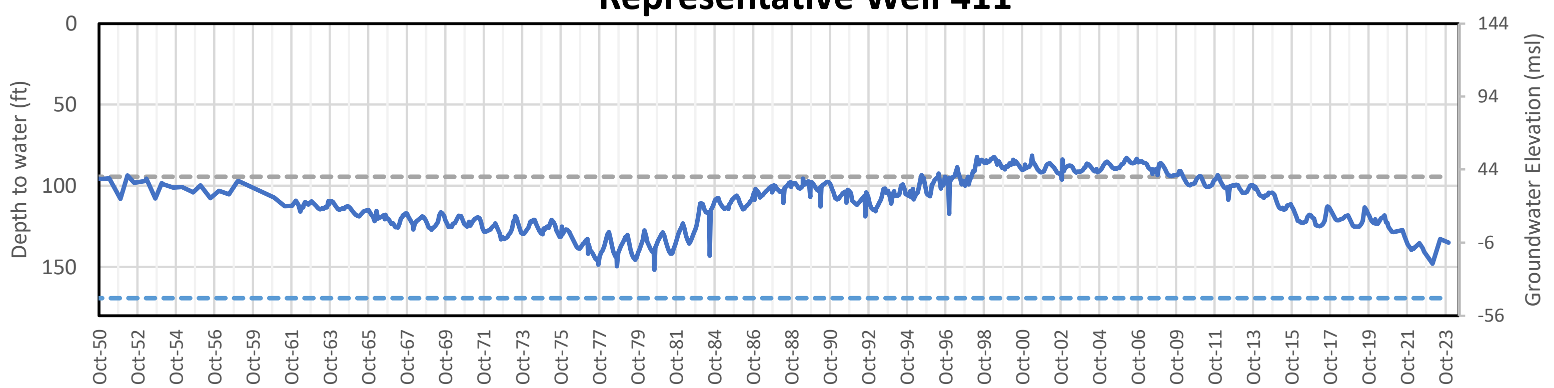
Representative Well 405



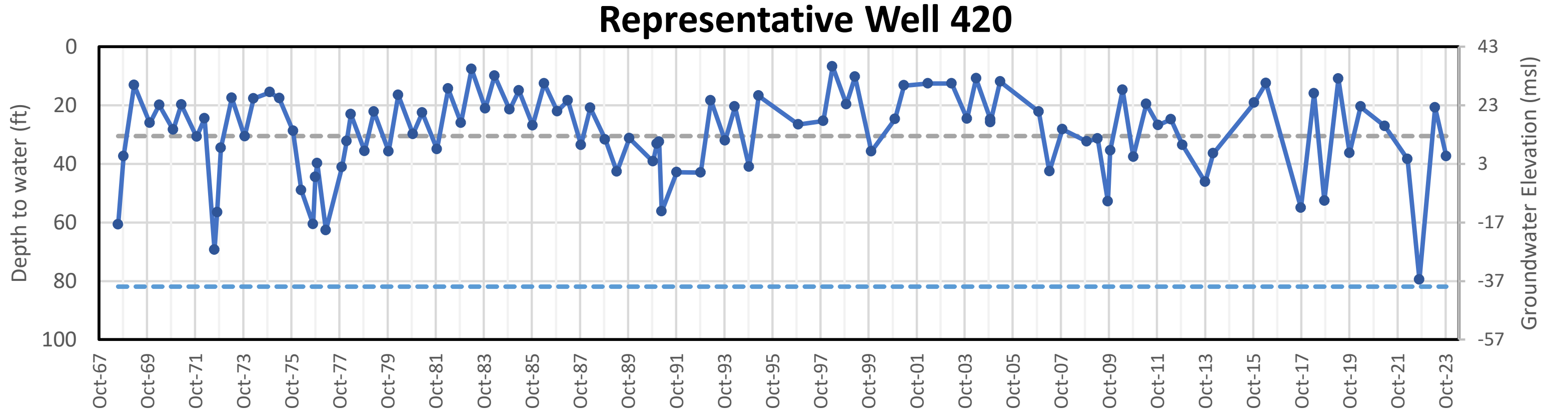
Representative Well 410

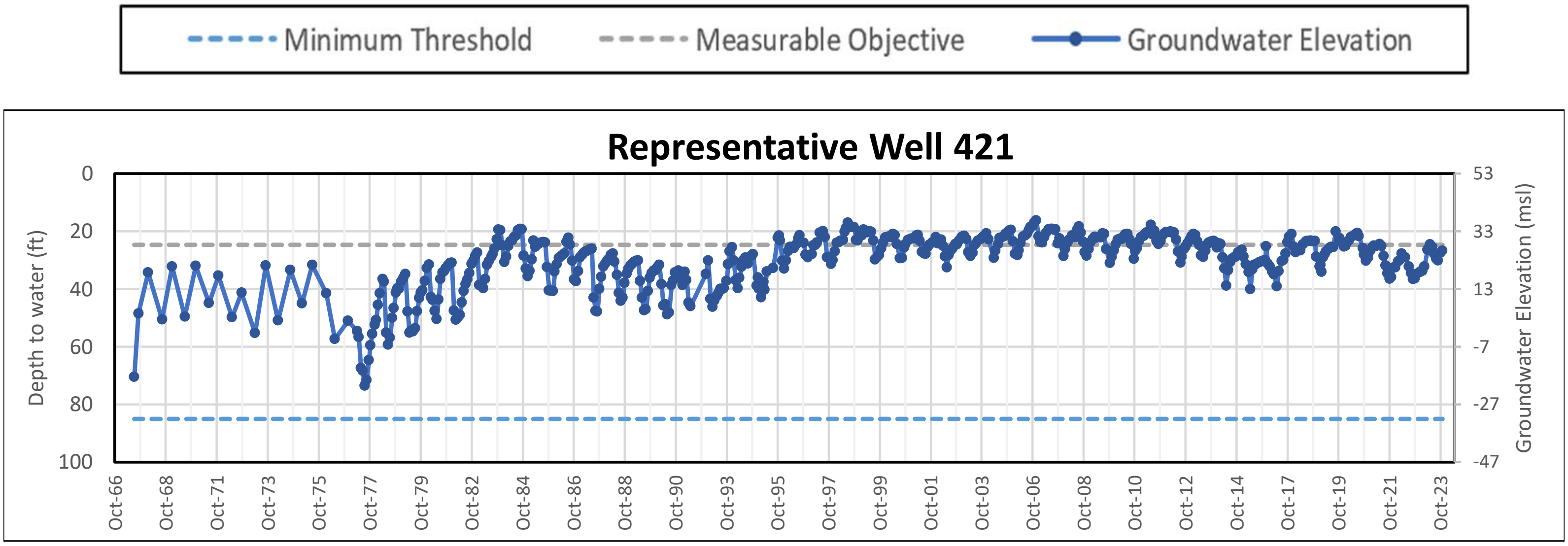


Representative Well 411



Representative Well 420



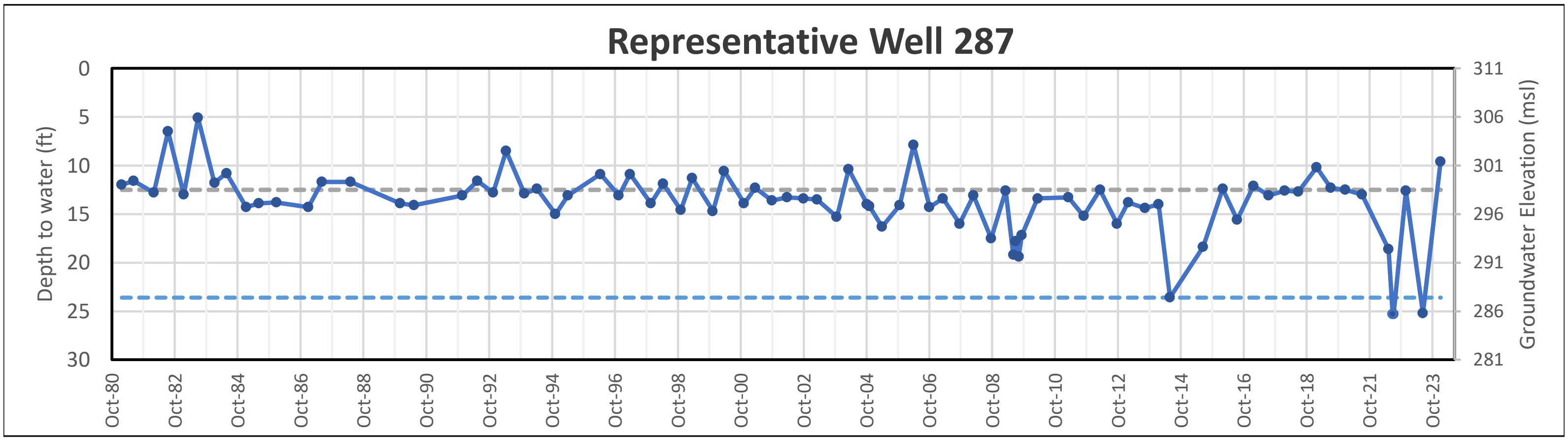

Minimum Threshold
Measurable Objective
Groundwater Elevation
Representative Well 421
Depth to water (ft)
Groundwater Elevation (msl)
0
20
40
60
80
100
53
33
13
-7
-27
-47
Oct-66
Oct-68
Oct-71
Oct-73
Oct-75
Oct-77
Oct-79
Oct-82
Oct-84
Oct-86
Oct-88
Oct-90
Oct-93
Oct-95
Oct-97
Oct-99
Oct-01
Oct-03
Oct-06
Oct-08
Oct-10
Oct-12
Oct-14
Oct-17
Oct-19
Oct-21
Oct-23

