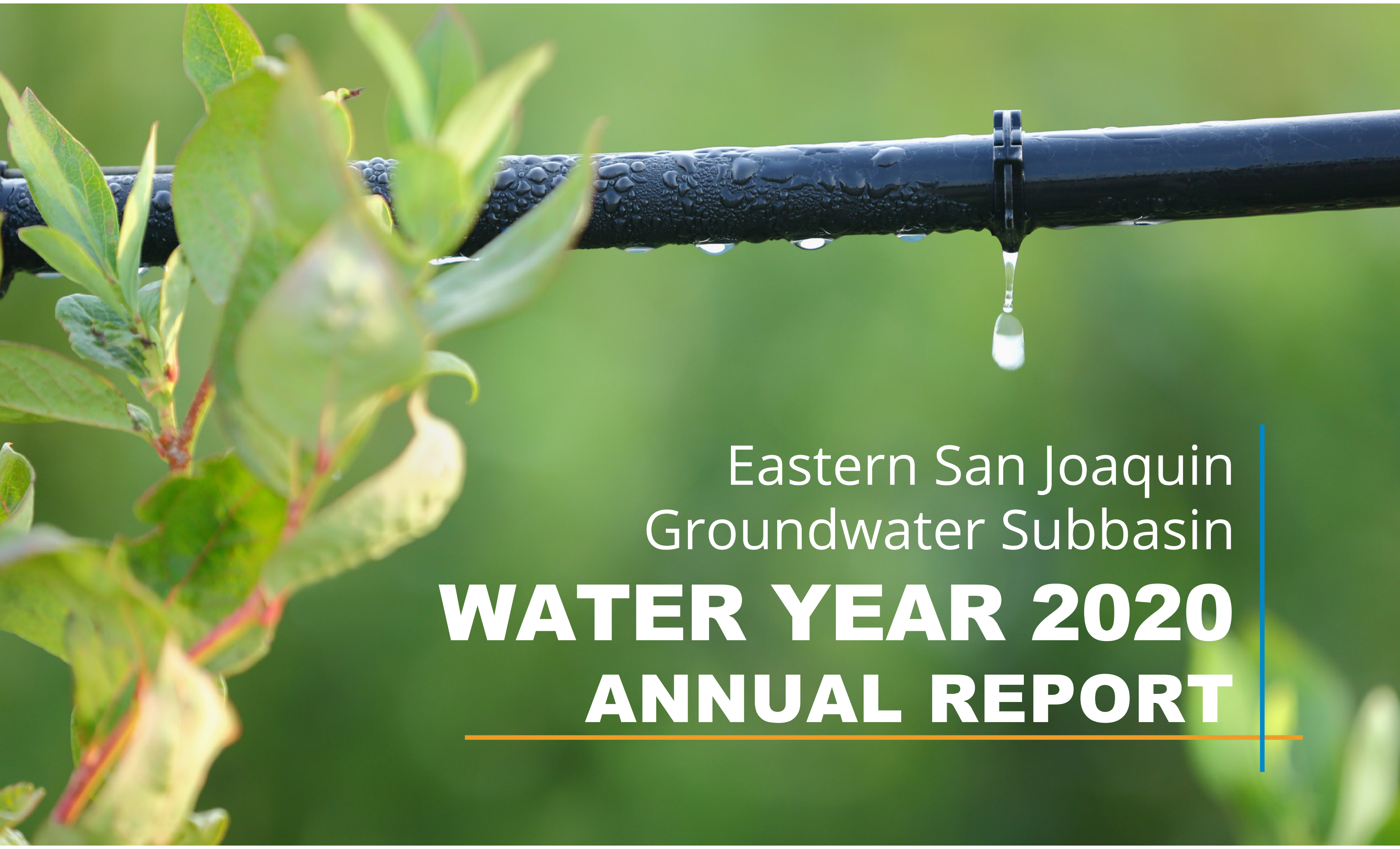
EASTERN SAN JOAQUIN GROUNDWATER AUTHORITY



Eastern San Joaquin
Groundwater Subbasin

WATER YEAR 2020
ANNUAL REPORT

April
2021

Table of Contents

Executive Summary 1
1. Introduction 1-1
2. Groundwater Management Activities and Milestones 2-1
2.1 Groundwater Sustainability Plan Development 2-1
2.2 Groundwater Sustainability Plan Contents Summary 2-1
2.2.1 Plan Area 2-1
2.2.2 Hydrogeologic Conceptual Model 2-2
2.2.3 Existing Groundwater Conditions 2-2
2.2.4 Water Budgets 2-3
2.2.5 Sustainable Management Criteria 2-4
2.2.6 Monitoring Networks 2-5
2.2.7 Projects and Management Actions 2-6
2.2.8 Implementation 2-9
2.3 GSP Implementation Progress 2-9
2.3.1 Groundwater Levels 2-10
2.3.2 Groundwater Storage 2-13
2.3.3 Groundwater Quality 2-13
2.3.4 Salt Water Migration 2-16
2.3.5 Land Subsidence 2-16
2.3.6 Groundwater-Surface Water Interaction 2-16
3. Groundwater Monitoring and Conditions Assessment 3-1
3.1 Hydrologic Conditions 3-1
3.2 Groundwater Levels 3-1
3.2.1 Comparison of Current and Historical Spring Groundwater Levels 3-2
3.2.2 Groundwater Level Contour Maps 3-2
3.3 Groundwater Storage 3-6
3.4 Groundwater Quality 3-11
3.4.1 Total Dissolved Solids Measurements in Representative Monitoring Network Wells 3-11
3.4.2 Contaminated Sites 3-12
3.4.3 Regional Groundwater Quality 3-12
3.5 Salt water migration 3-13
3.6 Land Subsidence 3-13
3.7 Groundwater-Surface Water Interaction 3-14
3.8 Total Water Use 3-14
3.8.1 Groundwater Use 3-14
3.8.2 Surface Water Use 3-14
3.8.3 Total Water Use 3-16
3.8.4 Eastern San Joaquin Water Resources Model Update 3-21
4. References 4-1

List of Figures

Figure 1. Eastern San Joaquin Groundwater Subbasin 1-3
Figure 2. Groundwater Level Representative Monitoring Well Locations 3-2
Figure 3. Seasonal Low Groundwater Levels in the Eastern San Joaquin Subbasin, Fall 2019 3-4
Figure 4. Seasonal High Groundwater Levels in the Eastern San Joaquin Subbasin, Spring 2020 3-5
Figure 5. Seasonal Low Groundwater Levels in the Eastern San Joaquin Subbasin, Fall 2020 3-6
Figure 6. Historical Modeled Change in Annual Storage with Water Use and Year Type 3-7
Figure 7. Historical Modeled Change in Annual Storage with Inflows and Year Type 3-8
Figure 8. Historical Modeled Change in Annual Storage with Groundwater Pumping and Year Type 3-9
Figure 9. Eastern San Joaquin Subbasin WY 2020 Change in Storage 3-10
Figure 10. Water Year 2020 Total Dissolved Solids Measurements at Representative Monitoring Well Sites 3-12
Figure 11. Water Year 2020 Chloride Measurements at Representative Monitoring Well Sites 3-13
Figure 12. Eastern San Joaquin Subbasin WY 2020 Groundwater Extraction 3-17
Figure 13. WY 2020 Average Annual Estimated Groundwater Budget, Eastern San Joaquin Subbasin 3-24

List of Tables

Table 1. Summary of Sustainable Management Criteria 2-7
Table 2. Chronic Lowering of Groundwater Levels Threshold Analysis 2-11
Table 3. Degraded Water Quality Threshold Analysis 2-14
Table 4. Salt Water Migration Threshold Analysis 2-16
Table 6. Water Year 2020 Monthly Groundwater Extraction (in acre-feet) 3-18
Table 7. Water Year 2020 Monthly Surface Water Delivered for Use (in acre-feet) 3-19
Table 8. Water Year 2020 Monthly Total Water Use (in acre-feet) 3-20
Table 9. Comparison of WY 2019 and WY 2020 Water Budget (in acre-feet) 3-24

Appendices

Appendix A – GSP Implementation Progress
Appendix B – Representative Monitoring Network Well Hydrographs
Appendix C – Broad Monitoring Network Well Hydrographs

List of Abbreviations and Acronyms

AC	Advisory Committee
AF	acre-feet
AFY	acre-feet per year
bgs	below ground surface
CALSIMETAW	California Simulation of Evapotranspiration of Applied Water
CASGEM	California Statewide Groundwater Elevation Monitoring
CCWD	Calaveras County Water District
CDWA	Central Delta Water Agency
CIP	Capital Improvement Program
CSJWCD	Central San Joaquin Water Conservation District
Delta	Sacramento-San Joaquin River Delta
DMS	Data Management System
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
ESJ	Eastern San Joaquin
ESJGWA	Eastern San Joaquin Groundwater Authority
ESJWRM	Eastern San Joaquin Water Resources Model
ft/mi	feet per mile
GMP	Groundwater Management Plan
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IDW	Inverse Distance Weighting
IWFM	Integrated Water Flow Model
LCSD	Lockeford Community Services District
LCWD	Linden County Water District
MAF	Million acre-feet
MAR	Managed Aquifer Recharge
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
msl	mean sea level

MUD	Municipal Utilities Department
NAVD	North American Vertical Datum
NSJWCD	North San Joaquin Water Conservation District
OID	Oakdale Irrigation District
PRISM	Precipitation-Elevation Regressions on Independent Slopes Model
SDWA	South Delta Water Agency
SEWD	Stockton East Water District
SGMA	Sustainable Groundwater Management Act
SMCL	Secondary Maximum Contaminant Level
SSJ GSA	South San Joaquin GSA
SSJID	South San Joaquin Irrigation District
TDS	total dissolved solids
USGS	United States Geological Survey
VFD	variable frequency drive
WID	Woodbridge Irrigation District
Workgroup	Groundwater Sustainability Workgroup
WY	Water Year

EXECUTIVE SUMMARY

INTRODUCTION

The Eastern San Joaquin Groundwater Subbasin (Eastern San Joaquin Subbasin, or Subbasin) has a long history of proactively and collaboratively managing water resources, with strong participation from local water management agencies, other local agencies, stakeholders, and state and federal agencies. Collaborative efforts that have guided sustainable groundwater resources management in the Eastern San Joaquin Subbasin include the *Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan* (GSP) (2019) and its forerunner, the *Eastern San Joaquin Groundwater Basin Groundwater Management Plan* (GMP) (2004).

The GSP was developed jointly with the Eastern San Joaquin Groundwater Authority (ESJGWA), which is a joint powers authority formed by the 16 groundwater sustainability agencies (GSAs) within the Eastern San Joaquin Subbasin (ESJGWA, 2019). The ESJGWA includes the Central Delta Water Agency (CDWA), Central San Joaquin Water Conservation District (CSJWCD), City of Lodi, City of Manteca, City of Stockton, Eastside San Joaquin GSA (Eastside GSA) (composed of Calaveras County, Calaveras County Water District [CCWD], Stanislaus County, and Rock Creek Water District), Linden County Water District (LCWD), Lockeford Community Services District (LCSD), North San Joaquin Water Conservation District (NSJWCD), Oakdale Irrigation District (OID), County of San Joaquin GSAs (-Eastern San Joaquin 1 and -Eastern San Joaquin 2), South Delta Water Agency (SDWA), South San Joaquin GSA (composed of South San Joaquin Irrigation District [SSJID] including all conveyance works, Woodward Reservoir, City of Ripon, and City of Escalon), Stockton East Water District (SEWD), and Woodbridge Irrigation District (WID). Collectively, these 16 GSAs will be referred to as "GSAs."

Between November 2019 and January 2020, the GSAs individually adopted the GSP, which meets all relevant requirements contained within the Sustainable Groundwater Management Act (SGMA) of 2014 and the GSP Emergency Regulations. The GSP was developed in a stakeholder-driven environment with cooperation between the GSAs and their member agencies. A stakeholder engagement strategy was developed to enable the interests of beneficial users of groundwater in the Subbasin to be considered. The strategy incorporated monthly Groundwater Sustainability Workgroup meetings, monthly Advisory Committee meetings, monthly ESJGWA Board meetings, coordination with neighboring Subbasins, approximately quarterly informational open house events, outreach presentations to community groups, and information distribution to property owners and residents in the Subbasin. The GSP describes groundwater conditions in the Eastern San Joaquin Subbasin and sets up a system of management based on sustainable management criteria supported by monitoring networks, projects and management actions, adaptive management, and reporting.

This water year (WY) 2020 Annual Report for the Eastern San Joaquin Subbasin has been prepared in compliance with Article 7 *Annual Reports and Periodic Evaluations by the Agency*, § 356.2 *Annual Reports* of the GSP Emergency Regulations, as included in the California Code of Regulations. WY 2020 includes the period from October 2019 through September 2020.

GROUNDWATER MANAGEMENT ACTIVITIES AND MILESTONES

As the second Annual Report for WY 2020 covers a portion of the calendar year prior to the adoption of the GSP, some of the information contained in this report relates to activities that occurred during and immediately after the development of the GSP.

While enactment of SGMA in 2015 prohibited the development or renewal of any GMPs within medium and high priority basins (such as the Eastern San Joaquin Subbasin), the GSAs continued to implement the management activities identified in the 2004 GMP throughout the GSP development process (ending January 31, 2020). Such activities included continuing to work with DWR to improve sharing and exchange of data and development of the Eastern San Joaquin Water Resources Model (ESJWRM).

WY 2020 covers the first year of GSP implementation. This Annual Report uses the information contained within the GSP, along with data collected during this first year of implementation, to evaluate continued sustainable conditions throughout the planning and implementation horizon.

The GSP sets sustainable management criteria for applicable sustainability indicators and identifies projects and management actions to aid in maintaining sustainable conditions throughout the Eastern San Joaquin Subbasin. Under SGMA, sustainable management criteria can be defined as the following:

- **Minimum Threshold** – Quantitative threshold for each sustainability indicator used to define the point at which undesirable results may begin to occur
- **Measurable Objective** – Quantitative target that establishes a point above the minimum threshold that allows for a range of active management in order to prevent undesirable results
- **Interim Milestones** – Targets set in increments of five years over the implementation period of the GSP to put the basin on a path to achieving sustainability by 2040
- **Margin of Operational Flexibility** – The range of active management between the measurable objective and the minimum threshold

During WY 2020, monitoring relative to all sustainability indicators indicated the Eastern San Joaquin Subbasin was continuing to operate under sustainable conditions relative to their respective sustainability indicators and established sustainable management criteria. As Projects are implemented, the ESJGWA will continue to assess conditions relative to established criteria and definitions of undesirable results.

GROUNDWATER MONITORING AND CONDITIONS ASSESSMENT

Hydrologic Conditions

WY 2020 was drier than average and drier than WY 2019. During WY 2020, estimated precipitation in the Subbasin was 63 percent of long-term average (Oregon State University, 2019). Measured stream flows in the San Joaquin River were approximately 42 percent of long-term averages, whereas those in the Mokelumne River were 45 percent of long-term averages and those in the Stanislaus River were 86 percent of long-term averages (USGS, 2021).

Groundwater Levels

Groundwater elevations generally decreased or remained stable through WY 2020 for almost all wells in the representative monitoring network with groundwater level data available. Only one representative well in the southwestern portion of the Subbasin (01N07E14J002) reported Spring 2020 levels below the measurable objective. All recent data shows typical patterns of annual highs in the Spring and lows in the late Summer or Fall that match the historical trends. No wells reported groundwater levels below the minimum thresholds establish in the GSP.

Groundwater Storage

The groundwater storage sustainability indicator for the Eastern San Joaquin Subbasin uses the groundwater level sustainable management criteria (i.e., Minimum Threshold, Measurable Objective, Interim Milestones, and Margin of Operational Flexibility) as a proxy. Therefore, the minimum thresholds for groundwater levels are designed to be protective of significant and unreasonable impacts to changes in groundwater storage. For WY 2020, groundwater storage was estimated using the ESJWRM. Based on these estimates, from beginning to the end of WY 2020, storage in the Eastern San Joaquin Subbasin decreased approximately 213,000 acre-feet (AF). This volume represents about 0.4% of the total fresh groundwater in storage, which was estimated to be more than 50 million acre-feet (MAF) in 2015.

Groundwater Quality

Salinity is the only water quality constituent for which minimum thresholds are established in the Eastern San Joaquin Subbasin. In WY 2020, four out of ten of the representative monitoring wells reported measurements for total dissolved solids. All measurements reported did not surpass minimum thresholds for water quality set in the GSP.

Saltwater Migration

The Eastern San Joaquin Subbasin is not in a coastal area, and seawater intrusion via the aquifer formations is unlikely. Seawater could migrate into the Sacramento-San Joaquin River Delta (Delta) via the tides or as result of sea level rise and climate change. This could create the potential for seawater to percolate into the aquifers. This condition would be observable and widely noted with current monitoring of surface water conditions in the Delta.

There is saline water underlying the Delta in deeper aquifers, and saline conditions have been observed in shallower zones. This potential impairment to beneficial uses of groundwater would be related to the migration of the saline waters from west to east into the Eastern San Joaquin Groundwater Subbasin due to hydraulic conditions and the lowering of groundwater levels. The GSP established monitoring protocols for the early detection of saltwater migration from the west, under the Delta, to the east into the Eastern San Joaquin Groundwater Subbasin. The monitoring program is intended to identify the issue associated with saltwater migrations so that the ESJGWA can take early action to address undesirable results. In WY 2020, four out of ten of the representative monitoring wells reported measurements for chloride. All measurements reported were well below the minimum threshold for chloride concentrations set in the GSP.

Land Subsidence

The land subsidence sustainability indicator in the Eastern San Joaquin Subbasin uses the groundwater level sustainable management criteria as a proxy. The minimum thresholds for groundwater levels are designed to be protective of significant and unreasonable impacts to land subsidence. There were no minimum threshold exceedances for groundwater levels; therefore, there were no land subsidence sustainability threshold exceedances. Land subsidence has not historically been an area of concern in the Subbasin and there are no records of significant land subsidence caused by groundwater pumping in the Subbasin. Section 2.1.5 of the GSP details the extent of clay deposits in the Subbasin, and Section 2.2.5 of the GSP includes a description of the minimal subsidence that has historically occurred in the Subbasin.

Groundwater-Surface Water Interaction

The depletions of interconnected surface water sustainability indicator in the Eastern San Joaquin Subbasin uses the groundwater level sustainable management criteria as a proxy. The minimum thresholds for groundwater levels are designed to be protective of significant and unreasonable impacts to depletions of interconnected surface waters. There were no minimum threshold exceedances for groundwater levels; therefore, there were no interconnected surface water sustainability threshold exceedances.

Total Water Use

The primary water use sectors in the Eastern San Joaquin Subbasin include urban and agriculture uses, with groundwater supplying the majority of the total water use. During WY 2020, groundwater extraction and use is estimated to be 790,400 AF for the Eastern San Joaquin Subbasin. Surface water deliveries during WY 2020 are estimated to be 505,500 AF. The majority of surface water is used between May and September. Total water use is the sum of the groundwater use and surface water use; therefore, total water use during WY 2020 is estimated to be 1,295,934 AF.

ANNUAL REPORT ELEMENTS

The following table presents the sections and page numbers where requirements for Annual Report elements are included, subject to Article 7 § 356.2 of the GSP Regulation Sections in the California Code of Regulations.

California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and page numbers(s) where requirements for Annual Report elements are included
Article 7	**Annual Reports and Periodic Evaluations by Agency**	
§ 356.2	**Annual Reports**	
	Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:	
	(a) General information, including an executive summary and a location map depicting the basin covered by the report.	Executive Summary, Figure 1 (1-3)
	(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:	--
	(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:	--
	(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.	Section 3.2 (3-1), Figure 2 (3-2), Figure 4 (3-5), Figure 5 (3-6)
	(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.	Section 3.2 (3-1), Figure 2 (3-2), Appendix B (B-1), Appendix C (C-1)
	(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.	Section 3.8.1 (3-14), Figure 12 (3-17), Table 5 (3-18)
	(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.	Section 3.8.2 (3-14), Table 6 (3-19)
	(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.	Section 0 (3-16), Table 7 (3-20)
	(5) Change in groundwater in storage shall include the following:	--
	(A) Change in groundwater in storage maps for each principal aquifer in the basin.	Section 3.3 (3-6), Figure 9 (3-10)

California Code of Regulations - GSP Regulation Sections	Annual Report Elements	Section(s) and page numbers(s) where requirements for Annual Report elements are included
	(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.	Section 3.3 (3-6), Figure 6 (3-7), Figure 7 (3-8), Figure 8 (3-9)
	(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.	Section 2.3 (2-9), Appendix A (A-1)

This page left blank intentionally.

1. INTRODUCTION

The Eastern San Joaquin Groundwater Subbasin (Eastern San Joaquin Subbasin or Subbasin) (**Figure 1**) has been identified by the California Department of Water Resources (DWR) as critically overdrafted. The Eastern San Joaquin Groundwater Sustainability Plan (Eastern San Joaquin GSP, GSP, or the Plan) has been developed and submitted to meet SGMA regulatory requirements by the January 31, 2020, deadline for critically-overdrafted basins while reflecting local needs and preserving local control over water resources. While the Eastern San Joaquin GSP offers a new and significant approach to groundwater resource protection, it was developed within an existing framework of comprehensive planning efforts. Throughout the region, several separate yet related planning efforts have occurred previously or are concurrently proceeding, including integrated regional water management, urban water management, agricultural water management, watershed management, habitat conservation, and general planning and most closely, the *Eastern San Joaquin Groundwater Basin Groundwater Management Plan* (GMP) (2004). The Eastern San Joaquin GSP fits in with these prior planning efforts, building on existing local management and basin characterization.