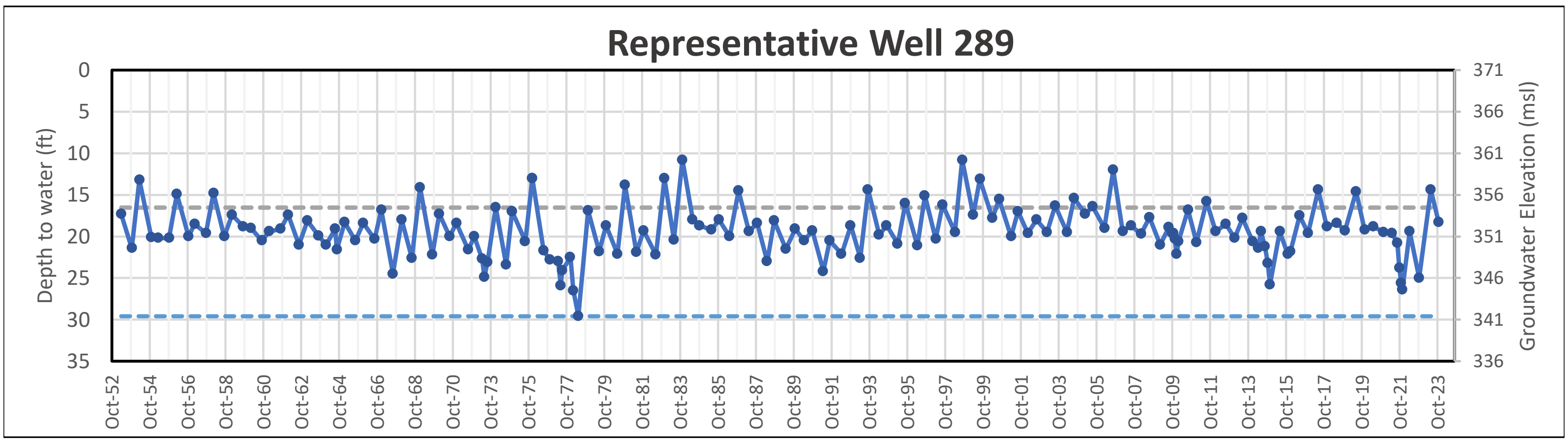
YOLO SUBBASIN GSP ANNUAL REPORT 2024

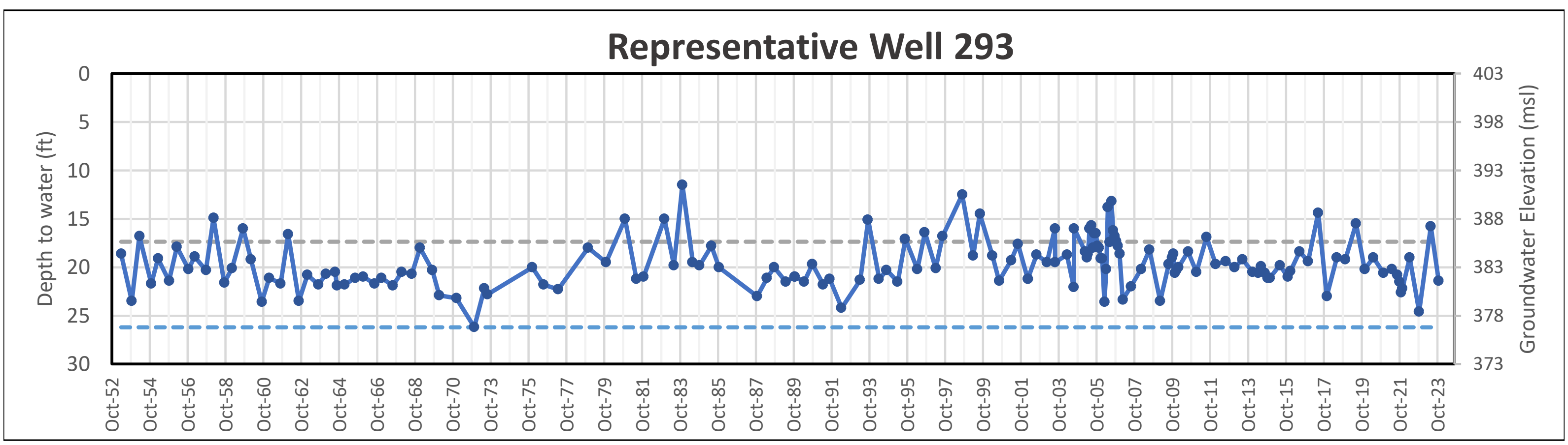
ATTACHMENT B

INTERCONNECTED SURFACE WATERS REPRESENTATIVE WELL HYDROGRAPHS


Minimum Threshold
Measurable Objective
Groundwater Elevation


Representative Well 287
Depth to water (ft)
0
5
10
15
20
25
30
Groundwater Elevation (msl)
311
306
301
296
291
286
281
Oct-80
Oct-82
Oct-84
Oct-86
Oct-88
Oct-90
Oct-92
Oct-94
Oct-96
Oct-98
Oct-00
Oct-02
Oct-04
Oct-06
Oct-08
Oct-10
Oct-12
Oct-14
Oct-16
Oct-18
Oct-21
Oct-23

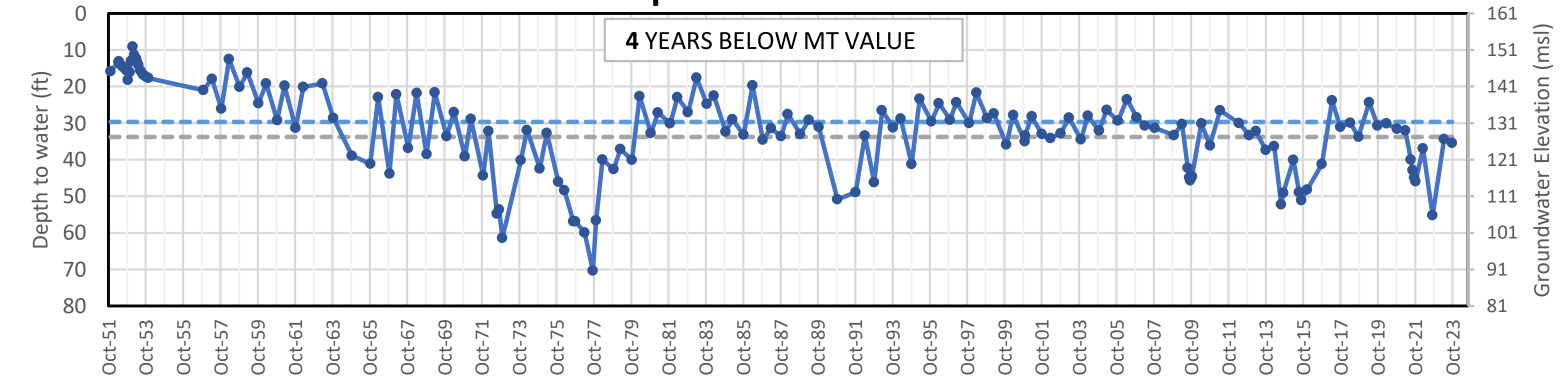

Representative Well 289
Depth to water (ft)
0
5
10
15
20
25
30
35
Groundwater Elevation (msl)
371
366
361
356
351
346
341
336
Oct-52
Oct-54
Oct-56
Oct-58
Oct-60
Oct-62
Oct-64
Oct-66
Oct-68
Oct-70
Oct-73
Oct-75
Oct-77
Oct-79
Oct-81
Oct-83
Oct-85
Oct-87
Oct-89
Oct-91
Oct-93
Oct-95
Oct-97
Oct-99
Oct-01
Oct-03
Oct-05
Oct-07
Oct-09
Oct-11
Oct-13
Oct-15
Oct-17
Oct-19
Oct-21
Oct-23


Representative Well 293
Depth to water (ft)
0
5
10
15
20
25
30
Groundwater Elevation (msl)
403
398
393
388
383
378
373
Oct-52
Oct-54
Oct-56
Oct-58
Oct-60
Oct-62
Oct-64
Oct-66
Oct-68
Oct-70
Oct-73
Oct-75
Oct-77
Oct-79
Oct-81
Oct-83
Oct-85
Oct-87
Oct-89
Oct-91
Oct-93
Oct-95
Oct-97
Oct-99
Oct-01
Oct-03
Oct-05
Oct-07
Oct-09
Oct-11
Oct-13
Oct-15
Oct-17
Oct-19
Oct-21
Oct-23

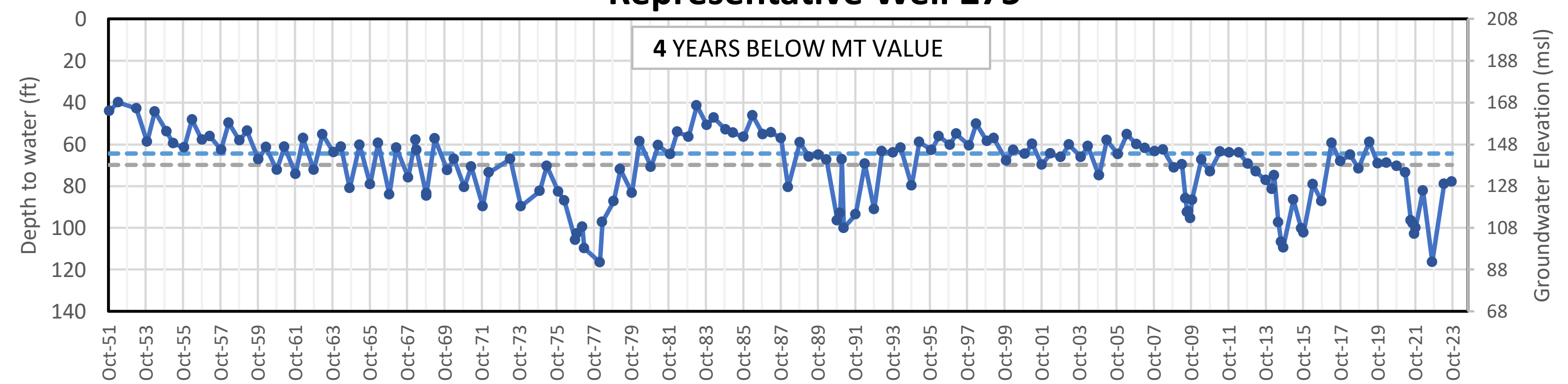