The Eastern San Joaquin GSP provides a path to achieve and document sustainable groundwater management within 20 years following Plan adoption, promoting the long-term sustainability of locally-managed groundwater resources now and into the future.

The GSP was developed jointly by the Eastern San Joaquin Groundwater Authority (ESJGWA), which is a joint powers authority formed by the following 16 groundwater sustainability agencies (GSAs) within the Eastern San Joaquin Subbasin. Collectively, these 16 GSAs will be referred to as "GSAs".

- Central Delta Water Agency (CDWA)
- Central San Joaquin Water Conservation District (CSJWCD)
- City of Lodi
- City of Manteca
- City of Stockton
- Eastside San Joaquin GSA (Eastside GSA) (composed of Calaveras County, Calaveras County Water District [CCWD], Stanislaus County, and Rock Creek Water District)
- Linden County Water District (LCWD)
- Lockeford Community Services District (LCSD)
- North San Joaquin Water Conservation District (NSJWCD)
- Oakdale Irrigation District (OID)
- County of San Joaquin GSA – Eastern San Joaquin 1
- County of San Joaquin GSA – Eastern San Joaquin 2
- South Delta Water Agency (SDWA)
- South San Joaquin GSA (composed of South San Joaquin Irrigation District [SSJID] including all conveyance works, Woodward Reservoir, City of Ripon, and City of Escalon)
- Stockton East Water District (SEWD)

- Woodbridge Irrigation District (WID)

During water year (WY) 2020 (October 1, 2019, through September 30, 2020), groundwater management within the Eastern San Joaquin Subbasin evolved through the implementation of the GSP, which was ultimately adopted by the GSAs between November 2019 and January 2020. The GSP was developed in a stakeholder-driven environment, including 69 open meetings and numerous other outreach activities. The result is a GSP that describes groundwater conditions in the Eastern San Joaquin Subbasin and sets up a system of management based on quantitative thresholds, termed sustainable management criteria, for six sustainability indicators: chronic lowering of groundwater levels, degraded water quality, saltwater migration, land subsidence, change in groundwater storage, and depletions of interconnected surface water.

This Annual Report provides information on conditions in the Eastern San Joaquin Subbasin and progress towards implementing the GSP for WY 2020. The report has been prepared in accordance with Article 7 *Annual Reports and Periodic Evaluations by the Agency,* § 356.2 *Annual Reports* of the GSP Emergency Regulations as contained within the California Code of Regulations.

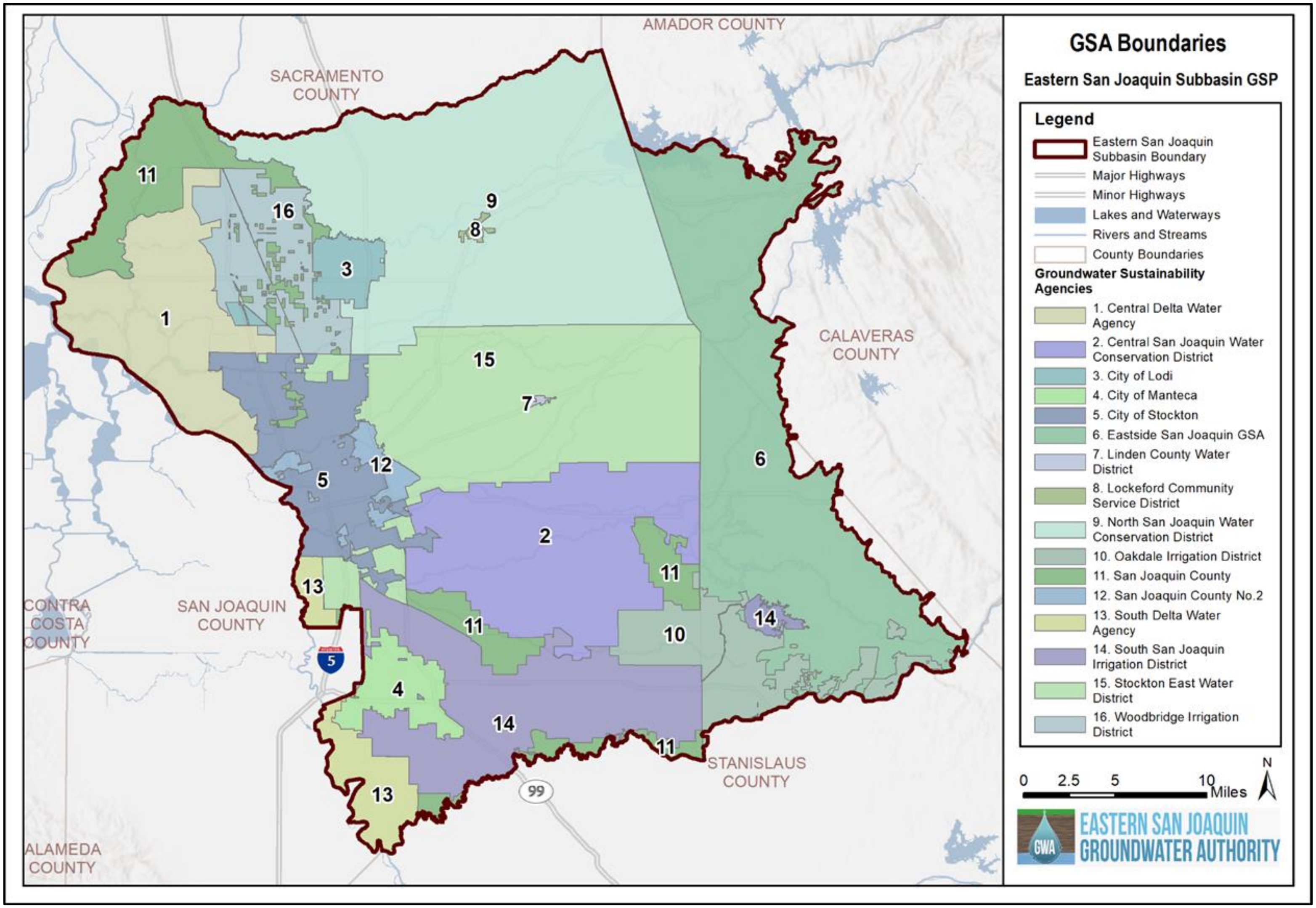


Figure 1. Eastern San Joaquin Groundwater Subbasin

This page left blank intentionally.

2. GROUNDWATER MANAGEMENT ACTIVITIES AND MILESTONES

This section documents the initial activities and milestones from the passing of the Sustainable Groundwater Management Act (SGMA) throughout GSP development, summarizes the contents of the GSP for the Eastern San Joaquin Subbasins, and documents GSP implementation progress during WY 2020 (the first year of GSP implementation which included a portion of the GSP development period).

Implementation of the GSP is underway, which includes this Annual Report as well as monitoring and associated assessment of sustainable management criteria and identified projects, management actions, and adaptive management (as needed).

2.1 GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT

Preliminary development of the Eastern San Joaquin GSP began with formation of the member GSAs and agreement to form the ESJGWA for the purpose of GSP development and implementation. The ESJGWA Board of Directors (ESJGWA Board) developed an Advisory Committee (AC) that included staff members from the GSAs. The AC provides technical review and recommendations to the ESJGWA Board for ongoing sustainable groundwater management and development of the Eastern San Joaquin GSP. The ESJGWA also developed a Groundwater Sustainability Workgroup (Workgroup) to promote stakeholder input and relied upon the Workgroup when developing the GSP. The Workgroup began with an application process to ensure a diverse cross section of populations were represented to serve on the Workgroup. Workgroup members participated and provided valuable input throughout the GSP development process.

On March 3, 2018, the GSAs filed a notice of intent to prepare a GSP with DWR. A public draft of the GSP was posted for public comment in July 2019, and a notice of intent to adopt a GSP was sent by the ESJGWA to all cities and counties in the Eastern San Joaquin Subbasin on August 16, 2019. The Final GSP, published November 5, 2019, was adopted by the individual GSAs between November 2019 and January 2020. On January 8, 2020, the ESJGWA Board passed a resolution agreeing to submit the Plan to DWR on behalf of the 16 GSAs.

2.2 GROUNDWATER SUSTAINABILITY PLAN CONTENTS SUMMARY

The GSP was prepared in compliance with all relevant elements of the SGMA Regulations and GSP Emergency Regulations, Article 5 *Plan Contents*. The subsections below summarize the contents of the GSP relevant to assessing changing conditions in the Eastern San Joaquin Subbasin for the purposes of evaluating GSP implementation progress in this Annual Report.

2.2.1 Plan Area

The GSP's plan area encompasses the Eastern San Joaquin Subbasin (5-22.01), as defined by DWR's Final 2018 Basin Boundary Modifications (released February 11, 2019). The Eastern Subbasin is located at the north end of the larger San Joaquin Valley Groundwater Basin, to the west of the Sacramento-San Joaquin River Delta (Delta), and is generally bounded by the Sierra Nevada foothills to the east, the San Joaquin River to the west, Dry Creek to the north, and Stanislaus River to the south. The major river systems traversing the Subbasin include the Calaveras, Mokelumne, and Stanislaus Rivers. Multiple smaller streams flow into the San Joaquin River.

The plan area covers areas of San Joaquin County east of the San Joaquin River, including the cities of Stockton, Lodi, Manteca, Escalon, and Ripon, and portions of Calaveras and Stanislaus Counties. The

Subbasin is bordered by Sacramento, Amador, and Contra Costa Counties. Land use patterns in the Eastern San Joaquin Subbasin are dominated by agricultural uses, including nut and fruit trees, vineyards, row crops, grazing, and forage. Irrigated crop acreage in the Subbasin is 37% fruit and nut trees, 24% vineyards, and 11% alfalfa and irrigated pasture, according to 2015 CropScape data.

2.2.2 Hydrogeologic Conceptual Model

One principal aquifer exists across the Eastern San Joaquin Subbasin that is composed of three water production zones. The zones are:

- **Shallow Zone** that consists of the alluvial sands and gravels of the Modesto, Riverbank, and Upper Turlock Lake Formations
- **Intermediate Zone** that consists of the Lower Turlock Lake and Laguna Formations
- **Deep Zone** that consists of the consolidated sands and gravels of the Mehrten Formation

The Stockton Fault is the largest fault in the Eastern San Joaquin Subbasin. It is a large reverse fault with displacements of up to 3,600 feet. The Vernalis Fault is a reverse fault with a northwest-southeast trend that bounds the Tracy-Vernalis anticlinal trend that is mapped outside of the west boundary of the Eastern San Joaquin Subbasin. Additionally, the Stockton Arch is a broad transverse structure that underlies the southern half of the Eastern San Joaquin Subbasin. The base of fresh water (encountered saline) has been observed as shallow as 650 feet below ground surface (bgs) in the eastern part of the Subbasin to over 2,000 feet bgs in the northern part of the Subbasin.

2.2.3 Existing Groundwater Conditions

Groundwater levels in some portions of the Subbasin have been declining for many years, while groundwater levels in other areas of the Subbasin have remained stable or increased in recent years. The change in groundwater levels varies across the Subbasin, with the greatest declines occurring in the central portion of the Subbasin. The western and southern portions of the Subbasin have experienced less change in groundwater levels, in part due to the minimal groundwater pumping in the Delta area to the west and the import of surface water for agricultural and urban uses.

In many areas of the Subbasin, groundwater levels reached their lowest in Fall 1992. In many cases, areas that experienced undesirable results in 1992 put mitigation measures in place, often deepening wells, meaning that 1992 groundwater levels would no longer trigger undesirable effects. Groundwater levels in some areas of the Subbasin have recovered since 1992; however, groundwater levels in other portions of the Subbasin further declined below 1992 levels.

A central pumping depression exists east of the City of Stockton. Groundwater generally flows from the outer edges of the Subbasin towards the depression in the middle of the Subbasin. Along the eastern side of the Subbasin, the lateral gradient of groundwater levels ranges from approximately 21 feet per mile (ft/mi) during the seasonal high to 16 ft/mi during the seasonal low. Along the western side of the Subbasin, the lateral gradient ranges from approximately 7 ft/mi during the seasonal high to 6 ft/mi during the seasonal low. The steeper gradients on the east side of the Subbasin compared to the west side is primarily due to the steeper aquifer units in that area, combined with a lack of head influence from the Delta.

Groundwater quality in the Subbasin varies by location. Areas along the western margin have historically had higher levels of salinity. Salinity may be naturally occurring or the result of human activity. Sources of salinity in the Subbasin include Delta sediments, deep saline groundwater, and irrigation return water. Elevated concentrations of other constituents, such as nitrate, arsenic, and point-source contaminants, are generally localized and not widespread and are generally related to natural sources or land use activities.

While the total volume of groundwater in storage in the Subbasin has declined over time, groundwater storage reduction has not historically been an area of concern in the Subbasin as there are large volumes of fresh water stored in the aquifer. As estimated in the ESJGSP, the total volume of fresh groundwater in storage was estimated at over 53 million acre-feet (MAF) in 2015 (Woodard & Curran, 2019, page 2-80). Significant impacts to groundwater beneficial uses were estimated (via modeling) to occur if there was a depletion of 23 MAF (e.g., only 30 MAF of fresh groundwater remained in the aquifer). As such, it is highly unlikely the Subbasin will experience conditions under which the volume of stored groundwater poses a concern, although the depth to access that groundwater does pose a concern.

Land subsidence has not historically been an area of concern in the Subbasin, and there are no records of land subsidence caused by groundwater pumping in the Subbasin.

Seawater intrusion is not present in the Subbasin. While the Delta ecosystem evolved with a natural salinity cycle that brought brackish tidal water in from the San Francisco Bay, current management practices endeavor to maintain freshwater flows through a combination of hydraulic and physical barriers and alterations to existing channels.

Major river systems in the Subbasin are highly managed to meet instream flow requirements for fisheries, water quality standards, and water rights of users downstream. Many smaller streams run through the Subbasin that provide contributions to both groundwater, riparian habitat, and the major river systems. The interconnection between reaches of these streams and the groundwater system will be better understood through monitoring as the GSP is implemented.

2.2.4 Water Budgets

Water budgets provide a quantitative accounting of surface water and groundwater entering and leaving the Eastern San Joaquin Subbasin under historical, current, projected, and projected with climate change conditions. The budgets were estimated using the ESJWRM. The primary components of the groundwater budget are:

- Inflows:
    - Deep percolation from precipitation, applied water (surface water and groundwater) for agricultural lands, and applied water (surface water and groundwater) for outdoor use in the urban areas or industrial purposes
    - Stream seepage (i.e., losses to the groundwater system)
    - Other recharge (including unlined canals/reservoir seepage, local tributaries seepage, and Managed Aquifer Recharge [MAR] projects)
    - Subsurface inflow
- Outflows:
    - Groundwater outflow to streams (i.e., stream gain from the groundwater system)
    - Groundwater pumping
    - Subsurface outflow
- Change in Groundwater Storage (Inflows Minus Outflows)

The average annual groundwater storage is shown as decreasing under historical, current, projected, and projected with climate change conditions, suggesting conditions of overdraft.

The sustainable conditions scenario results in groundwater outflows almost equal to groundwater inflows, bringing the long-term (50-year) average change in groundwater storage to close to zero. Based on this analysis, the sustainable yield of the Subbasin is 715,000 acre-feet per year (AFY) ± 10 percent. Groundwater pumping and sustainable yield is discussed further in Section 3.8.1.

2.2.5 Sustainable Management Criteria

SGMA allows several pathways to meet the distinct local needs of each groundwater basin, including development of sustainable management criteria, usage of other sustainability indicators as a proxy, and identification of indicators as not being applicable to the basin. Sustainable management criteria were developed based on information about the Subbasin in the hydrogeologic conceptual model, the descriptions of current and historical groundwater conditions, the water budget, and input from stakeholders during the GSP development process.

The sustainability goal for the Eastern San Joaquin Subbasins is:

> *to maintain an economically viable groundwater resource for the beneficial use of the people of the Eastern San Joaquin Subbasin by operating the Subbasin within its sustainable yield or by modification of existing management to address future conditions. This goal will be achieved through the implementation of a mix of supply and demand type projects consistent with the GSP implementation plan*.

The method prescribed by SGMA to measure undesirable results and achieve the sustainability goal involves setting minimum thresholds and measurable objectives for a series of representative monitoring sites. These representative sites are a subset of the monitoring network developed as part of the GSP. The sustainable management criteria are summarized in Table 1.

Of the six sustainability indicators addressed in the Eastern San Joaquin Subbasin, chronic lowering of groundwater levels is the driver for sustainable groundwater management, as several other indicators all correlated with groundwater levels. Measurable objectives, minimum thresholds, and interim milestones were developed for each of the identified representative wells.

Minimum thresholds for groundwater levels were developed with reference to historical drought low conditions and domestic well depths. Specifically, minimum thresholds were established based on the deeper of the historical drought low plus a buffer of the historical fluctuation or the 10th percentile domestic well depth, whichever is shallower – establishing levels that are protective of 90 percent of domestic wells. In municipalities with ordinances requiring the use of municipal water (water provided by a city's municipal wells) for domestic users, the 10th percentile municipal well depth is used in place of the 10th percentile domestic well depth criteria. Measurable objectives were established based on the historical drought low and provide a buffer above the minimum threshold. A table summarizing minimum thresholds and measurable objectives is included in the GSP. Graphs showing the minimum threshold and measurable objective for each of the representative wells are contained in an appendix to the GSP and included herein as **Appendix B**.

Minimum thresholds for water quality were defined by considering two primary beneficial uses at risk of undesirable results related to salinity: drinking water and agriculture uses. Minimum thresholds are 1,000 milligrams per liter (mg/L) for each representative monitoring well, consistent with the upper limit secondary maximum contaminant level (SMCL) for total dissolved solids (TDS). Crop tolerances in the Subbasin range by crop type from 900 mg/L TDS for almonds up to 4,000 mg/L TDS for wheat, assuming a 90 percent yield.

The Eastern San Joaquin Subbasin is not in a coastal area, and seawater intrusion is not currently present. Undesirable results related to seawater intrusion are not currently occurring and are not reasonably expected to occur. However, this GSP recognizes that saltwater currently found in some of the aquifers under the Delta could migrate and impair groundwater quality. As such, the GSP establishes monitoring protocols for the early detection of saltwater migration from under the Delta or deep aquifer zones, were it ever to occur, so that the ESJGWA can take early actions to address any associated undesirable results.

The GSP develops minimum thresholds and measurable objectives that include monitoring for chloride and an analysis of isotopic ratios to identify the source of high salinity. The minimum threshold for saltwater migration is a 2,000 mg/L chloride isocontour line established near the western edge of the Subbasin between sentinel monitoring locations. 2,000 mg/L chloride is approximately 10 percent of seawater chloride concentrations (19,500 mg/L).

For depletions of interconnected surface water, the minimum thresholds and measurable objectives for groundwater levels are used. There is significant correlation between groundwater levels and depletions, and the groundwater levels minimum thresholds are found to be protective of depletions. Similarly, the minimum thresholds and measurable objectives for groundwater levels are used for the land subsidence and groundwater storage sustainability indicators as both are also strongly linked to groundwater levels. The groundwater levels minimum thresholds are found to be protective of land subsidence and groundwater storage.

2.2.6 Monitoring Networks

Monitoring networks were developed for the sustainability indicators that apply to the Eastern San Joaquin Subbasin, leveraging existing monitoring that has been developed locally and in cooperation with DWR. The objective of these monitoring networks is to monitor conditions across the Subbasin so that the GSAs can continue to manage groundwater sustainably. Specifically, the monitoring network was developed to do the following:

- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Demonstrate progress toward achieving measurable objectives described in the GSP
- Support estimation of annual changes in water budget components

To achieve these objectives, the monitoring well networks incorporate sites and frequencies that can detect seasonal and long-term trends for each applicable sustainability indicator. This includes selection of an appropriate temporal frequency and spatial density to evaluate groundwater conditions related to the effectiveness of the GSP.

There are four monitoring well networks established within the Eastern San Joaquin Subbasin GSP: a representative network for water levels, a broad network for water levels, a representative network for water quality, and a broad network for water quality. Monitoring well data from the representative networks are used to determine compliance with the minimum thresholds, while data from the broad networks are used for informational purposes to identify trends and fill data gaps. The two monitoring well networks for water quality are also used to develop a chloride isocontour to evaluate potential for saltwater migration. Water level data inform depletions of interconnected surface water.

Wells in the monitoring networks are measured on a semi-annual schedule (spring and fall) for both groundwater levels and water quality. Historical measurements have been entered into the Subbasin Data Management System (DMS), and future data are also be stored in the DMS.

A summary of the wells in the monitoring networks is shown in the table below.

Summary of Monitoring Network Wells	
Representative Networks	**Well Count**
Groundwater Level*	21
Groundwater Quality**	10
Broad Networks	
CASGEM (Groundwater Levels)	76
Nested or Clustered Wells (Groundwater Levels & Quality)*	16
Agency Wells (Groundwater Levels & Quality)*	5

*A new representative monitoring network well was added for groundwater levels.

**The 10 groundwater quality wells in the Representative Networks are also part of the Broad Networks. The well count presented in this table for the Broad Network do not the 10 wells that are included in the Representative Network for water quality.

2.2.7 Projects and Management Actions

Achieving sustainability in the Subbasin requires implementation of projects and management actions (**Table 1**). The Subbasin will achieve sustainability by implementing water supply projects that either replace groundwater use or supplement groundwater supplies to attain the current estimated pumping offset and/or recharge targets identified in the GSP. In addition, three projects have been identified that support demand-side reduction activities through conservation measures, including water use efficiency upgrades. Currently, no pumping restrictions have been proposed for the Subbasin; however, GSAs maintain the flexibility to implement such demand-side management actions in the future if need is determined. Additional management activities are:

- Monitoring and recording of groundwater levels and groundwater quality data
- Maintaining and updating the DMS with newly collected data
- Annual monitoring of progress toward sustainability
- Annual reporting of Subbasin conditions to DWR as required by SGMA

Table 1. Summary of Sustainable Management Criteria

Sustainability Indicator	Undesirable Results	Identification of Undesirable Results	Measurable Objective	Minimum Threshold
Chronic lowering of groundwater levels	An undesirable result is experienced if sustained groundwater levels are too low to satisfy beneficial uses within the Subbasin over the planning and implementation horizon of the GSP.	Undesirable results occur when more than 25% of representative monitoring wells (5 of 20 wells in the Subbasin) fall below their minimum elevation thresholds for two consecutive years that are categorized as non-dry years (below-normal, above-normal, or wet), according to the San Joaquin Valley Water Year Hydrologic Classification.	At each of 20 representative wells, the measurable objective was defined based on the deeper of 1992 or 2015-2016 groundwater level values.	The deeper of 1992 and 2015-2016 groundwater levels with a buffer of 100 percent of historical range applied, or the 10th percentile domestic well depth within a 3-mile radius of the monitoring well,[1] whichever is shallower. In municipalities with ordinances requiring the use of municipal water, the 10th percentile municipal well depth is used in place of the 10th percentile domestic well depth criteria.
Reduction in groundwater storage	An undesirable result is experienced if sustained groundwater storage volumes are insufficient to satisfy beneficial uses within the Subbasin over the planning and implementation horizon of the GSP. Undesirable results related to groundwater storage are not present and are not likely to occur in the Subbasin.	Undesirable results would occur if groundwater storage volumes were depleted by 23 MAF (e.g., 30 MAF of freshwater remain in storage).	Management of reduction in groundwater storage is performed using groundwater levels as a proxy.	Management of reduction in groundwater storage is performed using groundwater levels as a proxy.
Degraded water quality	An undesirable result is experienced if SGMA-related groundwater management activities cause significant and unreasonable impacts to the long-term viability of domestic, agricultural, municipal, environmental, or other beneficial uses over the planning and implementation horizon of the GSP.	Undesirable results occur when more than 25% of representative monitoring wells (3 of 10 wells in the Subbasin) exceed the minimum thresholds for water quality for two consecutive years and where these concentrations are the result of groundwater management activities.	At each of 10 representative wells, 600 mg/L TDS. The measurable objective is close to the recommended SMCL of 500 mg/L and significantly below the upper limit SMCL of 1,000 mg/L.	At each of 10 representative wells, 1,000 mg/L TDS, consistent with the upper SMCL and developed based on the crop tolerances for fruit and nut trees and vineyards.

Sustainability Indicator	Undesirable Results	Identification of Undesirable Results	Measurable Objective	Minimum Threshold
Saltwater migration	An undesirable result is experienced if sustained groundwater salinity levels caused by saltwater migration and due to groundwater management practices are too high to satisfy beneficial uses within the basin over the planning and implementation horizon of the GSP. Saltwater migration is not present and is not likely to occur in the Eastern San Joaquin Subbasin.	Undesirable results are considered to occur during GSP implementation when 2,000 mg/L chloride reaches an established isocontour line and where these concentrations are caused by intrusion of a seawater source as a result of groundwater management activity.	500 mg/L chloride concentrations at an established isocontour line along the western portion of the Subbasin.	2,000 mg/L chloride concentrations at the established isocontour line along the western portion of the Subbasin. An action plan is in place to trigger additional monitoring and analysis at detections of 1,000 mg/L chloride in the monitoring network to confirm seawater source.
Land subsidence	An undesirable result is experienced if the occurrence of land subsidence substantially interferes with beneficial uses of groundwater and infrastructure within the Subbasin over the planning and implementation horizon of the GSP. There are no historical records of significant and unreasonable impacts from subsidence in the Subbasin.	An undesirable result occurs when subsidence substantially interferes with beneficial uses of groundwater and surface land uses. Undesirable results would occur when substantial interference with land use occurs, including significant damage to canals, pipes, or other water conveyance facilities.	Management of land subsidence is performed using groundwater levels as a proxy.	Management of land subsidence is performed using groundwater levels as a proxy.
Depletions of interconnected surface water	An undesirable result is experienced if the depletions of interconnected surface water causes significant and unreasonable adverse effects on beneficial uses of surface water within the Subbasin over the planning and implementation horizon of the GSP.	An undesirable result occurs when depletions result in reductions in flow or levels of major rivers and streams that are hydrologically connected to the basin such that the reduced surface water flow or levels have a significant and unreasonable adverse impact on beneficial uses and users of the surface water.	Management of depletions of interconnected surface water is performed using groundwater levels as a proxy.	Management of depletions of interconnected surface water is performed using groundwater levels as a proxy.

Notes:
[1] A radius of 2 miles was used for well 03N07E21L003 to reflect domestic well depths in close proximity to the Mokelumne River.

2.2.8 Implementation

Implementation of the GSP includes monitoring of conditions, comparing against sustainable management criteria, reporting of those conditions, evaluating the GSP, implementing adaptive management strategies, implementing projects and management actions, and funding of these activities. Data are collected through monitoring on a prescribed schedule for each monitoring network.

The data collected are used to improve the understanding of the Subbasin as well as for comparison with the sustainable management criteria. Each representative monitoring well site included in each monitoring well network has defined measurable objectives and minimum thresholds for each applicable sustainability indicator. Comparison of monitoring well data and measurable objectives allow for assessment and tracking of desired conditions. Comparisons with minimum thresholds allow for assessment and tracking of undesirable results.

While undesirable results are not anticipated, should sites begin to approach minimum thresholds, the ESJGWA will convene a working group to evaluate adaptive management strategies, such as the implementation of groundwater pumping curtailments, land fallowing, etc. Further, the total percentage of representative sites exceeding minimum thresholds will be calculated and compared against the percentage which has been identified as reflective of undesirable results.

Implementation activities are reported in annual reports due April 1st of each year and includes conditions and activities from the previous water year. This WY 2020 report is the second annual report, and the first to be prepared follow GSP submittal on January 31, 2020. Evaluation reports will also be developed every five years to document progress on implementation and to reconsider elements of the GSP.

The Eastern San Joaquin Subbasin applied for funding under the Proposition 68 Sustainable Groundwater Management Grant Program, Round 3. The ESJGWA was awarded $500,000 on January 24, 2020. These grant funds will be used to install additional monitoring wells adjacent to the Delta to assess cross-boundary flows in the area, improve the existing DMS, and design a Rate Study to develop a cost allocation framework that will help the Subbasin identify how costs for implementation activities will be distributed between GSAs. Such implementation activities include monitoring and reporting, model verification efforts, and public engagement and outreach. Projects are being implemented at the GSA level.

2.3 GSP IMPLEMENTATION PROGRESS

Since the Eastern San Joaquin GSP was not adopted by the GSAs until January 2020, implementation of the GSP did not begin until the second quarter of WY 2020. As such, this annual report will document the initial progress made towards the implementation of the GSP.

Throughout the GSP development process, measurable objectives, interim milestones, and minimum thresholds for applicable sustainability indicators, as well as projects and management actions, were identified to aid in maintaining sustainable conditions throughout the Subbasin. Implementation progress of projects, management actions, and adaptive management activities are detailed in **Appendix A**.

The following sections describe progress made in achieving the interim milestones identified in the GSP for groundwater levels and groundwater quality. Groundwater levels are used as a proxy for reduction in groundwater storage, land subsidence, and depletions of interconnected surface water. Monitoring for saltwater migration is done in conjunction with measuring chloride concentrations through the groundwater quality representative monitoring network wells. The ESJWRM was used to quantify recent changes in groundwater storage to reflect WY 2016 to 2020 for this Annual Report, described in

Section 3.4. During WY 2020, conditions relative to all thresholds for all applicable sustainability indicators were considered sustainable.

It should be noted that since early 2020, GSP implementation has been affected by the coronavirus pandemic (COVID-19) as GSA employees were encouraged to work from home and avoid public gatherings to prevent the spread of the virus. Monitoring activities that required traveling and in-person contact may have been temporarily suspended or delayed in accordance with State and public health guidelines, resulting in monitoring data gaps during WY 2020. Pandemic restrictions may have also delayed implementation progress of projects, management actions, and adaptive management activities described in **Appendix A**.

2.3.1 Groundwater Levels

An analysis was performed to determine conditions relative to established thresholds (including interim milestones for 2025, measurable objectives, and minimum thresholds) during WY 2020 for the chronic lowering of groundwater levels sustainability indicator (**Table 2**). Three representative monitoring network wells were not monitored in WY 2020 and five were only monitored once due to external factors such as travel restrictions as a result of COVID-19, as shown in **Table 2**. Groundwater levels at these wells will be reported on in future annual reports. Hydrographs with historical data at each of the 20 representative monitoring network wells are included in **Appendix B**.

As defined in the GSP, interim milestones are established as the current condition for the first 10 years and then follow a linear trend between the current condition and the measurable objective.

A new representative monitoring network well was added in addition to those documented in the GSP (01S10E04C001M). This well is within the Eastside San Joaquin GSA and will be monitored for groundwater levels, not water quality, going forward.

Table 2. Chronic Lowering of Groundwater Levels Threshold Analysis

Well ID	CASGEM ID	Interim Milestone (2025) (IM)	Measurable Objective (MO)	Minimum Threshold (MT)	Fall 2019 (Seasonal Low)	Difference between Fall 2019 (ft msl)			Spring 2020 (Seasonal High)	Difference between Spring 2020 (ft msl)		
		(ft msl)	(ft msl)	(ft msl)	(ft msl)	IM	MO	MT	(ft msl)	IM	MO	MT
01S09E05H002	378824N1210000W001	-8.7	-19.6	-49.8	-32.6	-23.9	-13	17.2	-8.7	0.0	11.0	41.2
01N07E14J002	379316N1211665W001	-49.9	-70.4	-114.4	*	*	*	*	-81.4	-31.5	-11.0	33.0
Lodi City Well #2	Not Part of CASGEM Program	0.6	-3.5	-38.5	5.9	5.3	9.4	44.4	5.9	5.3	9.4	44.4
Manteca 18	Not Part of CASGEM Program	9.1	5.8	-16	1.8	-7.3	-4	17.8	*	*	*	*
Swenson-3	380067N1213458W003	-19.3	-19.3	-26.6	*	*	*	*	*	*	*	*
01S10E26J001M	378163N1208321W001	81.7	81.7	43.7	83.98	2.28	2.28	40.28	84.9	3.2	3.2	41.2
02N08E15M002	380206N1210943W001	-63.2	-69.7	-124.1	*	*	*	*	*	*	*	*
#3 Bear Creek	Not Part of CASGEM Program	-49.3	-50.3	-72.3	-54.3	-5	-4	18	-47.3	2.0	3.0	25.0
04N07E20H003M	381843N1212261W001	-35.5	-36.7	-81.7	-29.7	5.8	7	52	-24.1	11.4	12.6	57.6
03N07E21L003	380909N1212153W001	-51.5	-57.5	-100	-55	-3.5	2.5	45	*	*	*	*
Hirschfeld (OID-8)	Not Part of CASGEM Program	36.0	36.0	12.5	33.5	-2.5	-2.5	21	35.5	-0.5	-0.5	23.0
Burnett (OID-4)	377909N1208675W001	79.7	79.7	60.7	79	-0.7	-0.7	18.3	81.9	2.2	2.2	21.2
02S07E31N001	377136N1212508W001	13.8	13	1.5	18**	4.2	5	16.5	*	*	*	*
02S08E08A001	377810N1211142W001	22.2	24	0.6	17.36	-4.84	-6.64	16.76	21.4	-0.8	-2.6	20.8
02N07E03D001	380578N1212017W001	-61.7	-79.7	-122.8	-59.73	1.97	19.97	63.07	*	*	*	*
01N09E05J001	379661N1210011W001	-20.2	-51.1	-86.8	*	*	*	*	*	*	*	*
02N07E29B001	379976N1212308W001	-49.8	-80.4	-130.1	-35.3***	14.5	45.1	94.8	*	*	*	*
04N05E36H003	381559N1213727W001	-5.1	-5.1	-31.1	5.43	10.53	10.53	36.53	3.3	8.4	8.4	34.4
03N06E05N003	381317N1213524W001	-14.1	-14.1	-35.1	-3.07	11.03	11.03	32.03	-2.1	12.0	12.0	33.0
04N05E24J004	381816N1213723W001	-6.2	-6.2	-31.2	5.8	12	12	37	4.8	11.0	11.0	36.0
01S10E04C001M[1]	378846N1208816W001		70	50	54.32		-15.68	4.32	68.2		-1.8	18.2

*   Groundwater level data for WY 2020 are unavailable.
**   Groundwater level data for WY 1991-2018 was provided by South Delta Water Agency, as reported in the GSP. Groundwater level data for WY 2019 were provided by San Joaquin County. WY 2020 water level data were obtained from CASGEM.
*** Groundwater level data for WY 1991-2018 were provided by Stockton East Water District, as reported in the GSP. Groundwater level data for WY 2019-2020 were provided by San Joaquin County.
[1]This is a new representative monitoring network well for groundwater levels. Interim Milestones for 2025 have not yet been established.

This page left blank intentionally.

2.3.2 Groundwater Storage

The GSP uses groundwater level minimum thresholds, measurable objectives, and interim milestones as a proxy for the reduction in groundwater storage sustainability indicator. An analysis to determine conditions relative to established thresholds (including interim milestones for 2025, measurable objectives, and minimum thresholds) during WY 2020 for the chronic lowering of groundwater levels sustainability indicator is described in Section 2.3.1. The ESJWRM was updated to estimate the changes in groundwater storage during WY 2020, as described in Section 3.3.

2.3.3 Groundwater Quality

An analysis was performed to determine conditions relative to established sustainable management criteria (including interim milestones for 2025, measurable objectives, and minimum thresholds) during WY 2020 for the degraded water quality sustainability indicator (**Table 3)**. TDS was not sampled during WY 2020 at Well 1, Well 2, Well 3, and Stockton 10R. Stockton Well SSS8 was on standby during WY 2020, but will be active for WY 2021 reporting. Stockton Well 26 was no longer active at the time this report was developed. It will be replaced in the representative monitoring network for water quality by another nearby City of Stockton well. The replacement well has yet to be determined. Results from sampling at these six wells will be reported on in future annual reports.

As defined in the GSP, interim milestones are established following a linear trend between the current condition and measurable objective. In many cases, the most recent available data are what was presented in the GSP. Additional groundwater quality data will be collected and reported moving forward as part of GSP implementation.

Table 3. Degraded Water Quality Threshold Analysis

Well ID	Interim Milestone (2025)	Measurable Objective	Minimum Threshold	Current Conditions from GSP	WY 2020, if available **	
	(Total Dissolved Solids, mg/L)	(Total Dissolved Solids, mg/L)	(Total Dissolved Solids, mg/L)	(Total Dissolved Solids, mg/L)	Date of Measurement	(Total Dissolved Solids, mg/L)
Well 1	525	600	1,000	500	-	No Data[1]
Well 2	532.5	600	1,000	510	-	No Data
Well 3	532.5	600	1,000	510	-	No Data
Stockton 10R	391.5	600	1,000	322	-	No Data[2]
Stockton 26	412.5	600	1,000	350	-	No Data[3]
Stockton SSS8	427.5	600	1,000	370	-	No Data[4]
Well 15	375	600	1,000	300	8/18/20	310
Well 16	360	600	1,000	280*	5/18/20	240
Well 17	375	600	1,000	300*	5/18/20	290
119-075-01	375	600	1,000	300	11/12/19	380

* Calculated by averaging 2012-2018 data due to limitations on data availability.
** For wells where Water Year 2020 data are unavailable, the current conditions presented in the GSP represent the most recent available information.

[1] No data available for WY 2020. The most recent measurement for Well 1 was 460 mg/L on 1/2/2019.
[2] No data available for WY 2020. The most recent measurement for Stockton 10R was 390 mg/L on 2/2/2019.
[3] City of Stockton Well 26 has been decommissioned and was inactive at the time this report was developed. This well will be replaced in the representative monitoring network for water quality by a neighboring City of Stockton well.
[4] City of Stockton Well SSS8 was on standby at the time this report was written. For reporting in WY 2021, it will be active.

This page left blank intentionally.

2.3.4 Saltwater Migration

An analysis was performed to determine conditions relative to established sustainable management criteria (including measurable objectives and minimum thresholds) during WY 2020 for the saltwater migration indicator (**Table 4**). Interim milestones, which are based on the measurable objective, are not included in **Table 4** as these will be further developed through ongoing water quality monitoring. Chloride concentrations were not sampled during WY 2020 at Well 1, Well 2, Well 3, and Stockton 10R. Stockton Well SSS8 was on standby during WY 2020, but will be active for WY 2021 reporting. Stockton Well 26 was no longer active at the time this Annual Report was developed. It will be replaced in the representative monitoring network by a neighboring City of Stockton well. The replacement well has yet to be determined. Results from sampling at these six wells will be reported on in future annual reports.

Table 4. Saltwater Migration Threshold Analysis

Well ID	Measurable Objective	Minimum Threshold	WY 2020, if available **	
	(Chloride, mg/L)	(Chloride, mg/L)	Date of Measurement	(Chloride, mg/L)
Well 1	500	2,000	-	No Data
Well 2	500	2,000	-	No Data
Well 3	500	2,000	-	No Data
Stockton 10R	500	2,000	-	No Data[5]
Stockton 26	500	2,000	-	No Data[6]
Stockton SSS8	500	2,000	-	No Data[7]
Well 15	500	2,000	8/18/20	17
Well 16	500	2,000	5/18/20	11
Well 17	500	2,000	5/18/20	14
119-075-01	500	2,000	11/12/19	30

2.3.5 Land Subsidence

The GSP uses groundwater level minimum thresholds, measurable objectives, and interim milestones as a proxy for the land subsidence sustainability indicator. An analysis to determine conditions relative to established thresholds (including interim milestones for 2025, measurable objectives, and minimum thresholds) during WY 2020 for the chronic lowering of groundwater levels sustainability indicator is described in Section 2.3.1.

2.3.6 Groundwater-Surface Water Interaction

The GSP uses groundwater level minimum thresholds, measurable objectives, and interim milestones as a proxy for the depletions of interconnected surface water sustainability indicator. An analysis to determine conditions relative to established thresholds (including interim milestones for 2025, measurable objectives, and minimum thresholds) during WY 2020 for the chronic lowering of groundwater levels sustainability indicator is described in Section 2.3.1.

[5] No water quality data available for WY 2020. Monitoring data will be available for reporting in WY 2021.

[6] City of Stockton Well 26 has been decommissioned and was inactive at the time this report was developed. This well will be replaced in the representative monitoring network for water quality by a neighboring City of Stockton well.

[7] City of Stockton Well SSS8 was on standby at the time this report was written. For reporting in WY 2021, it will be active.

3. GROUNDWATER MONITORING AND CONDITIONS ASSESSMENT

This section discusses hydrologic conditions, groundwater elevation trends, groundwater quality, and groundwater-surface water interaction in the Eastern San Joaquin Subbasin.

3.1 HYDROLOGIC CONDITIONS

Rainfall data derived from the PRISM (Precipitation-Elevation Regressions on Independent Slopes Model) dataset of the DWR's California Simulation of Evapotranspiration of Applied Water (CALSIMETAW) model indicate a Subbasin average of 10 inches of rainfall during WY 2020. This represents approximately 63% of the long-term (WY 1969-2018) Subbasin average precipitation of 15.4 inches. San Joaquin River flow at Vernalis for the same period had an average monthly discharge of approximately 110 thousand acre-feet, representing about 42% of the long-term (WY 1930-2020) average flow at that location (USGS, 2021). The Stanislaus River flow at Ripon for this period had an average monthly discharge of approximately 49 thousand acre-feet, representing about 86% of the long-term (WY 1941-2020) average flow at that location; and Mokelumne River flow below Camanche Dam had an average monthly discharge of approximately 23 thousand acre-feet, representing about 45% of the long-term (WY 1905-2020) average flow at that location (USGS, 2021).

3.2 GROUNDWATER LEVELS

Figure 2 shows the location of the representative wells identified in the GSP monitoring network for the chronic lowering of groundwater levels. Individual hydrographs[8], charts of groundwater levels over time, for these wells are included in **Appendix B**. The hydrographs display historical trends of groundwater levels in the Subbasin through WY 2020, contingent upon data availability. All available data are shown (DWR, CASGEM Online System, 2020). Hydrographs for representative monitoring wells also display the minimum threshold and measurable objective that were developed in Chapter 3 (Sustainable Management Criteria) of the GSP. One new representative monitoring network well for groundwater levels has been added since GSP implementation started (01S10E04C001M). The location of this new addition to the monitoring network is indicated with a star in **Figure 2.**

All hydrographs show yearly cycles of groundwater level declines in summer due to typical patterns in groundwater pumping and recharge during winter recovery. Of the 20 representative wells, 13 wells reported groundwater levels for Fall 2019 and Spring 2020 as shown in **Table 2**. Generally, groundwater levels decreased or remained stable over WY 2020. Though water levels fluctuated around the measurable objective for multiple representative wells, water levels remained an average of 5.2 feet above the measurable objectives defined in the GSP. Only one representative well in the southwestern portion of the Subbasin (01N07E14J002) reported Spring 2019 levels below the measurable objective. Water levels remained an average of 34.6 feet above the minimum threshold for all representative wells with reported data in Spring 2020. No wells reported groundwater levels below the minimum threshold, and as a result, no undesirable results were triggered as specified by the sustainable management criteria set in the GSP.