LOWER CACHE CREEK REPRESENTATIVE HYDROGRAPHS

Minimum Threshold — Measurable Objective — Groundwater Elevation

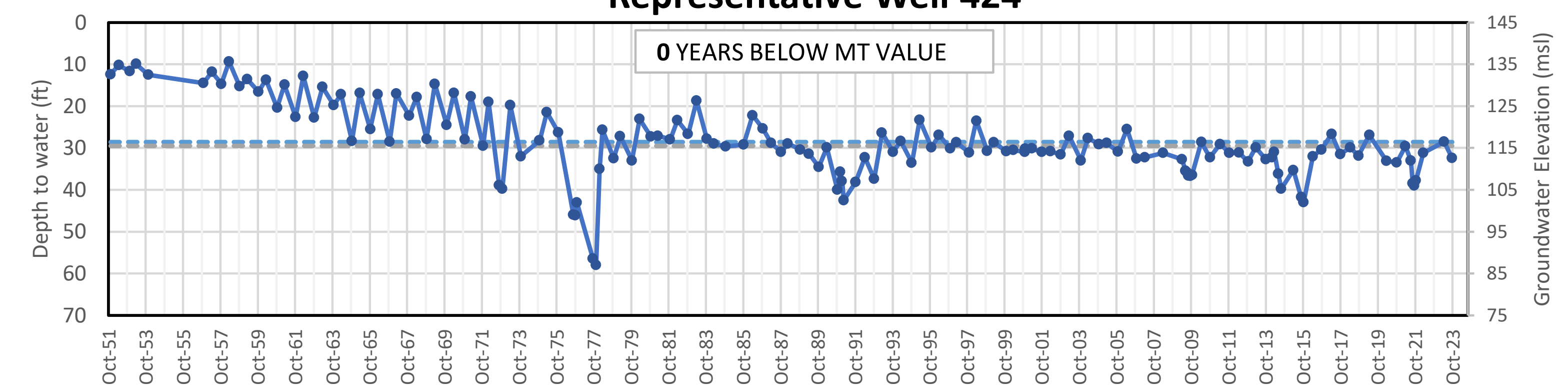
Representative Well 265



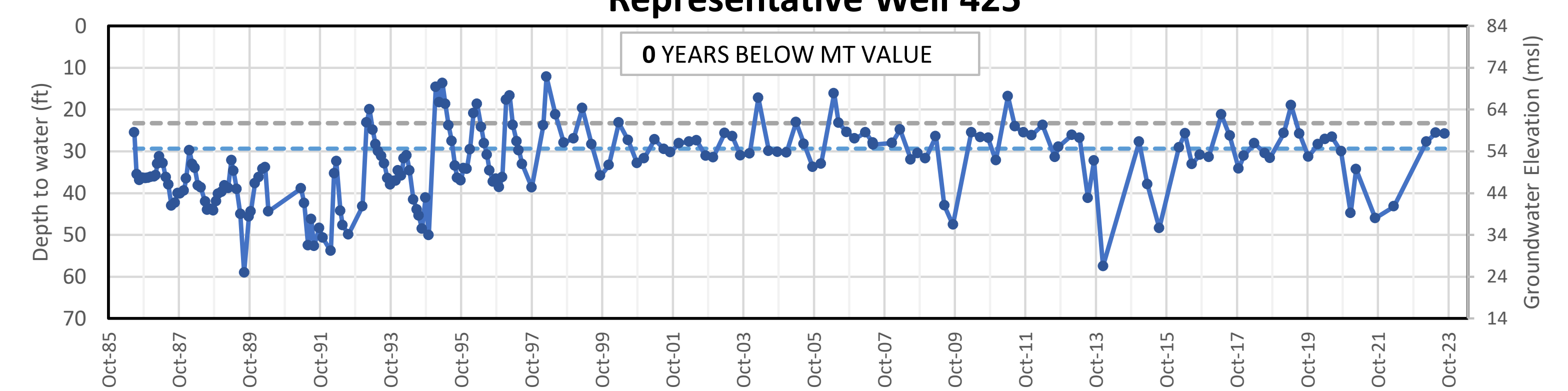
Representative Well 275

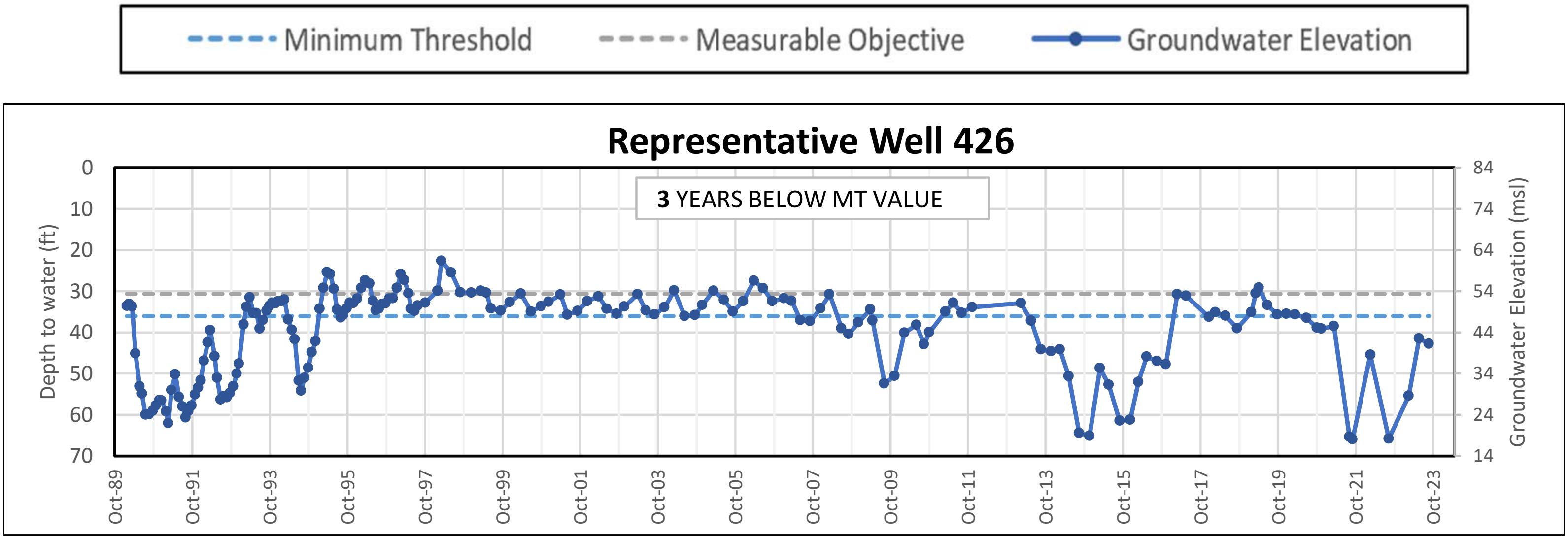


Representative Well 424



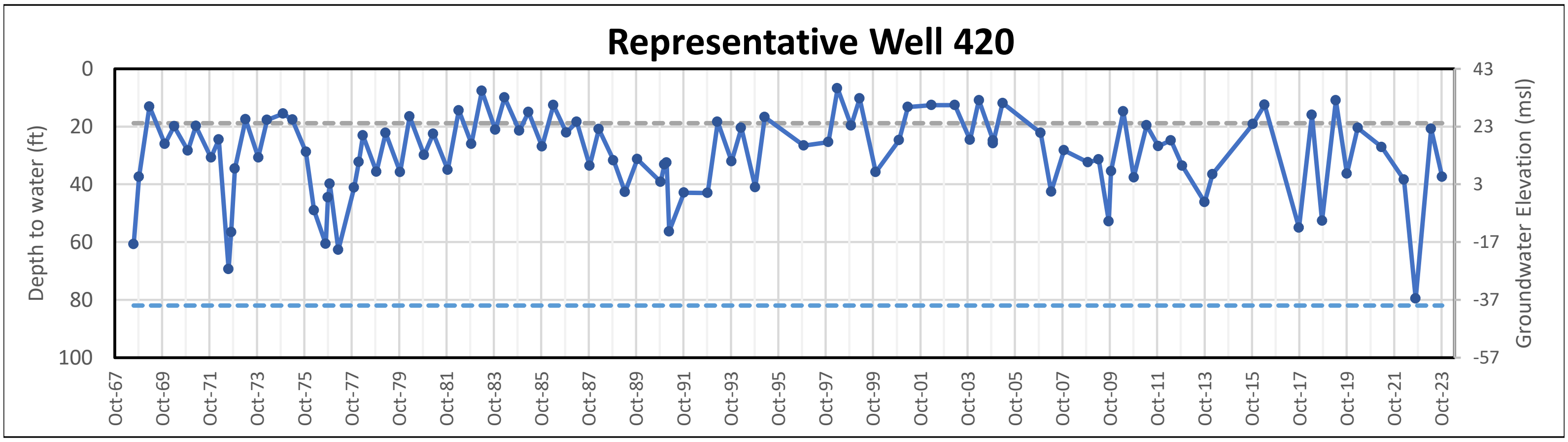
Representative Well 425