Hydrographs showing WY 2020 for wells in the broad monitoring network are included in **Appendix C**.

[8] Except where noted, groundwater levels in hydrographs were converted to the North American Vertical Datum of 1988 (NAVD88), consistent with CASGEM groundwater data reporting.

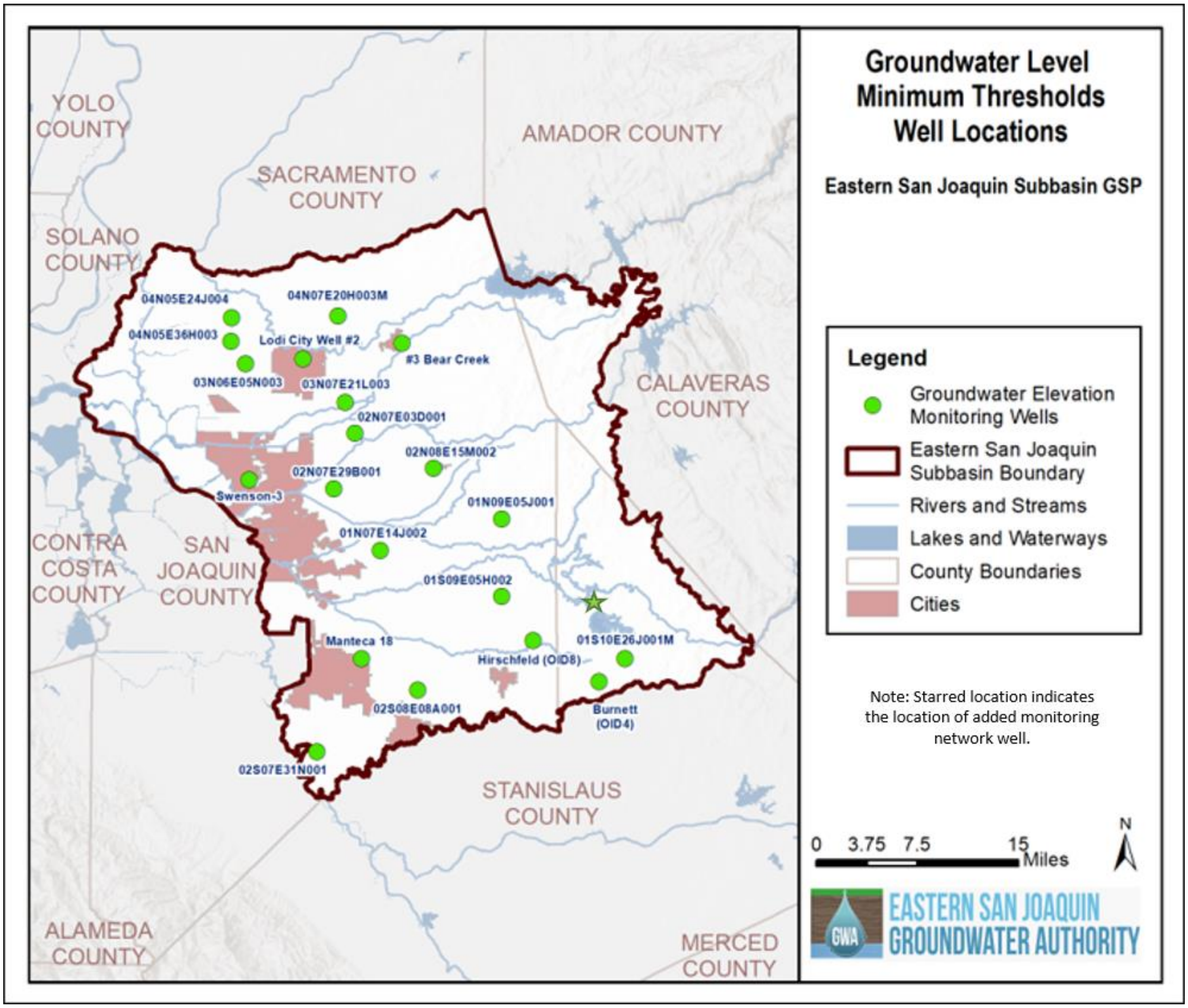


Figure 2. Groundwater Level Representative Monitoring Well Locations

3.2.1 Comparison of Current and Historical Spring Groundwater Levels

A comparison of Spring 2020 groundwater levels with the range of historical spring levels for representative wells in the Subbasin shows a general trend of decreasing groundwater levels. Groundwater levels decreased an average of 0.7 feet between Spring 2019 and Spring 2020 for representative wells with WY 2019 and WY 2020 data. This trend correlates with increased groundwater use during dry years, as WY 2020 was classified as a dry year under the San Joaquin Valley Water Year Index.

3.2.2 Groundwater Level Contour Maps

Groundwater level contour maps were developed as part of this annual report to represent seasonal high and seasonal low conditions. The Fall 2019 groundwater elevation contour map, reported in the previous annual report, is included to serve as a reference for groundwater elevations at the beginning of WY 2020, included as **Figure 3**. Spring 2020 (March, April, May 2020) and Fall 2020 (August, September, October, November 2020) groundwater elevation maps are included in **Figure 4** and **Figure 5.** Due to disruptions in monitoring during 2020, in many cases due to the COVID-19 pandemic, the period from which this analysis draws was increased from previous work to include measurements taken in May for the Spring 2020 map and October and November for the Fall 2020 map. This allowed the analysis to capture a larger dataset and better represent current conditions. Extending seasonal low conditions through November 2020 was deemed acceptable as there were no significant rain events occurring prior to December 2020 that would influence seasonal low groundwater conditions.

Generally, groundwater flows from the Sierra Nevada foothills west toward the pumping depression in the center of the Subbasin. Spring 2020 measured groundwater levels ranged from about -81 to 184 feet relative to mean sea level (MSL) (presented relative to the NAVD88 vertical datum). Groundwater levels observed during Fall 2019 ranged from about -64 to 363 feet relative to MSL, whereas those observed during Fall 2020 ranged from about -77 to 99 feet relative to MSL.

Groundwater elevation contours shown in **Figures 3 through 5** used the Inverse Distance Weighting (IDW) interpolation method (as opposed to the spline interpolation used in the GSP) as the IDW method better represented the updated data set. Areas where there were limited 2020 data available are indicated with hash marking all three figures. There is a notable data gap on the eastern side of the Subbasin. Installation of new monitoring wells in these regions as part of GSP implementation, as well as corresponding changes to groundwater level monitoring, will be critical in filling these data gaps.

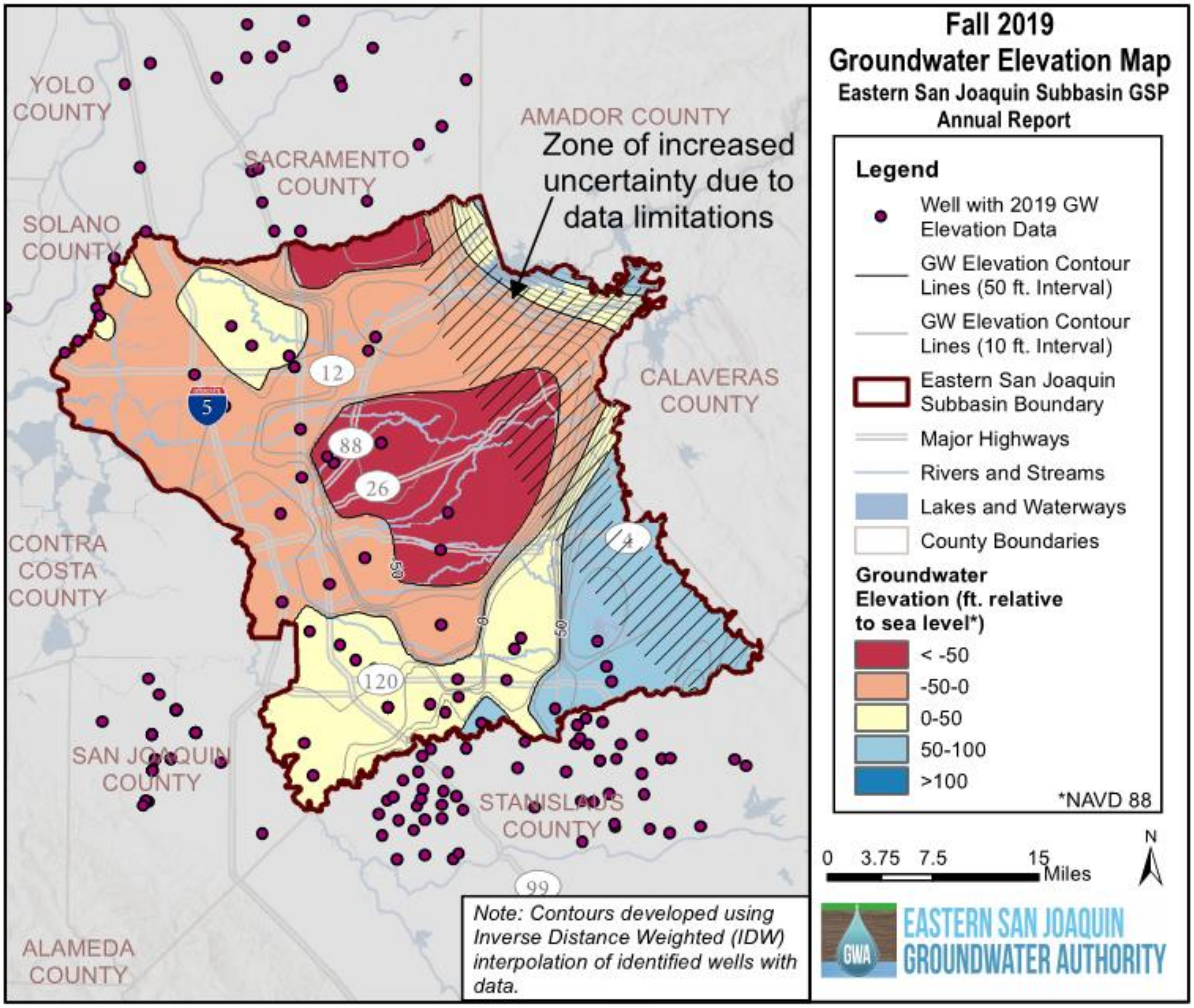


Figure 3. Seasonal Low Groundwater Levels in the Eastern San Joaquin Subbasin, Fall 2019

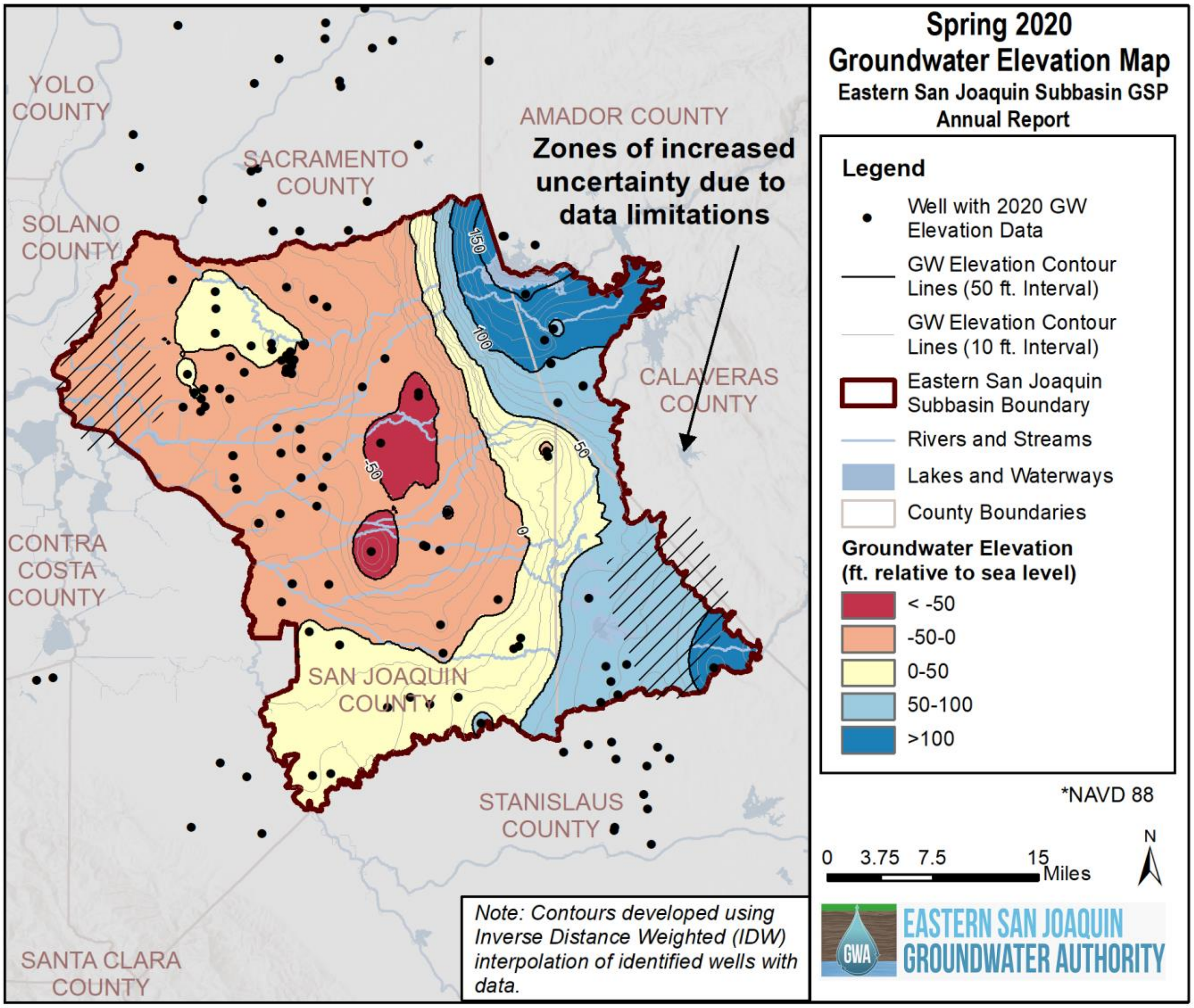


Figure 4. Seasonal High Groundwater Levels in the Eastern San Joaquin Subbasin, Spring 2020

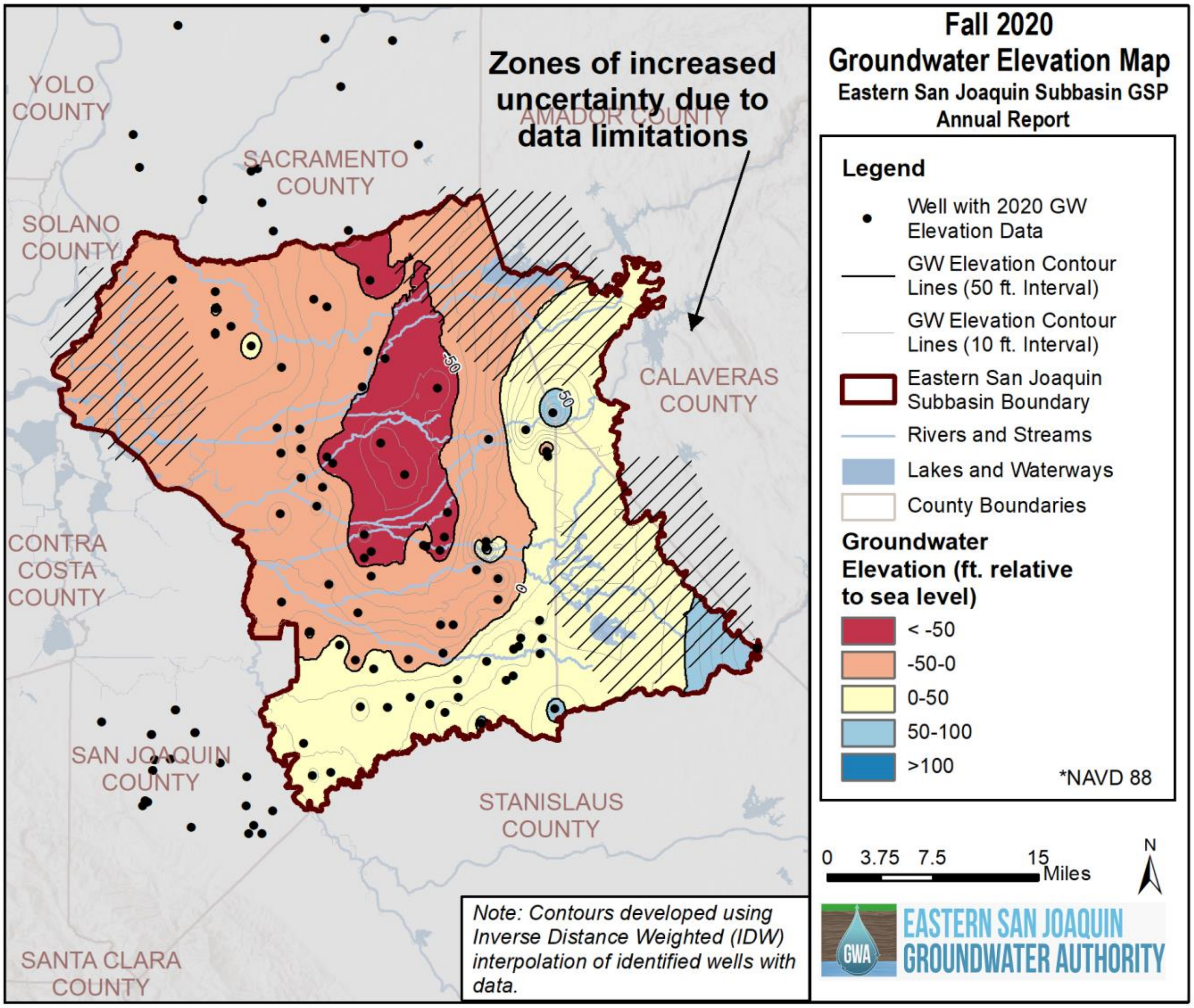
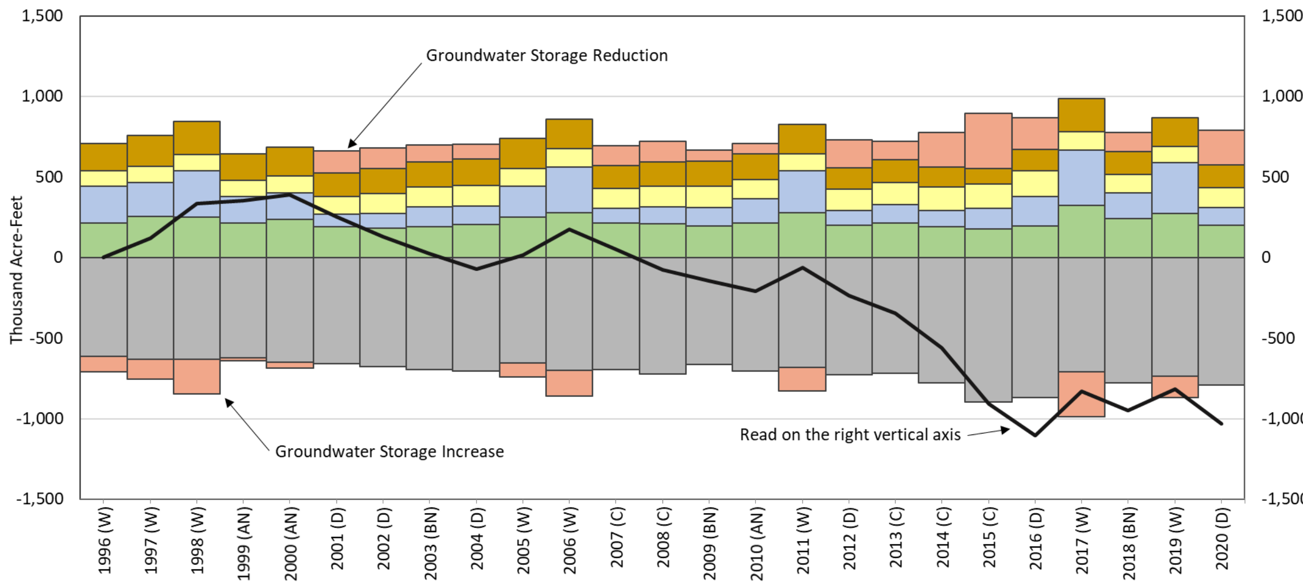


Figure 5. Seasonal Low Groundwater Levels in the Eastern San Joaquin Subbasin, Fall 2020

3.3 GROUNDWATER STORAGE

Change in groundwater storage is estimated using the ESJWRM. **Figure 6** shows the annual and cumulative change in storage from WY 1996 to 2020 for the Eastern San Joaquin Subbasin. In WY 2020 (October 1, 2019 to September 30, 2020), the Eastern San Joaquin Subbasin saw a decrease of groundwater in storage of approximately 213,000 AF, reflecting the dry conditions of the year. **Figure 6** indicates positive “Change in Storage”, meaning that inflows (consisting of deep percolation, recharge, flow from streams, and boundary inflows) were less than outflows in WY 2020. **Figure 7** adds all inflows together to highlight the annual change in storage. **Figure 8** shows this inverse “Change in Storage” plotted with “Groundwater Pumping” and “Cumulative Change in Storage”.