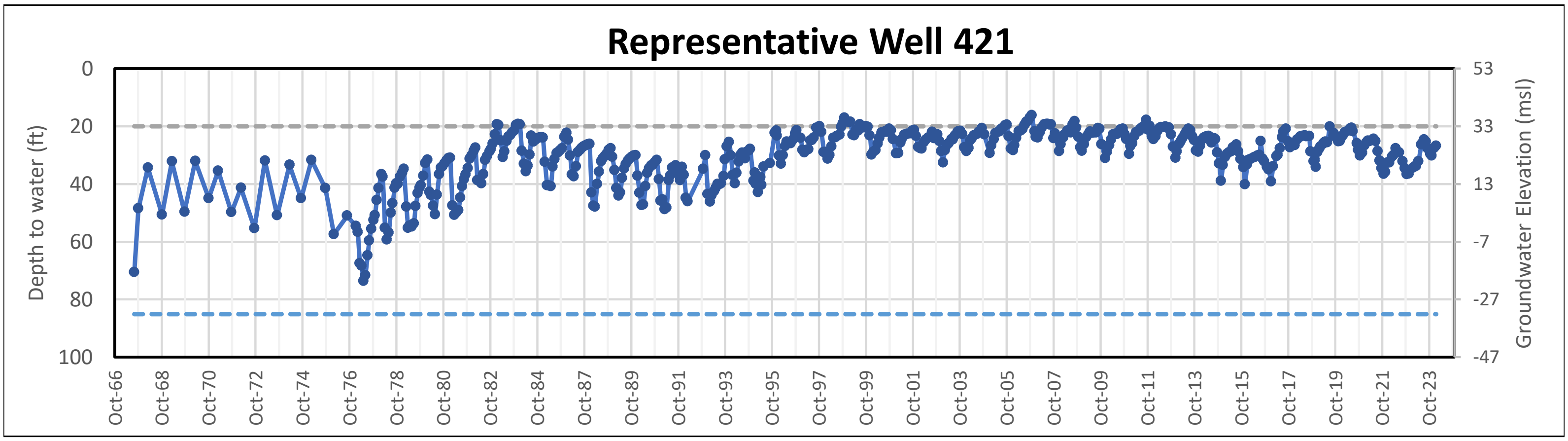


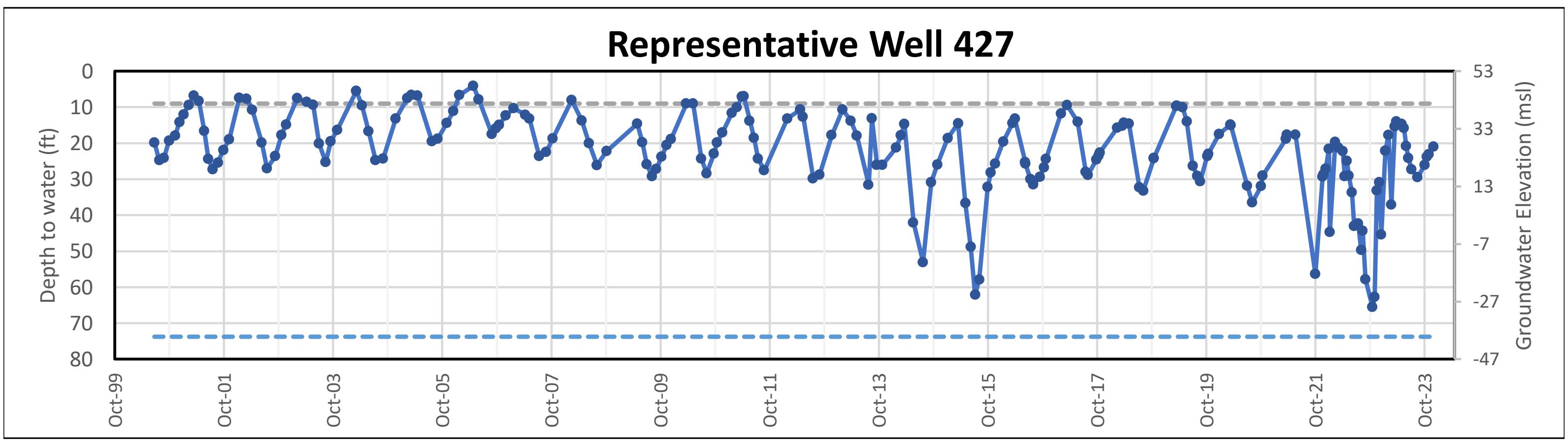

Minimum Threshold
Measurable Objective
Groundwater Elevation
Representative Well 426
3 YEARS BELOW MT VALUE
Depth to water (ft)
Groundwater Elevation (msl)
0
10
20
30
40
50
60
70
84
74
64
54
44
34
24
14
Oct-89
Oct-91
Oct-93
Oct-95
Oct-97
Oct-99
Oct-01
Oct-03
Oct-05
Oct-07
Oct-09
Oct-11
Oct-13
Oct-15
Oct-17
Oct-19
Oct-21
Oct-23