Figure 9 shows the change in groundwater storage for the Eastern San Joaquin Subbasin by ESJWRM element between October 1, 2019 and September 30, 2020. On an ESJWRM element basis, groundwater storage was estimated to increase or decrease by 0.25 feet over much of the Subbasin, with an area of decrease of up to 2 feet in the center of the Subbasin. Though change in storage varied on an ESJWRM element basis, there was an overall net decrease in groundwater storage in the Eastern San Joaquin Subbasin during WY 2020, as previously stated and reflected in **Figure 6** to **Figure 8,** and mapped in **Figure 9.**



X-Axis Abbreviation	Description
W	Wet year type
AN	Above normal year type
BN	Below normal year type
D	Dry year type
C	Critical year type

Figure 6. Historical Modeled Change in Annual Storage with Water Use and Year Type

Notes:

1. Water Year Types based on San Joaquin Valley Water Year Index (CA DWR, 2018). Water Year 2020 classification is Dry (D) based on the hydrologic conditions for that year.
2. "Other Recharge" includes managed aquifer recharge, recharge from unlined canals and/or reservoirs, and recharge from ungauged watersheds.
3. "Change in Storage" balances the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, but this would be shown as storage depletion on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.

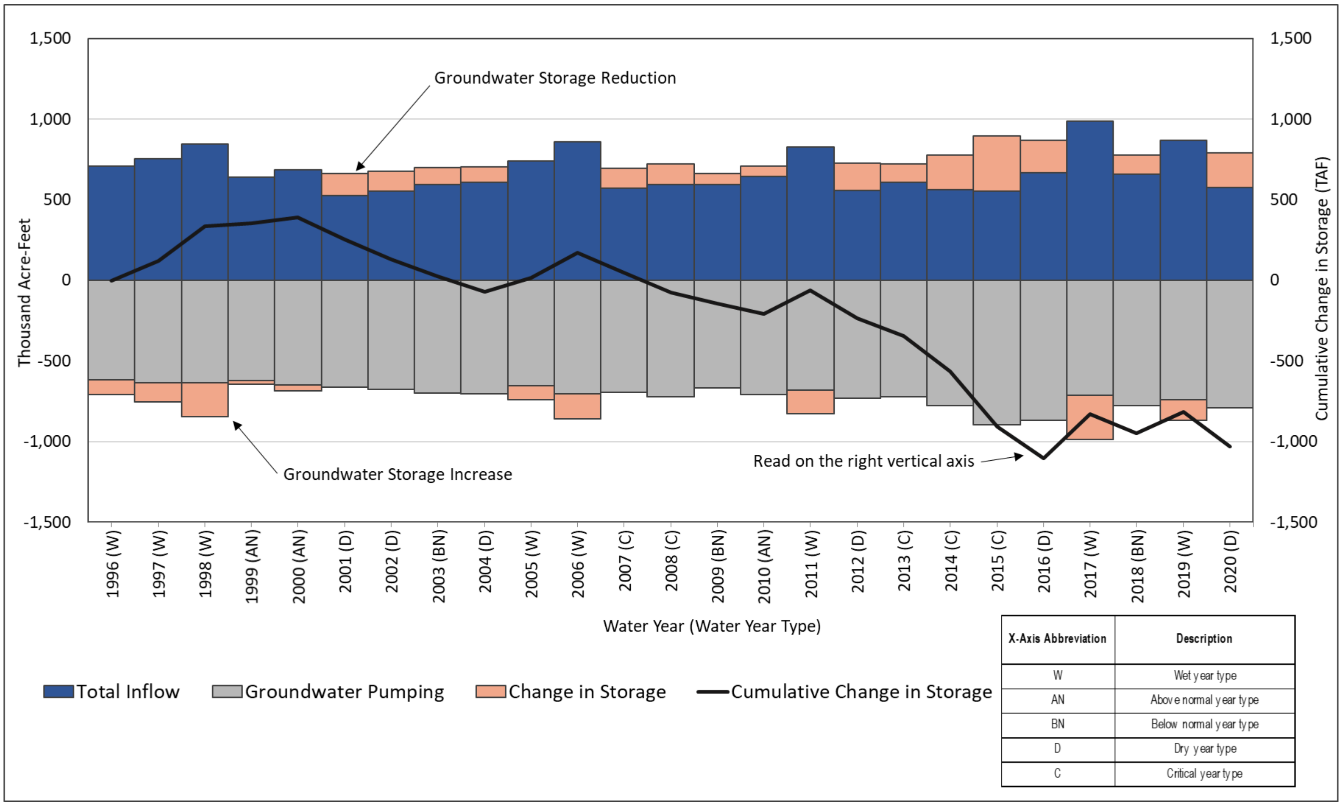


Figure 7. Historical Modeled Change in Annual Storage with Inflows and Year Type

Notes:

1. Water Year Types based on San Joaquin Valley Water Year Index (CA DWR, 2018). Water Year 2020 classification is Dry (D) based on the hydrologic conditions that year.
2. “Total Inflow” includes “Deep Percolation”, “Flow To/From Stream”, “Other Recharge”, and “Boundary Flow To/From Subbasin” from **Figure 6**.
3. “Change in Storage” balances the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, but this would be shown as storage depletion on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.

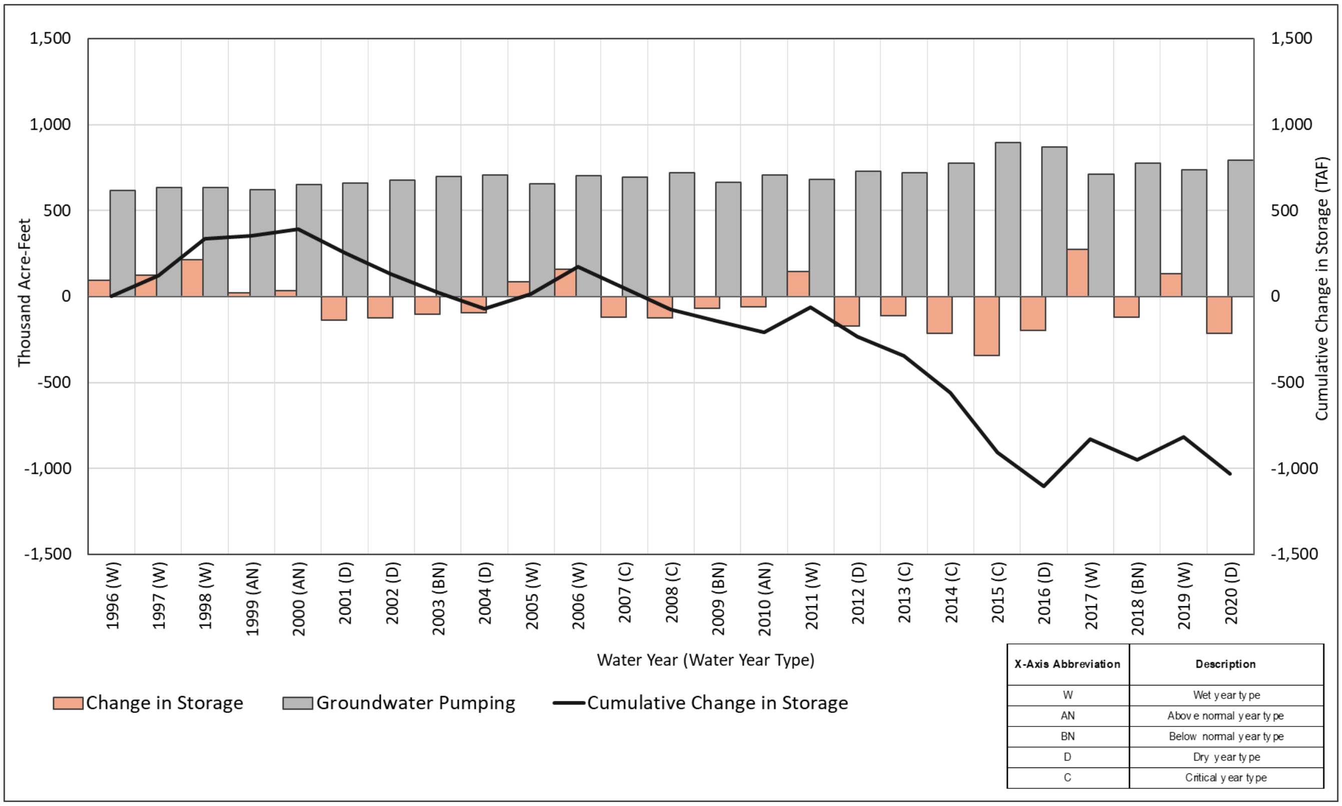


Figure 8. Historical Modeled Change in Annual Storage with Groundwater Pumping and Year Type

Notes:

1. Water Year Types based on San Joaquin Valley Water Year Index (CA DWR, 2018). Water Year 2020 classification is Dry (D) based on the hydrologic conditions for this analysis, however, the San Joaquin Valley Water Year Index has not yet published the WY 2020 designation.
2. “Groundwater Pumping” and “Change in Storage” are the inverse of what is shown in **Figure 6** and **Figure 7**. In this figure, a positive “Change in Storage” indicates an increase in groundwater storage, while a negative “Change in Storage” indicates a decrease in groundwater storage. These changes are directly reflected in the “Cumulative Change in Storage” line. The annual “Groundwater Pumping” is shown adjacent to the “Change in Storage” for the same year.

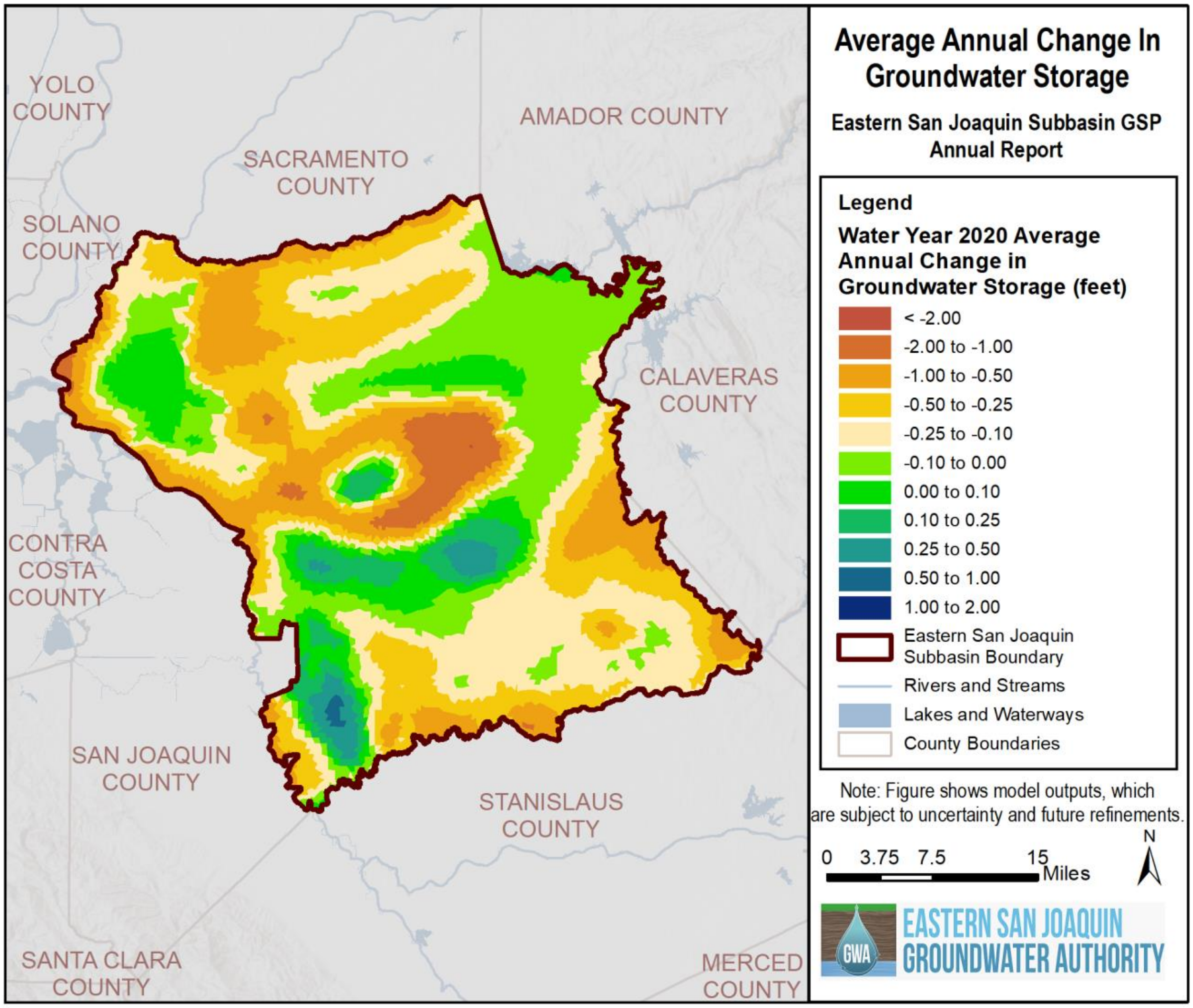


Figure 9. Eastern San Joaquin Subbasin WY 2020 Change in Storage

3.4 GROUNDWATER QUALITY

While groundwater quality in the Eastern San Joaquin Subbasin is generally sufficient to meet beneficial uses and is on track to surpass measurable objectives, there are a few constituents of concern that are either currently impacting groundwater use or could impact groundwater in the future. Each water quality parameter may be naturally occurring or anthropogenic in source as well as localized or widespread. The primary naturally occurring water quality constituents of concern in the Eastern San Joaquin Subbasin are salinity and arsenic. The primary water quality constituents related to human activity include nitrates, salinity, and various point-source contaminants such as petroleum hydrocarbons, solvents, and emerging contaminants. Historical groundwater quality conditions for these constituents are described in Section 2.2.4 in the GSP.

A primary maximum contaminant level (MCL) or secondary maximum contaminant level (SMCL) is defined for a variety of parameters. For the purposes of this GSP, comparing parameter concentrations to their MCL or SMCL is used as the basis for describing groundwater quality concerns in the Eastern San Joaquin Subbasin. Water quality has generally not significantly affected beneficial uses of groundwater in the Eastern San Joaquin Subbasin.

Through GSP implementation, monitoring networks for water quality are tested for TDS, cations and anions (including chloride and nitrate), arsenic, and field parameters including pH, electrical conductivity (EC), and temperature. Arsenic and nitrate are monitored for informational purposes only and to track trends in arsenic concentrations, especially as projects are implemented; the GSP does not include sustainability goals, measurable objectives, or minimum thresholds for arsenic or nitrate. Through new monitoring efforts, the GSP will document trends in monitored constituents and identify opportunities for coordination with existing programs. Through coordination with existing agencies and through additional monitoring, the ESJGWA will know if existing regulations are being met or if groundwater management activities in the Subbasin are contributing to significant and unreasonable undesirable effects related to degraded water quality. (It should be noted that arsenic and nitrate are currently regulated in the Subbasin through existing water resources monitoring and management programs such as the Irrigated Lands Regulatory Program. If groundwater quality conditions violate those regulations, or if monitoring efforts indicate concerning trends, the ESJGWA will take steps to coordinate with regulatory agencies implementing those programs and will evaluate establishing minimum thresholds and measurable objectives for these constituents at that time.)

Ten representative monitoring wells were selected to be monitored for water quality. These wells are currently monitored and managed by City of Manteca, Cal Water, City of Stockton, and San Joaquin County. These measurements are logged in **Table 3** in Section 2.5, GSP Implementation Progress of this Annual Report. Details regarding the status of wells that were not sampled during WY 2020 are also included. There were no minimum threshold exceedances to report for WY 2020.

The broad monitoring network for water quality includes sampling from five identified local water quality wells and 16 nested and/or clustered well sites that are also monitored for groundwater levels in the broad monitoring network for groundwater levels.

3.4.1 Total Dissolved Solids Measurements in Representative Monitoring Network Wells

TDS measurements were reported from four of the ten representative monitoring wells for water quality. These figures are included in **Table 3** and are shown visually in **Figure 10**. The six wells without data were not sampled for a variety of reasons, including reductions in field work as a result of the COVID-19 pandemic.

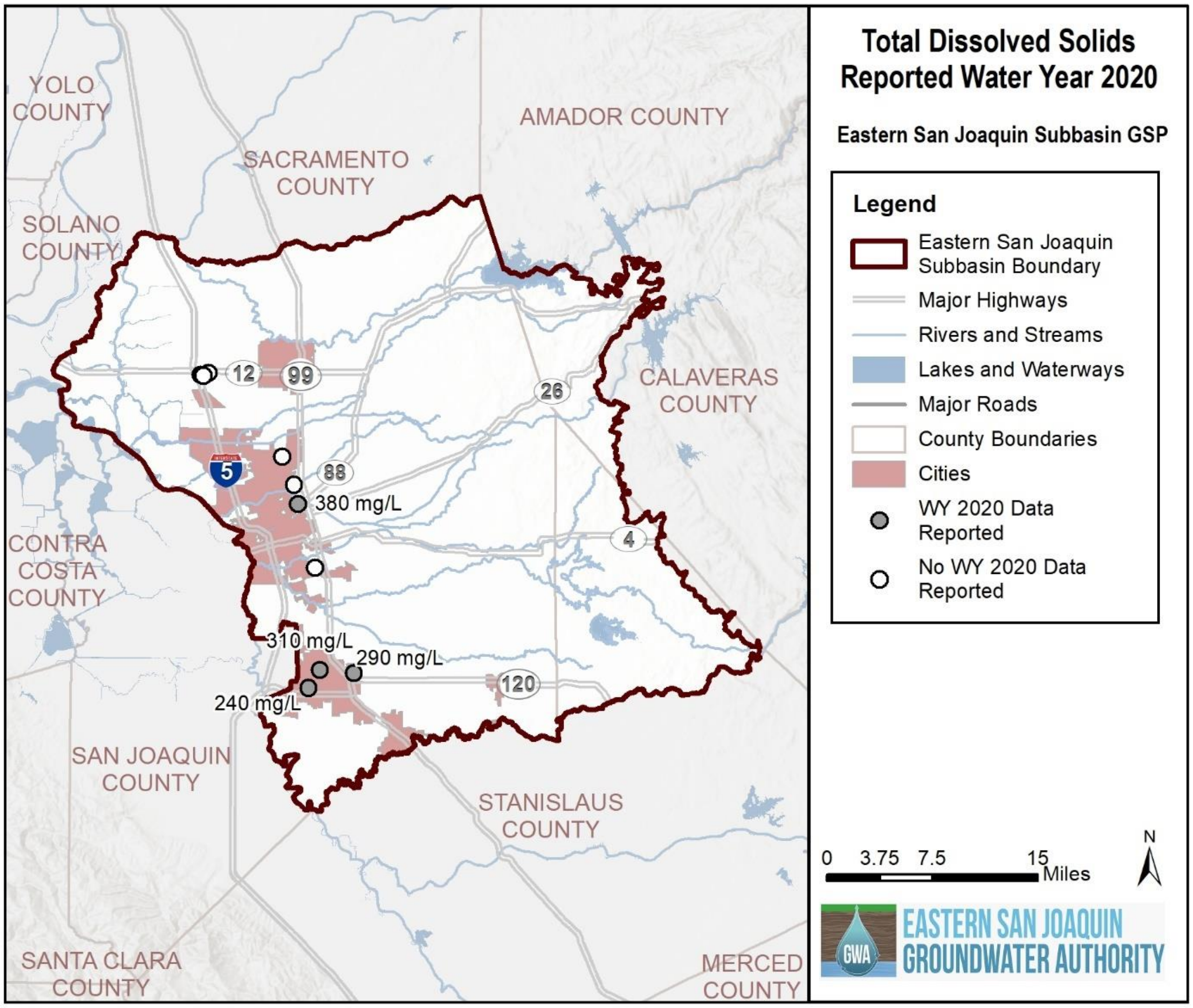


Figure 10. Water Year 2020 Total Dissolved Solids Measurements at Representative Monitoring Well Sites

3.4.2 Contaminated Sites

Please refer to the GSP for the most recent information regarding contaminated sites within the Eastern San Joaquin Subbasins. As the GSP was completed November 2019, limited additional data are available on contaminated sites. Updates regarding contaminated sites within the Eastern San Joaquin Subbasins will be provided in subsequent Annual Reports.

3.4.3 Regional Groundwater Quality

Please refer to the GSP for the most recent information regarding regional water quality within the Eastern San Joaquin Subbasin. As the GSP was completed November 2019, limited additional data are available on regional groundwater quality. Updates regarding regional water quality within the Eastern San Joaquin Subbasin will be provided in subsequent Annual Reports.

3.5 SALTWATER MIGRATION

As described in the GSP, the ESJGWA monitors chloride concentrations to support information collection and early detection of saltwater intrusion and will report chloride concentrations to DWR in each annual report. While saltwater migration is not expected to occur, the GSP established monitoring protocols for the early detection of saltwater migration were it ever to occur. Chloride measurements were reported from the four of the ten representative monitoring wells for water quality. These figures are included in **Table 4** and are shown visually in **Figure 11**. There were no minimum threshold exceedances for saltwater migration to report for WY 2020.