UPPER SACRAMENTO RIVER REPRESENTATIVE HYDROGRAPHS

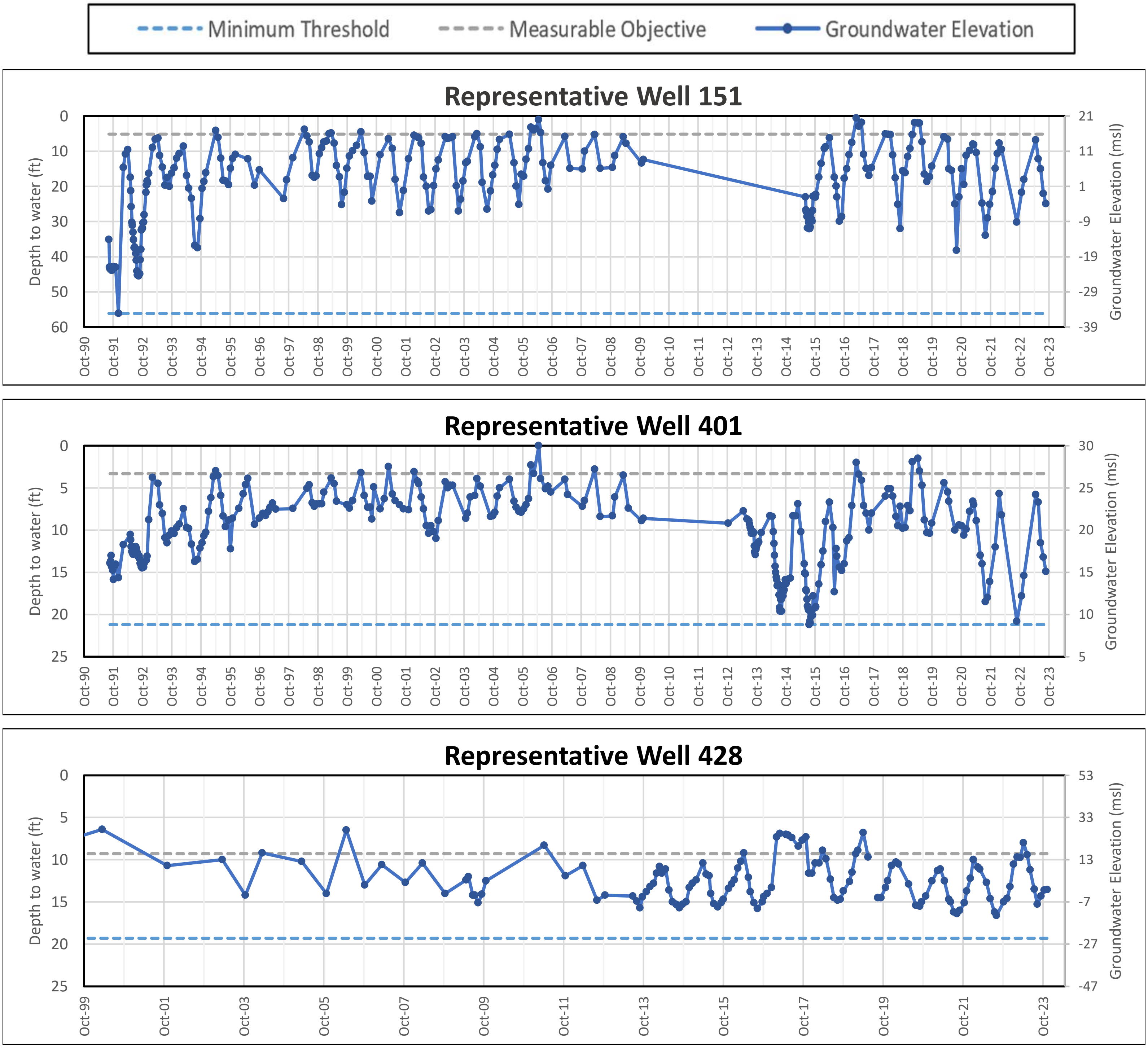
Minimum Threshold   Measurable Objective   Groundwater Elevation