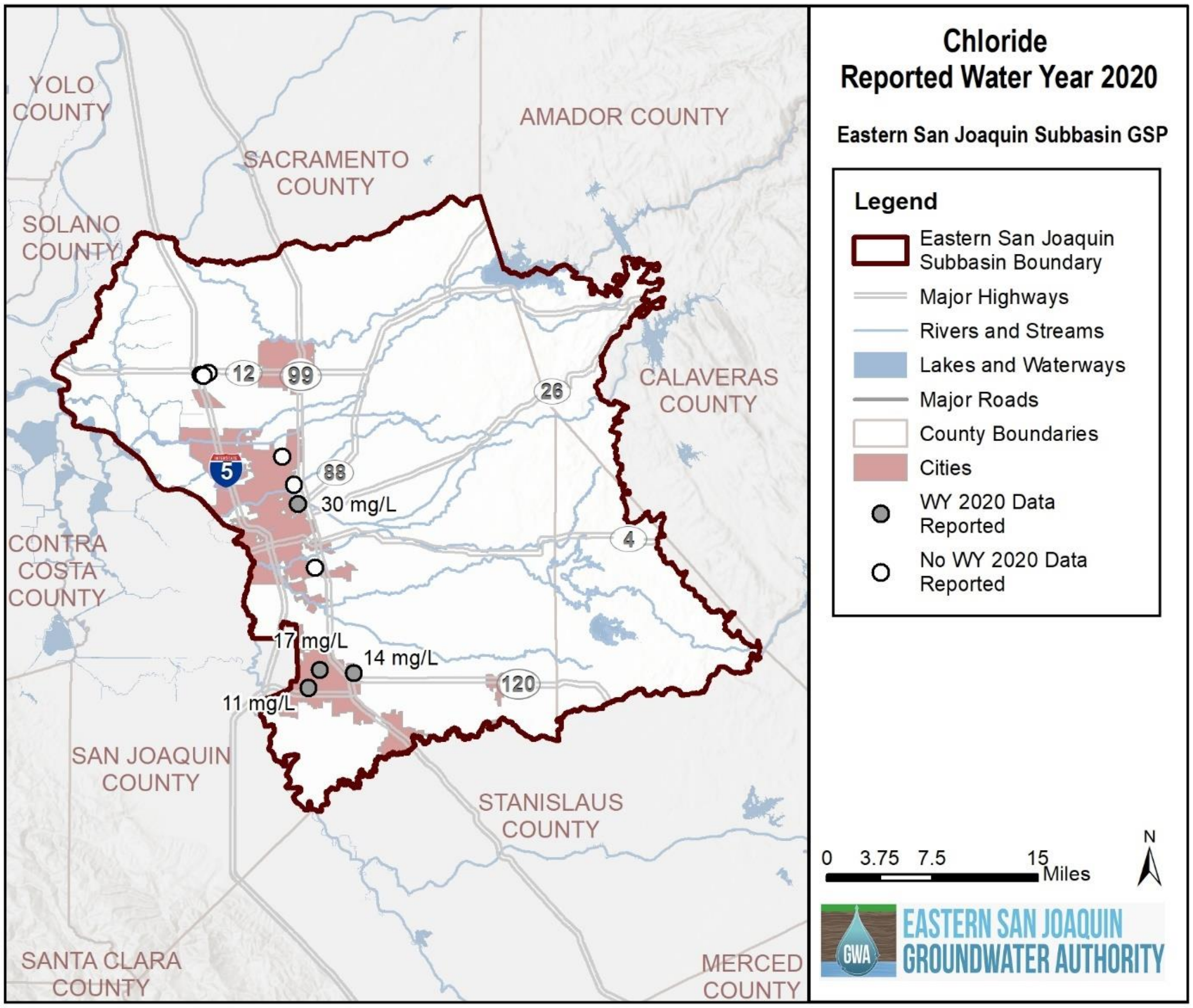


Figure 11. Water Year 2020 Chloride Measurements at Representative Monitoring Well Sites

3.6 LAND SUBSIDENCE

SGMA considers the impact of groundwater management actions on land subsidence through the land subsidence sustainability indicator. In the Eastern San Joaquin Subbasin, the land subsidence sustainability indicator uses the groundwater level sustainability indicator as a proxy. Minimum thresholds for groundwater levels are protective of significant and unreasonable impacts to land subsidence, as described in the GSP. There were no minimum threshold exceedances for groundwater levels; therefore, there are no land subsidence impacts to report for WY 2020.

3.7 GROUNDWATER-SURFACE WATER INTERACTION

SGMA considers the impact of groundwater management actions on groundwater-surface water interactions through the depletions of interconnected surface water sustainability indicator. In the Eastern San Joaquin Subbasin, the depletions of interconnected surface water sustainability indicator use the groundwater level sustainability indicator as a proxy. Minimum thresholds for groundwater levels are protective of significant and unreasonable impacts to depletions of interconnected surface waters, as described in the GSP. There were no minimum threshold exceedances for groundwater levels; therefore, there are no groundwater-surface water interaction impacts to report for WY 2020.

3.8 TOTAL WATER USE

3.8.1 Groundwater Use

Groundwater pumping data are available only from a limited number of metered wells within the Eastern San Joaquin Subbasin, with the remainder of extraction information estimated using ESJWRM[9]. Metered data are available from municipal water purveyors (Cal Water, City of Escalon, City of Lodi, City of Manteca, City of Ripon, City of Stockton, LCWD, LCSD, and SEWD). Agricultural, private domestic, and other groundwater production in the Subbasin is largely unmetered and were estimated using the ESJWRM, which bases water use on crop type, hydrologic data (precipitation and evapotranspiration), irrigation efficiency, and population information.

Figure 12 shows the general location and volume of groundwater pumping within the Subbasin by ESJWRM element for WY 2020. Large portions of the Subbasin elements experience very little pumping between 0.0 to 0.5 AF/acre or feet, while areas with agriculture or municipal pumping wells have pumping ranging from 0.5 to approximately 10 feet.

In WY 2020, total groundwater use in the Eastern San Joaquin Subbasin was estimated at 790,416 AF across water use sectors, as shown in **Table 5**. As the estimated sustainable yield of the Eastern San Joaquin Subbasin is 715,000 AFY ± 10 percent over the long-term, pumping may exceed the sustainable yield during certain years, balanced by other years with reduced pumping so that the long-term average remains at or below the sustainable yield. The groundwater use simulated in ESJWRM over the last 11 years (WY 2010-2020) ranged from a low of 682,000 AF in WY 2011 (wet year) to a high of 897,000 AF in WY 2015 (critical year), with 8 of the 11 simulated years staying within the range of the sustainable yield.

3.8.2 Surface Water Use

Surface water delivery data are available from purveyors in the Subbasin and include deliveries for urban and industrial use (City of Lodi; City of Manteca; and City of Stockton, including Cal Water and unincorporated portions of San Joaquin County) and deliveries for agricultural use (CCWD, CSJWCD, NSJWCD, OID, SSJID, SEWD, and WID).The remaining surface water use is estimated in the ESJWRM

[9] A pilot project was undertaken in SEWD to test use of satellite technology to measure and quantify crop evapotranspiration. These measurements, in combination with known data on surface water deliveries, could provide a more direct measure of groundwater pumping for agricultural irrigation. The approach will be further evaluated and may be used along with modeling to quantify agricultural groundwater extractions in the future.

and covers riparian diversions occurring in the CDWA, SDWA, and along major Subbasin rivers. Sources of surface water in the Subbasin include Calaveras River, Mokelumne River, San Joaquin River, and Stanislaus River. Surface water deliveries during WY 2020 are estimated to be 505,518 AF for the Eastern San Joaquin Subbasin (**Table 6).** The majority of surface water is used between May and September.

Conjunctive use is the use of surface water in coordination with groundwater to allow the Subbasin to recharge and store additional water supply, either through in-lieu use or direct recharge. In-lieu recharge occurs for both agricultural and municipal purveyors wherever surface water is being delivered to offset groundwater that would have otherwise been used. Agencies conducting in-lieu recharge include Cal Water, CCWD, City of Escalon, City of Lodi, City of Manteca, City of Ripon, City of Stockton, CSJWCD, LCWD, LCSD, NSJWCD, OID, SSJID, SEWD, and WID. While in-lieu recharge was not quantified separately in this report, estimates may be made in future annual reports.

Direct recharge projects exist in NSJWCD and SEWD and recharged over 9,500 AF in WY 2020. These projects use water from the Calaveras River, Mokelumne River, and Stanislaus River and include NSJWCD's Tracy Lake Groundwater Recharge Project, NSJWCD's Cal-Fed/Costa Recharge project, and SEWD's Farmington Groundwater Recharge Program.

3.8.3 Total Water Use

Total water use is the sum of the groundwater use and surface water use. Total water use during WY 2020 is estimated to be 1,295,934 AF for the Eastern San Joaquin Subbasin **(Table 8).** Groundwater pumping accounts for just over 60% of total water use in the Subbasin, while surface water deliveries are a little less than 40% of total water use.

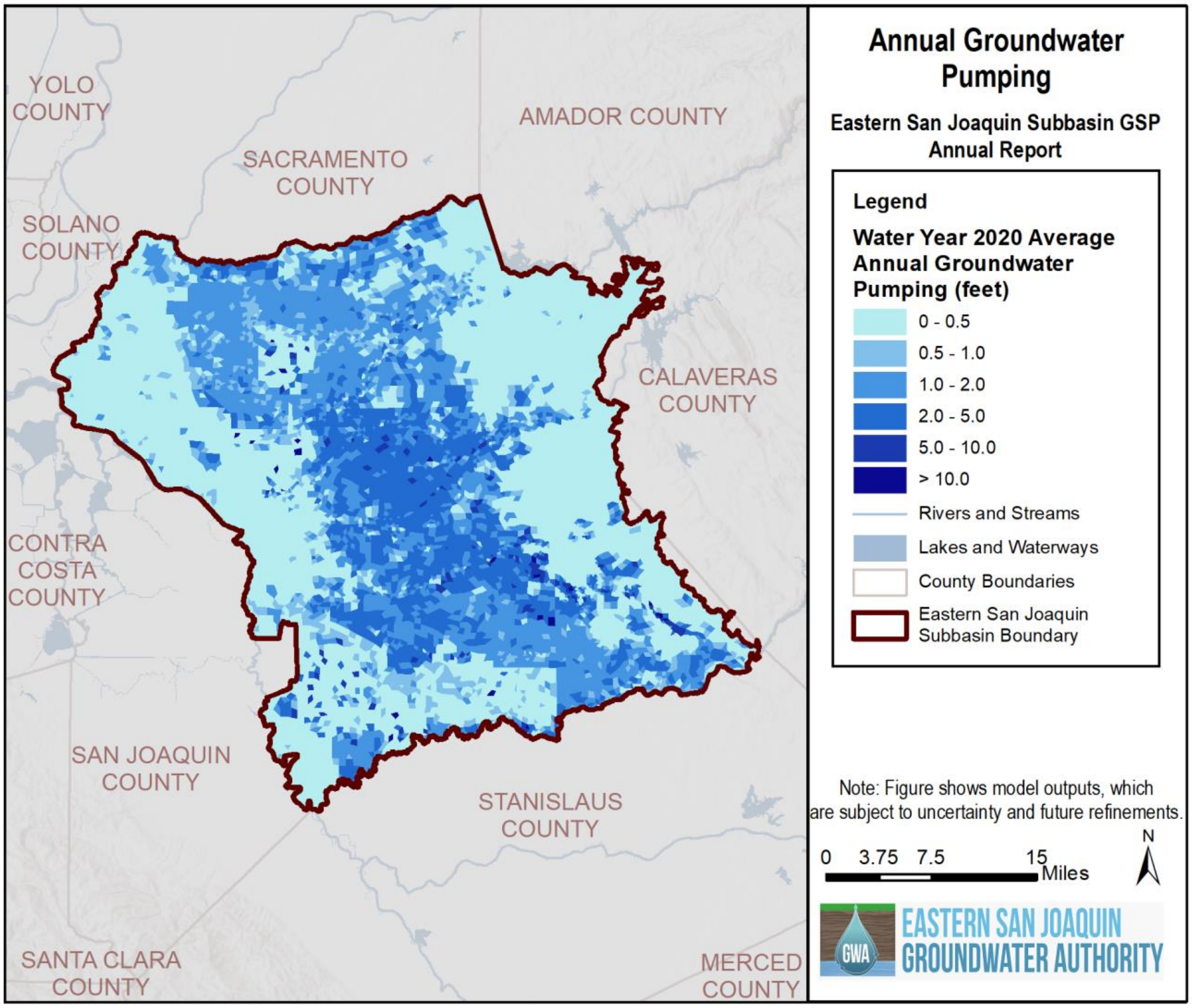


Figure 12. Eastern San Joaquin Subbasin WY 2020 Groundwater Extraction

Table 5. Water Year 2020 Monthly Groundwater Extraction (in acre-feet)

Month	Agricultural		Urban and Industrial		Total
	*Agency Reported Values**	*Estimated Agricultural***	*Agency Reported Values**	*Private Domestic***	
Oct-19	163	105,900	2,507	2,400	110,970
Nov-19	50	3,700	1,305	1,500	6,555
Dec-19	68	2,400	997	1,400	4,865
Jan-20	43	1,300	1,015	1,200	3,559
Feb-20	180	25,100	1,661	1,400	28,340
Mar-20	214	16,100	1,752	1,400	19,466
Apr-20	196	101,600	1,916	1,700	105,412
May-20	277	52,400	3,158	2,700	58,535
Jun-20	360	175,200	4,069	3,200	182,829
Jul-20	532	64,300	4,251	3,400	72,483
Aug-20	306	132,800	3,802	3,300	140,207
Sep-20	257	50,700	3,238	3,000	57,195
Total	2,645	731,500	29,671	26,600	790,416
Measurement Accuracy	***High***	***Medium***	***High***	***Medium***	-

* Agency reported values for agriculture were collected for some of the agencies (Manteca and OID) that report pumping for either agricultural or landscape use.

** Additional groundwater pumping is estimated by the ESJWRM based on crop type, hydrologic data (precipitation and evapotranspiration), irrigation efficiency, and population information.

Table 6. Water Year 2020 Monthly Surface Water Delivered for Use (in acre-feet)

Month	Agricultural		Urban and Industrial		Total
	*Agency Reported Values**	*Estimated Riparian***	*Agency Reported Values*	*Estimated in ESJWRM*	
Oct-19	17,552	7,700	6,397	0	31,649
Nov-19	2,795	800	4,245	0	7,840
Dec-19	2,159	300	4,066	0	6,525
Jan-20	1,826	600	3,363	0	5,789
Feb-20	2,035	1,300	2,303	0	5,637
Mar-20	17,884	3,600	3,650	0	25,135
Apr-20	21,466	9,900	4,088	0	35,453
May-20	39,310	38,300	5,029	0	82,639
Jun-20	41,091	24,200	5,528	0	70,819
Jul-20	47,436	39,600	6,695	0	93,731
Aug-20	44,236	24,500	6,666	0	75,402
Sep-20	30,607	27,600	6,690	0	64,897
Total	268,397	178,400	58,720	0	505,518
Measurement Accuracy	***High***	***Medium***	***High***	***Medium***	-

* Agency reported values reflect deliveries to meet demand, which was based on evapotranspiration and land use.

** Estimated agricultural surface water deliveries include deliveries to Central Delta Water Authority, South Delta Water Authority, and riparian users along major streams.

Table 7. Water Year 2020 Monthly Total Water Use (in acre-feet)

Month	Agricultural						Urban and Industrial						Total
	Direct Measurement			*Estimated in ESJWRM***			*Direct Measurement*			*Estimated in ESJWRM***			
	*Groundwater**	*Surface Water*	*Total*	*Ground water*	*Surface Water*	*Total*	*Groundwater*	*Surface Water*	*Total*	*Groundwater*	*Surface Water*	*Total*	
Oct-19	163	17552	17,716	105,900	7,700	113,600	2,507	6,397	8,904	2,400	0	2,400	142,619
Nov-19	50	2795	2,845	3,700	800	4,500	1,305	4,245	5,550	1,500	0	1,500	14,396
Dec-19	68	2159	2,226	2,400	300	2,700	997	4,066	5,064	1,400	0	1,400	11,390
Jan-20	43	1826	1,869	1,300	600	1,900	1,015	3,363	4,379	1,200	0	1,200	9,348
Feb-20	180	2035	2,214	25,100	1,300	26,400	1,661	2,303	3,963	1,400	0	1,400	33,978
Mar-20	214	17884	18,098	16,100	3,600	19,700	1,752	3,650	5,402	1,400	0	1,400	44,600
Apr-20	196	21466	21,662	101,600	9,900	111,500	1,916	4,088	6,003	1,700	0	1,700	140,865
May-20	277	39310	39,587	52,400	38,300	90,700	3,158	5,029	8,187	2,700	0	2,700	141,174
Jun-20	360	41091	41,451	175,200	24,200	199,400	4,069	5,528	9,597	3,200	0	3,200	253,648
Jul-20	532	47436	47,968	64,300	39,600	103,900	4,251	6,695	10,946	3,400	0	3,400	166,215
Aug-20	306	44236	44,542	132,800	24,500	157,300	3,802	6,666	10,468	3,300	0	3,300	215,610
Sep-20	257	30607	30,864	50,700	27,600	78,300	3,238	6,690	9,928	3,000	0	3,000	122,092
Total	2,645	268,397	271,043	731,500	178,400	909,900	29,671	58,720	88,392	26,600	0	26,600	1,295,934
Measurement Accuracy	***High***	***High***	***High***	***Medium***	***Medium***	***Medium***	***High***	***High***	***High***	***Medium***	***Medium***	***Medium***	-

* Agency reported values for agriculture was collected for some of the agencies (Manteca and OID) that report pumping for either agricultural or landscape use.

** Includes estimated agricultural groundwater use, estimated private domestic groundwater use, and estimated riparian surface water use. See previous tables for further details.

3.8.4 Eastern San Joaquin Water Resources Model Update

The ESJWRM was originally developed and calibrated to model historical groundwater storage from water years 1996-2015. The model was updated to WY 2019 in 2020 for the WY 2019 Annual Report and again in 2021 for this annual report to reflect more recent data. Data for WY 2020 were collected from the same public and private sources that had provided the historical data through 2015 used in the GSP. As a result of the model update, a new historical water budget was generated including updated estimates of change in groundwater storage. The *Eastern San Joaquin Water Resources Model Final Report* provides detailed documentation on the ESJWRM model (Woodard & Curran, 2018).

The 2016-2020 continuation of the historical water budget is intended to verify and further evaluate the aquifer system under a variety of hydrological and anthropogenic conditions. These updates are particularly critical to the management of the aquifer system as it reflects the post 2013-2015 drought conditions and operations of the Subbasin. The full annual groundwater budget for water years 1996-2020 is shown earlier in **Figure 6**.

Data Sources

Data were requested and received from the following entities in the Subbasin to complete the ESJWRM update through WY 2020:

Agricultural Water Purveyors

- Calaveras County Water District
- Central San Joaquin Water Conservation District
- North San Joaquin Water Conservation District
- Oakdale Irrigation District
- South San Joaquin Irrigation District
- Stockton East Water District
- Woodbridge Irrigation District

Municipal Water Purveyors

- California Water Service Company Stockton District
- City of Escalon
- City of Lodi
- City of Manteca
- City of Ripon
- City of Stockton
- Linden County Water District
- Lockeford Community Services District
- Stockton East Water District

Additional publicly-available data were downloaded to complete the ESJWRM update:

State

- California Department of Finance population estimates
- DWR 2016 Statewide Crop Mapping

Federal

- United States Geological Survey (USGS) stream flows[10]
- United States Army Corps of Engineers reservoir releases[11]

Other

- Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) Climate Group, Oregon State University

Updated Components

The above data sources provided the necessary data to allow the historical model to reflect recent conditions. The following components of the model were updated:

Surface Water Diversions and Deliveries: Monthly surface water diversions and deliveries were provided for October 2019 through September 2020 for urban and industrial use and agricultural use as described in Section 3.8.2. Remaining riparian diversion occurring in CDWA, SDWA, and along major rivers were estimated based off agricultural demands estimated in ESJWRM.

Groundwater Pumping: Groundwater extractions from October 2019 to September 2020 were provided by municipal water purveyors as described in Section 3.8.1. Pumping estimates were made in ESJWRM for private agriculture and domestic wells based on land use type and population.

Population: California Department of Finance estimates (E-4 Population Estimates for Cities, Counties, and the State, 2011-2020, with 2010 Census Benchmark) were downloaded to update annual population for 2020 (State of California, 2020). Rural populations were estimated from Department of Finance county totals and spatially assigned throughout the model by urban acreage.

Land Use: Each element within the ESJWRM is comprised of some fraction of 27 land uses, including 23 agricultural crop categories, native vegetation, water surface, riparian vegetation, and urban landscape. For the 2016-2020 update, the model utilizes data from DWR's 2016 Statewide Crop Mapping which provides data on urban and irrigated land throughout the model domain on a parcel scale (DWR, 2016).

Precipitation: Rainfall data for the model area are derived from the PRISM (Precipitation-Elevation Regressions on Independent Slopes Model) database used in the DWR's CALSIMETAW (California Simulation of Evapotranspiration of Applied Water) model. The database contains daily precipitation data from October 1, 1921, on a four-kilometer grid throughout the model area. ESJWRM has monthly rainfall data defined for every model element in order to preserve the spatial distribution of the monthly rainfall. Each of the model elements was mapped to the nearest of 364 available PRISM reference nodes, uniformly distributed across the model domain. The PRISM dataset is available online from Oregon State University through a partnership with the NRCS National Water and Climate Center (Oregon State University, 2019).

Streamflow: Monthly inflow to the Eastern San Joaquin Subbasin were updated for Dry Creek, Mokelumne River, Calaveras River, Stanislaus River, and San Joaquin River. Sources of data included USGS (USGS, 2021) and United States Army Corps of Engineers (US Army Corps of Engineers, 2020).

---

[10] New Melones Reservoir flows are monitored at a USGS gauge downstream on the Stanislaus River below Goodwin Dam near Knights Ferry, CA.

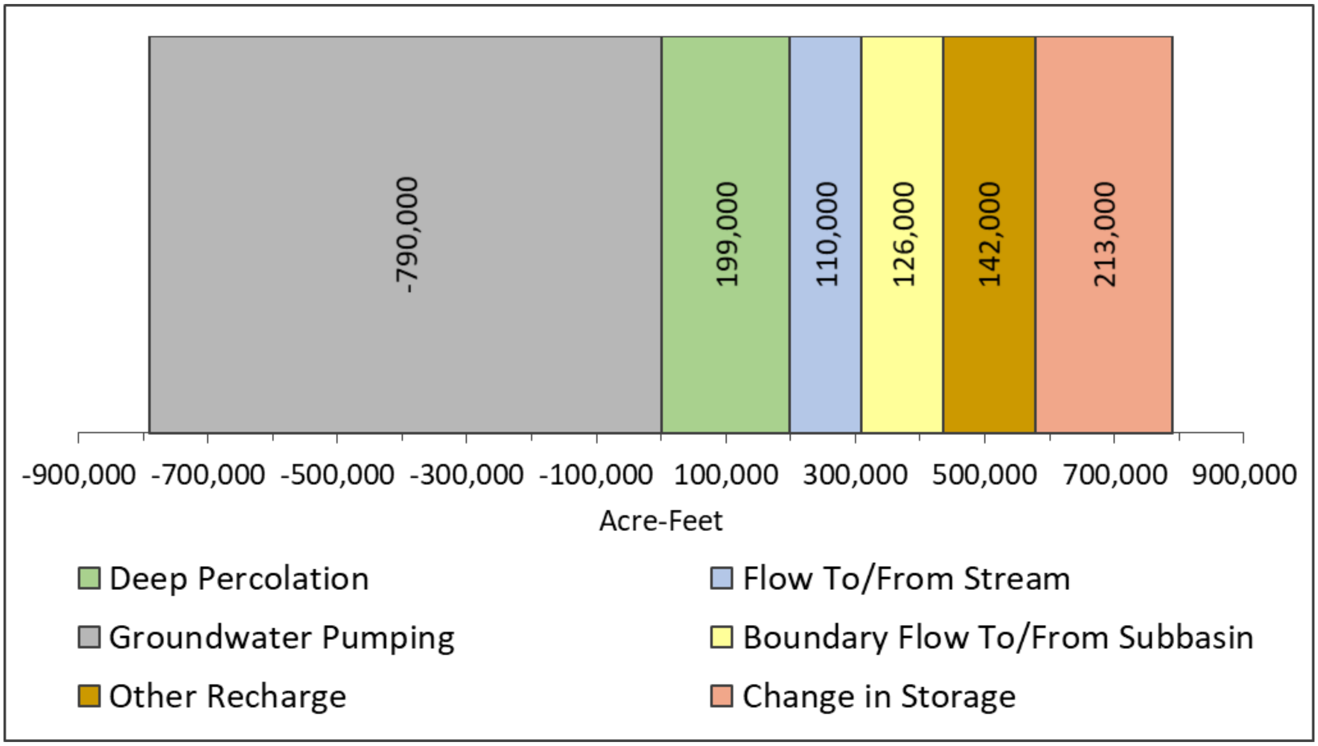
[11] Reservoir release for New Hogan Reservoir on the Calaveras River.

Non-gauged tributaries into the Subbasin were estimated internally by the model using the Integrated Water Flow Model (IWFM) small-watershed package.

Boundary Conditions: Averages of historical model data by water year type were used to update the assumed groundwater elevation boundary conditions in the model.

Results

Evaluation of WY 2020 (**Figure 13**) shows that the Eastern San Joaquin Subbasin experienced, on an average and net basis, 577,000 AF of inflows and 790,000 AF of outflow, leading to an annual decrease of groundwater in storage of 213,000 AF. Deep percolation from the root zone is the largest contributor of groundwater inflow (199,000 AFY), followed by recharge from managed aquifer projects, unlined canals or reservoirs, and ungauged watersheds (142,000 AFY); boundary flows from surrounding groundwater subbasins (126,000 AFY); and recharge from streams (110,000 AFY). Groundwater production (790,000 AFY) accounts for the greatest outflow from the Eastern San Joaquin Subbasin. **Table 8** compares these values against those from WY 2019.



Notes:

1. "Other Recharge" includes managed aquifer recharge, recharge from unlined canals and/or reservoirs, and recharge from ungauged watersheds.
2. "Change in Storage" is placed to balance the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, but this would be shown on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.

Figure 13. WY 2020 Average Annual Estimated Groundwater Budget, Eastern San Joaquin Subbasin

Table 8. Comparison of WY 2019 and WY 2020 Water Budget (in acre-feet)

Water Budget Element	WY 2019	WY 2020
Water Year Type	Wet	Dry
Deep Percolation	273,000	199,000
Other Recharge	179,000	142,000
Flow to/from Stream	314,000	110,000
Boundary Flow to/from Subbasin	104,000	126,000
Groundwater Pumping	-738,000	-790,000
Change in Storage	132,000	-213,000

4. REFERENCES

DWR. (2016). *Statewide Crop Mapping 2016*. Retrieved from https://gis.water.ca.gov/app/CADWRLandUseViewer/

DWR. (2020). *CASGEM Online System*. Retrieved from https://www.casgem.water.ca.gov/OSS/(S(ezkaom5a1ihttdi0zvoxrrke))/Default.aspx?ReturnUrl=%2fOSS%2f

ESJGWA. (2019). *Eastern San Joaquin Groundwater Subbasin Groundwater Sustainability Plan.*

Oregon State University. (2019). *PRISM Climate Group*. Retrieved from http://prism.oregonstate.edu./

State of California, D. o. (2020, May). *E-4 Population Estimates for Cities, Counties, and the State, 2011-2020 with 2010 Census Benchmark*. Retrieved from https://www.dof.ca.gov/Forecasting/Demographics/Estimates/e-4/2010-20/

US Army Corps of Engineers. (2020). *Sacramento District Water Control Data System*. Retrieved from http://www.spk-wc.usace.army.mil/reports/monthly.html

USGS. (2021). *National Water Information System*. Retrieved from https://waterdata.usgs.gov/nwis/

Woodard & Curran. (2018). *Eastern San Joaquin Water Resources Model (ESJWRM) Final Report.*

This page left blank intentionally.

Appendix A – GSP Implementation Progress

Table A-1. Summary of Implementation Progress of GSP Projects and Management Actions

Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Project 1: Lake Grupe In-lieu Recharge	In-lieu Recharge	SEWD	Can be implemented immediately	2020-2022	The Project is pending approval of a Clean Water Act Section 401 permit from the State Water Resources Control Board. All other permits have been acquired, and the Project is ready for construction.
Project 2: SEWD Surface Water Implementation Expansion	In-lieu Recharge	SEWD	Implementation phase	2019-2029	The Project is progressing from the advanced planning stage to the initial implementation phase. One customer has converted from groundwater to surface water use, and a second customer conversion is in progress. During WY 2021, the SEWD plans to continue constituent outreach efforts and address the necessary improvements to facilitate future conversions to surface water.
Project 3: City of Manteca Advanced Metering Infrastructure	Conservation	City of Manteca	Currently underway	2019-2021	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 due to delays as a result of COVID-19, staff shortages, and lack of funding. Updates regarding activity progress will be included in future Annual Reports.
Project 4: City of Lodi Surface Water Facility Expansion & Delivery Pipeline	In-lieu Recharge	City of Lodi	Planning phase	2030-2033	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 since implementation is not planned until 2030. Updates regarding activity progress will be included in future Annual Reports.
Project 5: White Slough Water Pollution Control Facility Expansion	Recycling/ In-lieu Recharge	City of Lodi	Construction complete	2019-2020	The Project status information presented in the GSP is up to date. The Project is complete.
Project 6: CSJWCD Capital Improvement Program	In-lieu Recharge	CSJWCD	Can be implemented immediately	2020-2027, on-going with 7-year completion cycles	The Project status information presented in the GSP is up to date. The Project has been implemented and is on-going each year of available water delivery. Updates regarding activity progress will be included in future Annual Reports.

Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Project 7: NSJWCD South System Modernization	In-lieu Recharge	NSJWCD	Environmental review is complete, funding has been sought and a landowner improvement district formed	2018-2023	This Project is progressing. The new pump station was completed in 2019. Variable frequency drive (VFD) and automation equipment were added in 2020. A new distribution box was constructed in Fall 2020, and meters and automation for the new distribution box are currently being added. The Project did not operate in irrigation season 2020 as there was no water available. During WY 2021, NSJWCD will continue to improve the pipeline and assist landowners with connections. A new Pixley lateral will be constructed as well as a second pump station off Pixley Slough for landowner diversions. An additional distribution box and lateral work is scheduled for 2022-2023 with existing funds from a Proposition 1 grant. NSJWCD applied for two WaterSMART grants in 2020; one was not awarded, and award decision for the second one is pending.
Project 8: Long-term Water Transfer to SEWD and CSJWCD	Transfers/ In-lieu Recharge	SSJ GSA	Infrastructure is in place. Environmental Review may need to be implemented	2019-2021	The Project status information presented in the GSP is up to date. Because Project implementation is subject to water availability based on hydrologic conditions, Project implementation did not occur during WY 2020 as it was a dry year. Updates regarding activity progress will be included in future Annual Reports.
Project 9: BNSF Railway Company Intermodal Facility Recharge Pond	Direct Recharge	CSJWCD	Planning phase	2020-2023	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 due to delays as a result of the COVID-19 pandemic. CSJWCD plans to move forward with the Project during WY 2022. Updates regarding activity progress will be included in future Annual Reports.
Project 10: City of Stockton Advanced Metering Infrastructure	Conservation	City of Stockton	Initial study completed in 2011	2020/25- 2025/28	During WY 2020, the Project's concept analysis and schedule were updated and included in City of Stockton Municipal Utilities Department's (MUD's) Capital Improvement Program (CIP) 2025 schedule.

Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Project 11: South System Groundwater Banking with East Bay Municipal Utilities District (EBMUD)	In-lieu Recharge	NSJWCD	Agreement is in place; parties need to finalize design. Environmental review and permitting needed	2020-2025	NSJWCD and EBMUD operated the pilot DREAM Project in Fall 2019. The pilot DREAM Project was not operated in 2020 due to lack of water availability. Facilities to complete the Project are currently under construction and are expected to be complete by Fall 2021.
Project 12: NSJWCD North System Modernization/Lakso Recharge	In-Lieu Recharge/ Direct Recharge	NSJWCD	Planning phase	2021-2026	Project planning is advancing. In December 2020, NSJWCD hired an engineering consultant to prepare design plans and a cost estimate to apply for the Proposition 68 grant application. The Project was not awarded Proposition 68 funding.
Project 13: Manaserro Recharge Project	Direct Recharge	NSJWCD	Planning phase	2019-2022	The Project status information presented in the GSP is up to date. A landowner workshop was held in December 2019, and newsletters were sent out. Project implementation did not occur during WY 2020 due to both lack of funding and lack of staff resources to complete the plans and move the projects forward.
Project 14: Tecklenburg Recharge Project	Direct Recharge	NSJWCD	Planning phase	2020-2023	The Project status information presented in the GSP is up to date. A landowner workshop was held in December 2019, and newsletters were sent out. Project implementation did not occur during WY 2020 due to both lack of funding and lack of staff resources to complete the plans and move the projects forward.
Project 15: City of Escalon Wastewater Reuse	Recycling/ In-lieu Recharge/ Transfers	SSJ GSA	Planning phase	2020-2028	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 as it is in the early conceptual stages and requires additional feasibility analysis and long-term planning. Updates regarding activity progress will be included in future Annual Reports.

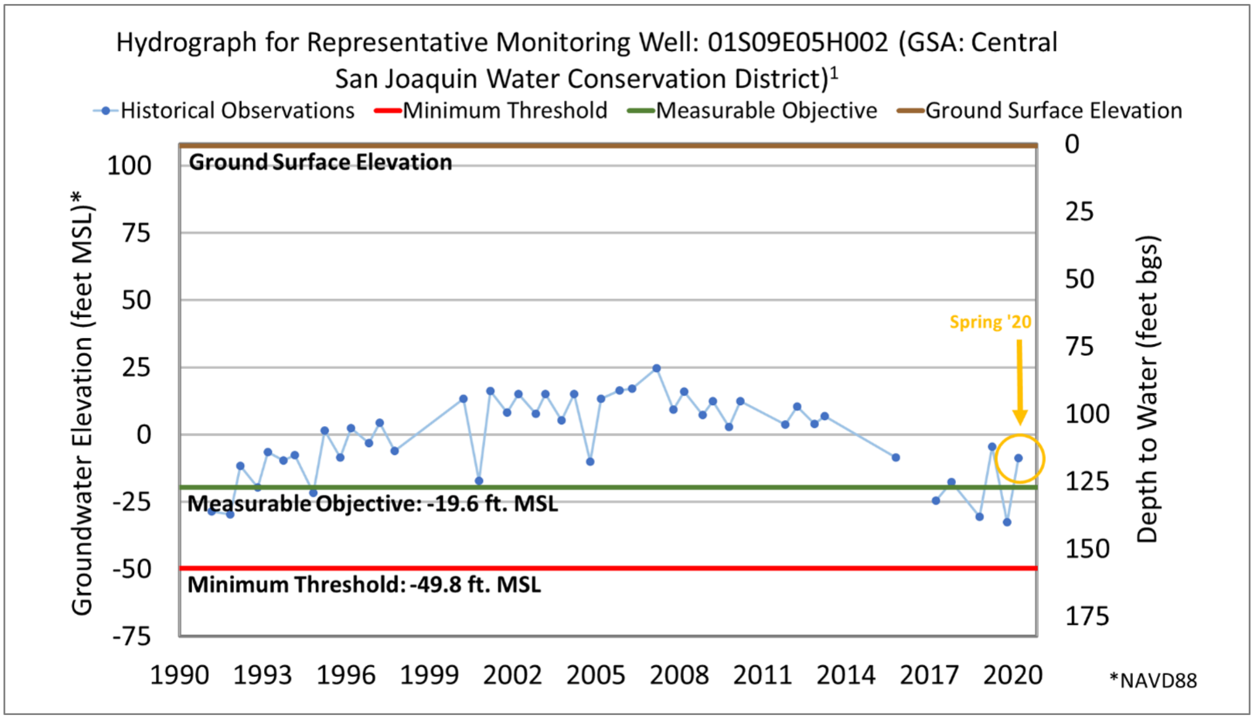
Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Project 16: City of Ripon Surface Water Supply	In-lieu Recharge	SSJ GSA	Design complete; environmental permitting underway	2020-2024	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 as it requires additional feasibility analysis and long-term planning. Updates regarding activity progress will be included in future Annual Reports.
Project 17: City of Escalon Connection to Nick DeGroot Water Treatment Plant	In-lieu Recharge	SSJ GSA	Conceptual design phase; environmental review complete	2020-2023	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 as it requires additional feasibility analysis and long-term planning. Updates regarding activity progress will be included in future Annual Reports.
Project 18: Farmington Dam Repurpose Project	Direct Recharge	SEWD	Preplanning phase with reconnaissance study complete	2030-2050	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 as SEWD dedicated resources to bring short-term projects online first. Updates regarding activity progress will be included in future Annual Reports.
Project 19: Recycled Water Transfer to Agriculture	Recycling/Transfers/ In-lieu Recharge	City of Manteca	Planning phase with evaluation completed in Draft Reclaimed Water Facilities Master Plan	Not determined	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 due to delays as a result of COVID-19, staff shortages, and lack of funding. Updates regarding activity progress will be included in future Annual Reports.
Project 20: Mobilizing Recharge Opportunities	Direct Recharge	San Joaquin County	Early conceptual planning phase	Not determined	The Project status information presented in the GSP is up to date. Funding for this project is being sought. Regionwide surface water availability discussions are being held, and options to potentially rescope this project to leverage available surface water, along with future acquisition of County's water rights, will be explored. Updates regarding activity progress will be included in future Annual Reports.

Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Project 21: NSJWCD Winery Recycled Water	Recycling/ In-Lieu Recharge/ Direct Recharge	NSJWCD	Conceptual planning and discussion	2025-2027	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 due to both lack of funding and lack of staff resources to complete the plans and move the projects forward.
Project 22: Pressurization of SSJID Facilities	Conservation	SSJ GSA	Feasibility study complete	2019-2030	SSJID is currently preparing a Water Master Plan to guide investments in capital projects to improve the level of service for irrigation customers and ensure SSJID's delivery system remains viable into the future. While the prospect of full pressurization for the entire District appears to be out of reach at this time, improvements that result in partial pressurization are also being considered. SSJID continues to fund capital improvements that accommodate micro-irrigation systems making these projects part of SSJID's annual CIP and could be expanded as a result of the Water Master Plan. Improvements such as cut-down pour over walls, float valves, and remote sensors create a system where downstream control has particularly enhanced the service level for customers converting to micro-irrigation from traditional flood irrigation and allows for the conservation of water for local transfers or new irrigation customers. The Water Master Plan is expected to be complete in 2021.
Project 23: SSJID Storm Water Reuse	Storm Water/ In-lieu Recharge/ Direct Recharge	SSJ GSA	Planning phase	2027-2030	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 since implementation is not planned until 2030. SSJID continues to fund capital improvements to make this Project part of SSJID's annual CIP and could be expanded as a result of the Water Master Plan. Updates regarding activity progress will be included in future Annual Reports.

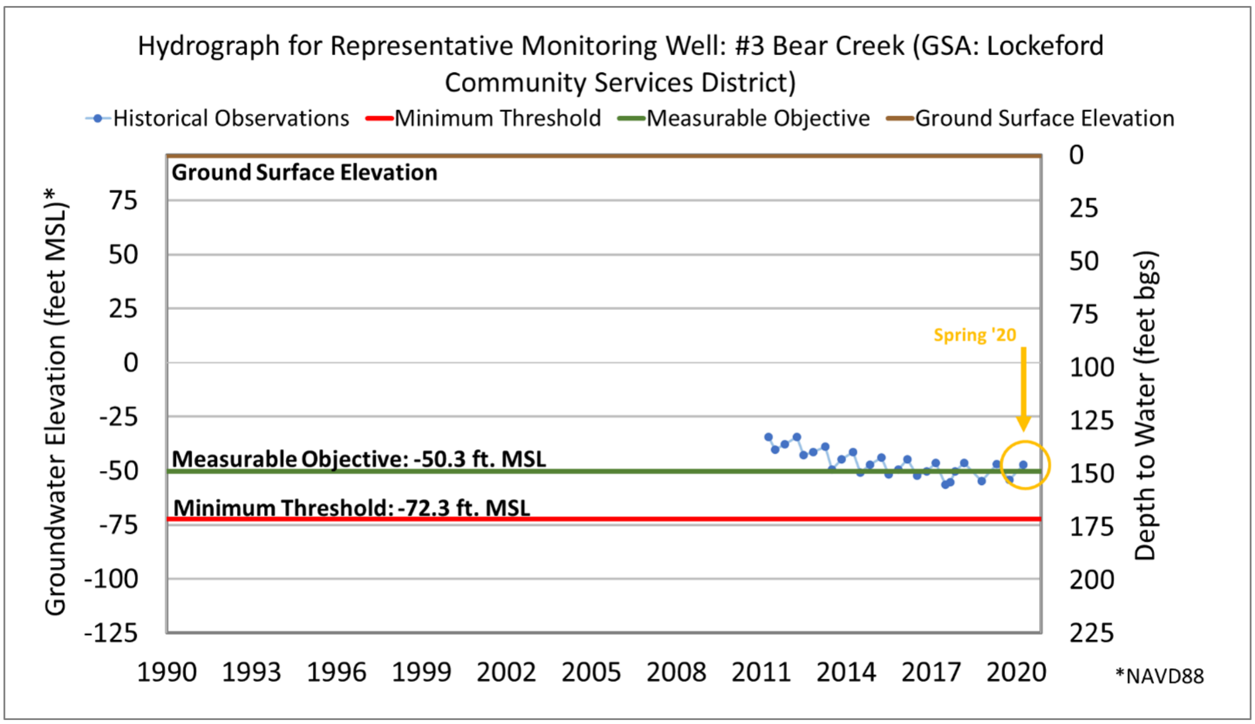
Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Mokelumne River Loss Study	Model Refinement and Validation	NSJWCD	Conceptual planning and discussion	2020-2025	The Project status information presented in the GSP is up to date. Project implementation did not occur during WY 2020 due to both lack of funding and lack of staff resources to complete the plans and move the projects forward.
Monitoring and recording of groundwater levels and groundwater quality data	Monitoring and Reporting	Implemented at Subbasin scale	Ongoing	2020-2040	The Project status information presented in the GSP is up to date. This is the second Annual Report that reports groundwater level and groundwater quality monitoring data. Updates regarding activity progress will be included in future Annual Reports.
Maintaining and updating the Subbasin Data Management System (DMS) with newly collected data	Monitoring and Reporting	Implemented at Subbasin scale	Ongoing	2020-2040	The Project status information presented in the GSP is up to date. The DMMs was maintained and updated to include monitoring data for WY 2020. Updates regarding activity progress will be included in future Annual Reports.
Annual monitoring of progress toward sustainability	Monitoring and Reporting	Implemented at Subbasin scale	Ongoing	2020-2040	The Project status information presented in the GSP is up to date. This is the second Annual Report that monitors the progress toward sustainability. Updates regarding progress toward sustainability will be included in future Annual Reports.
Annual reporting of Subbasin conditions to DWR as required by SGMA	Monitoring and Reporting	Implemented at Subbasin scale	Ongoing	2020-2040	The Project status information presented in the GSP is up to date. This is the second Annual Report that describes the current conditions in the Subbasin and will be submitted to DWR as required by SGMA. Updates regarding Subbasin conditions will be included in future Annual Reports.