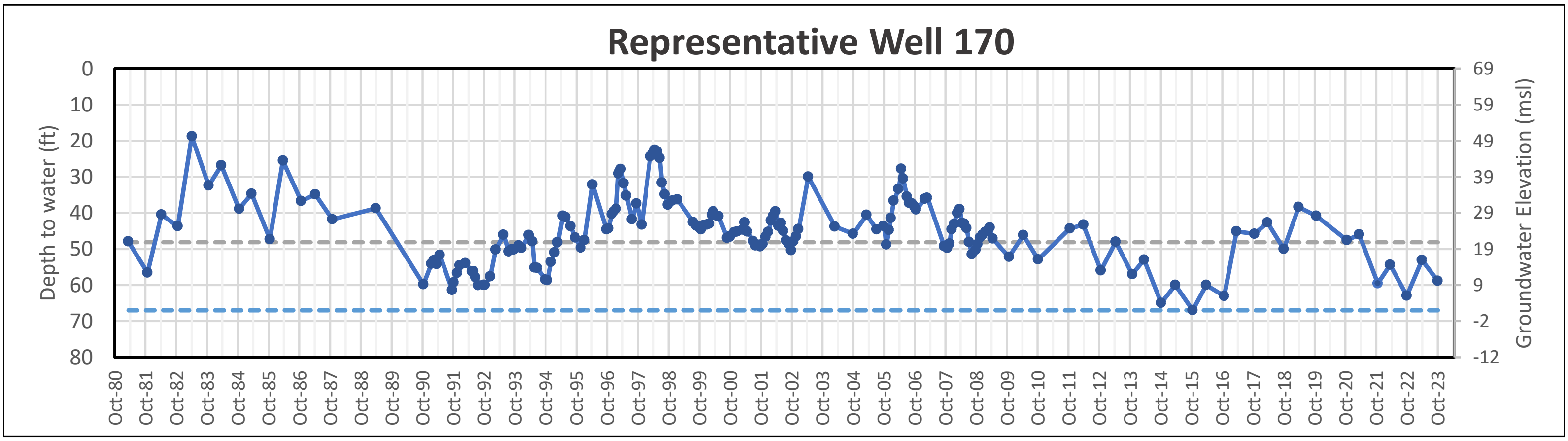


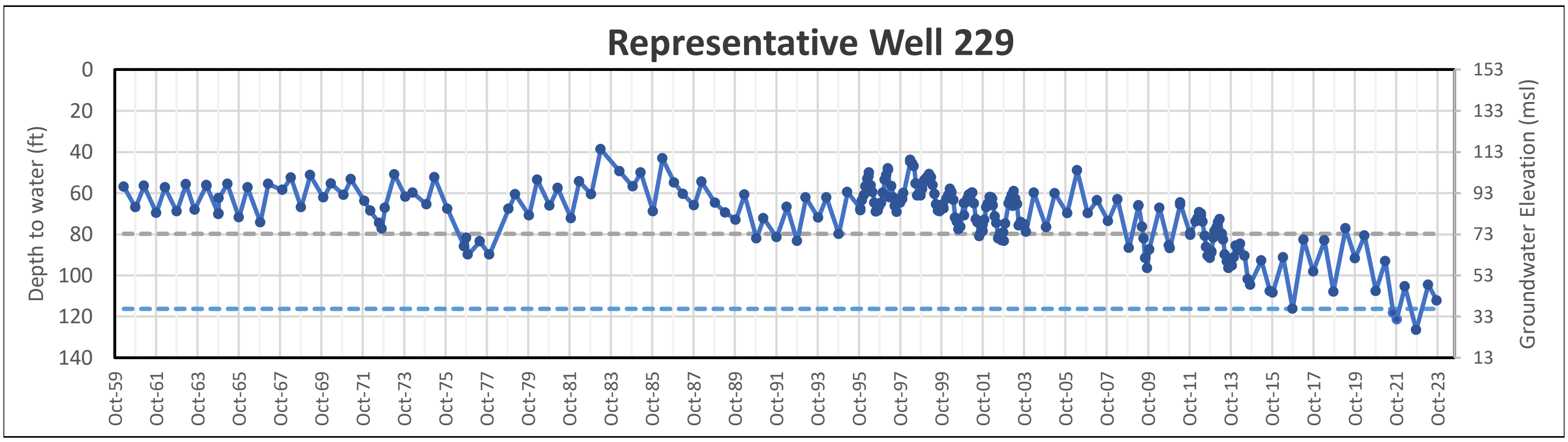


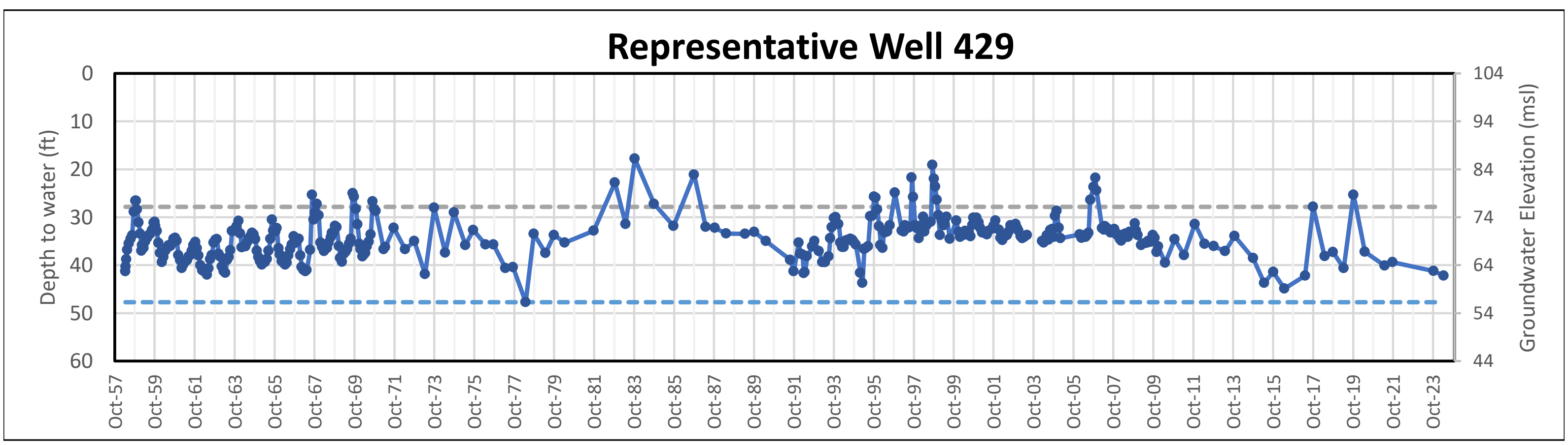
LOWER SACRAMENTO RIVER REPRESENTATIVE HYDROGRAPHS



PUTAH CREEK REPRESENTATIVE HYDROGRAPHS







530-662-3211
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34274 State Hwy 16, Woodland CA