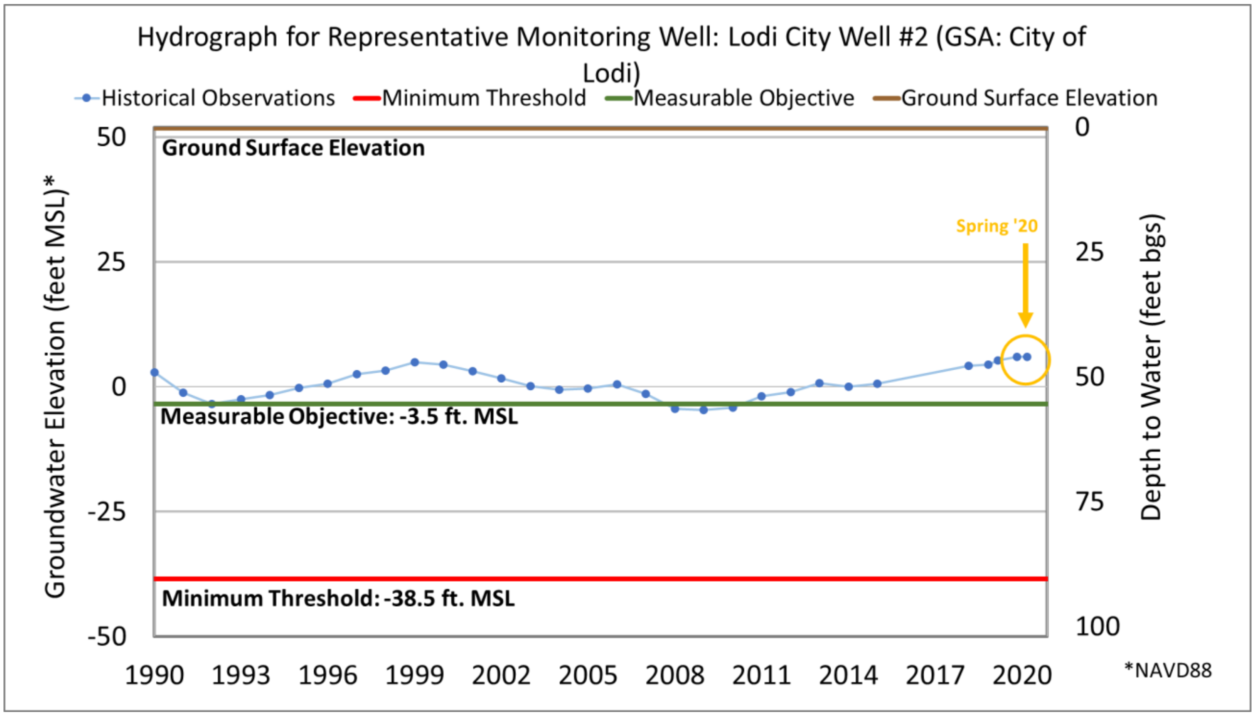
Activity	Project Type	Project Proponent	Current Status	Schedule (initiation and completion)	Status
Addressing Data Gaps	Monitoring and Reporting	San Joaquin County	Ongoing	2020-2040	During WY 2020, San Joaquin County made progress towards addressing data gaps in the Subbasin. Implementation activities included siting 8 shallow monitoring wells to address data gaps relative to interconnected surface water, and preliminary siting of 2 clustered or nested monitoring wells in the northwestern portion of the Subbasin to address data gaps relative to the Delta.

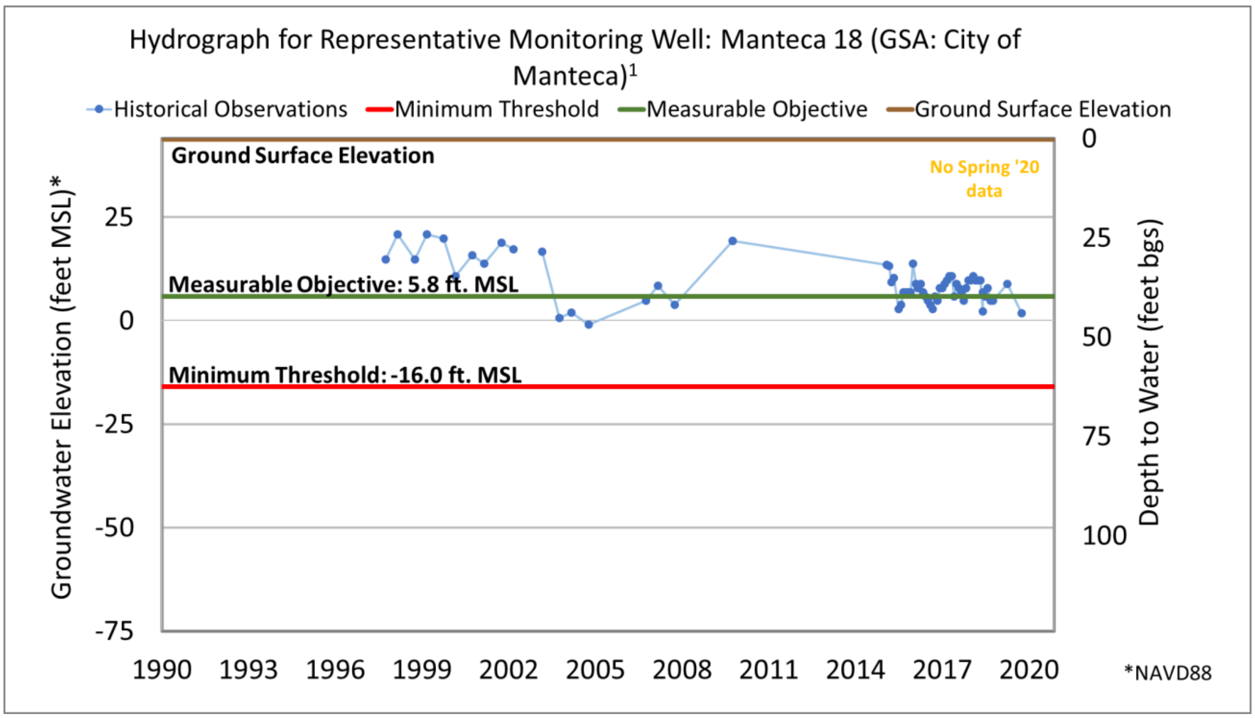
APPENDIX B – REPRESENTATIVE MONITORING NETWORK WELL HYDROGRAPHS



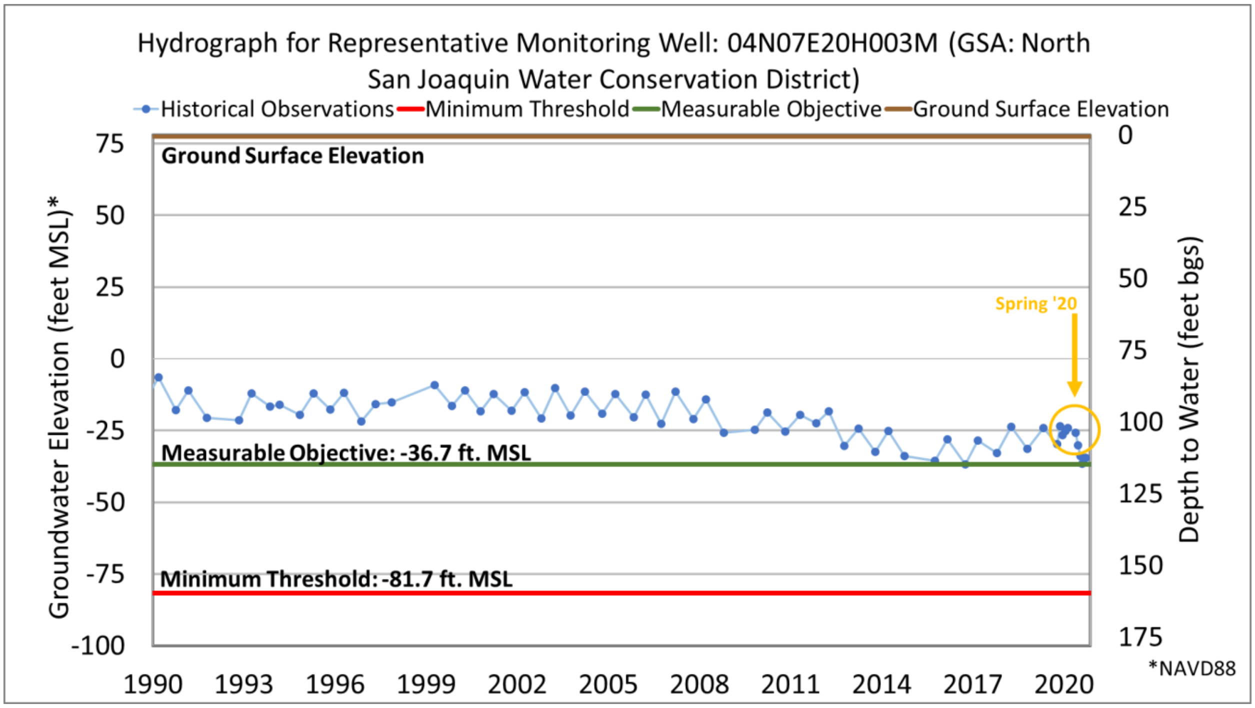
[1]The dataset shown in this hydrograph has been revised to remove the 2016 outlier.

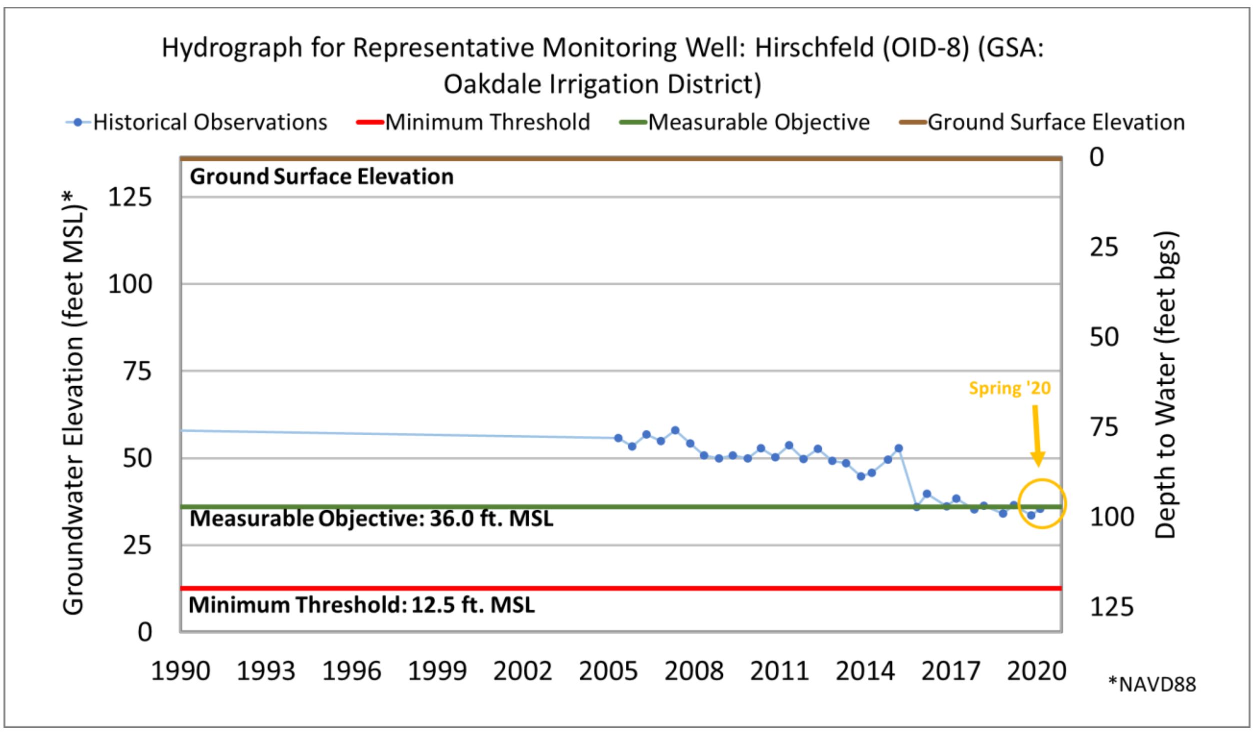


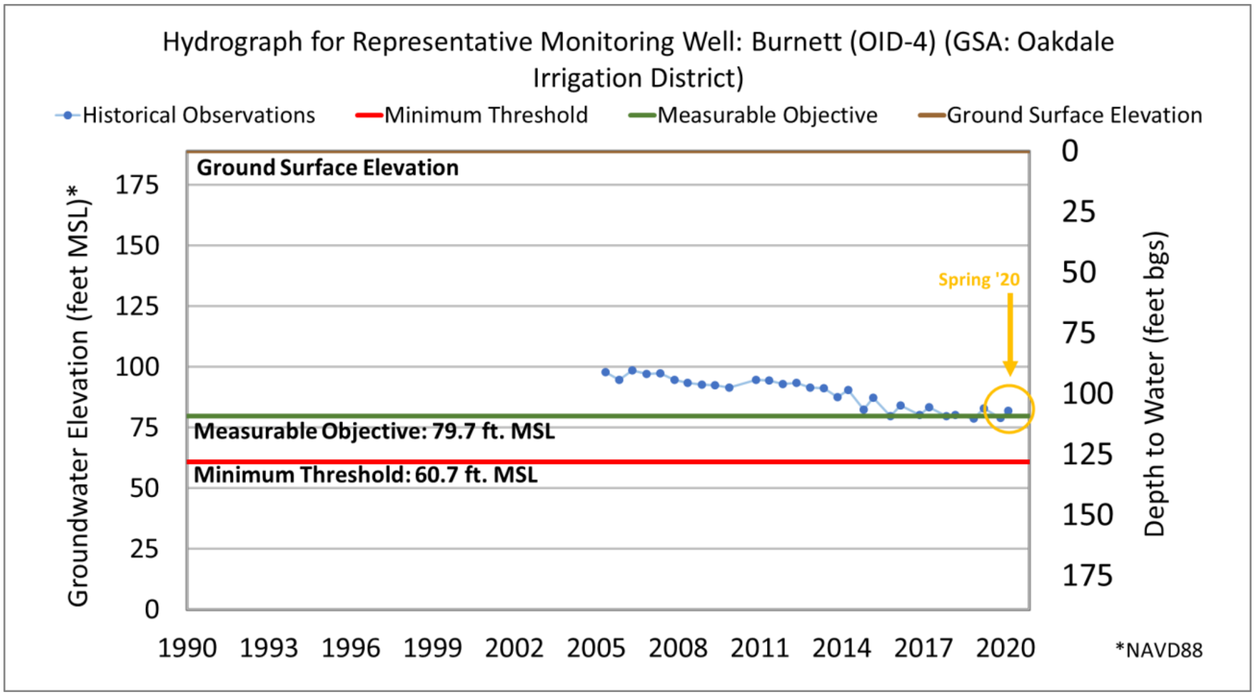


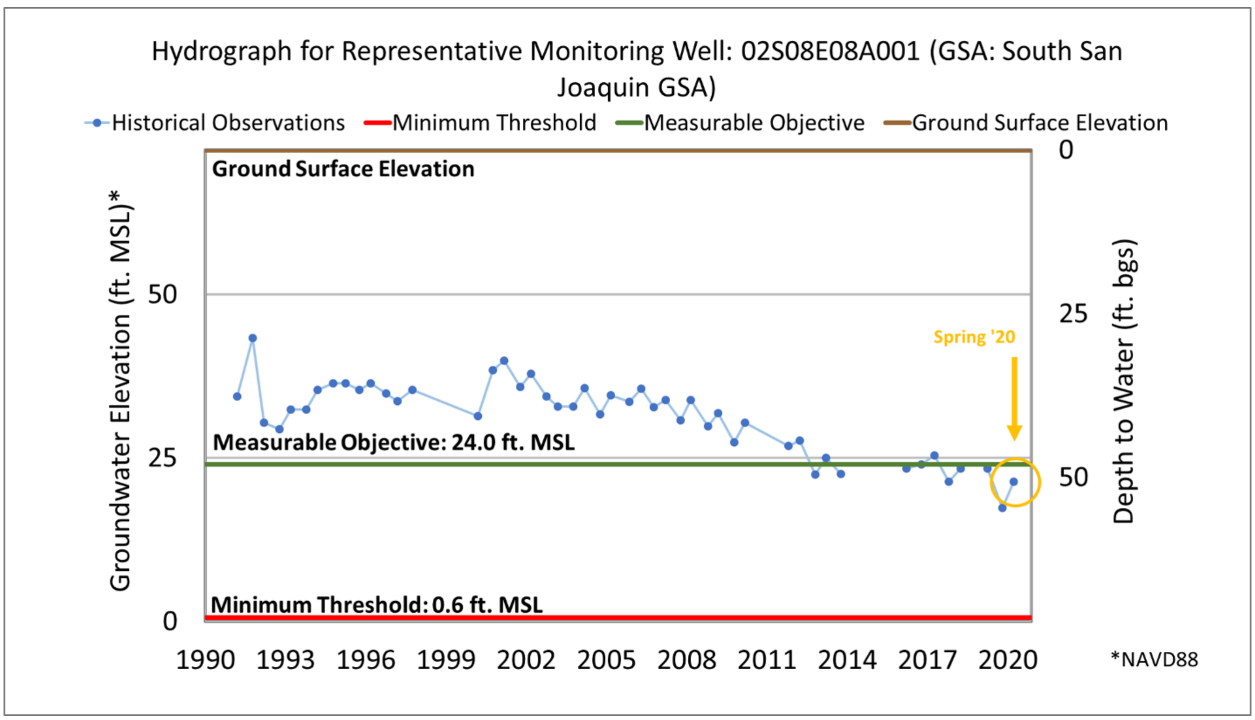


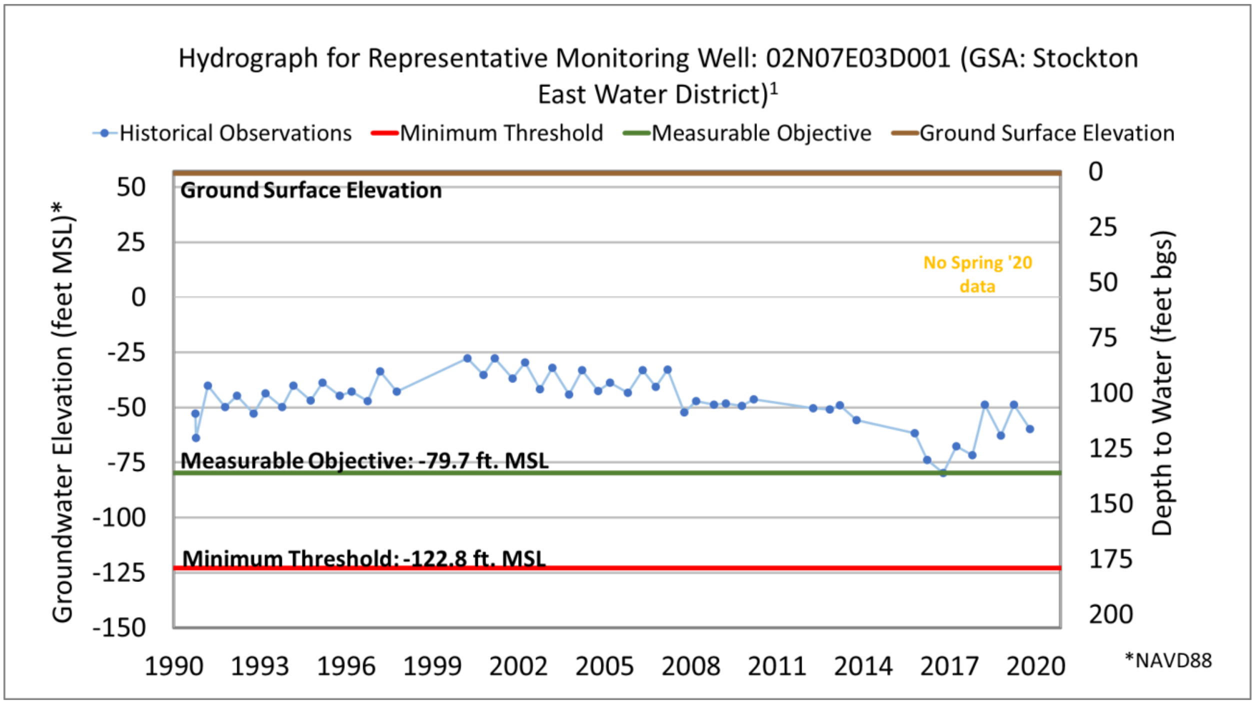
[1]The dataset shown in this hydrograph has been revised to remove the 2002 outlier. Groundwater level data for Spring 2020 unavailable.


Hydrograph for Representative Monitoring Well: 04N07E20H003M (GSA: North San Joaquin Water Conservation District)
Historical Observations
Minimum Threshold
Measurable Objective
Ground Surface Elevation
Ground Surface Elevation
Spring '20
Measurable Objective: -36.7 ft. MSL
Minimum Threshold: -81.7 ft. MSL
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
75
50
25
0
-25
-50
-75
-100
0
25
50
75
100
125
150
175
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
*NAVD88

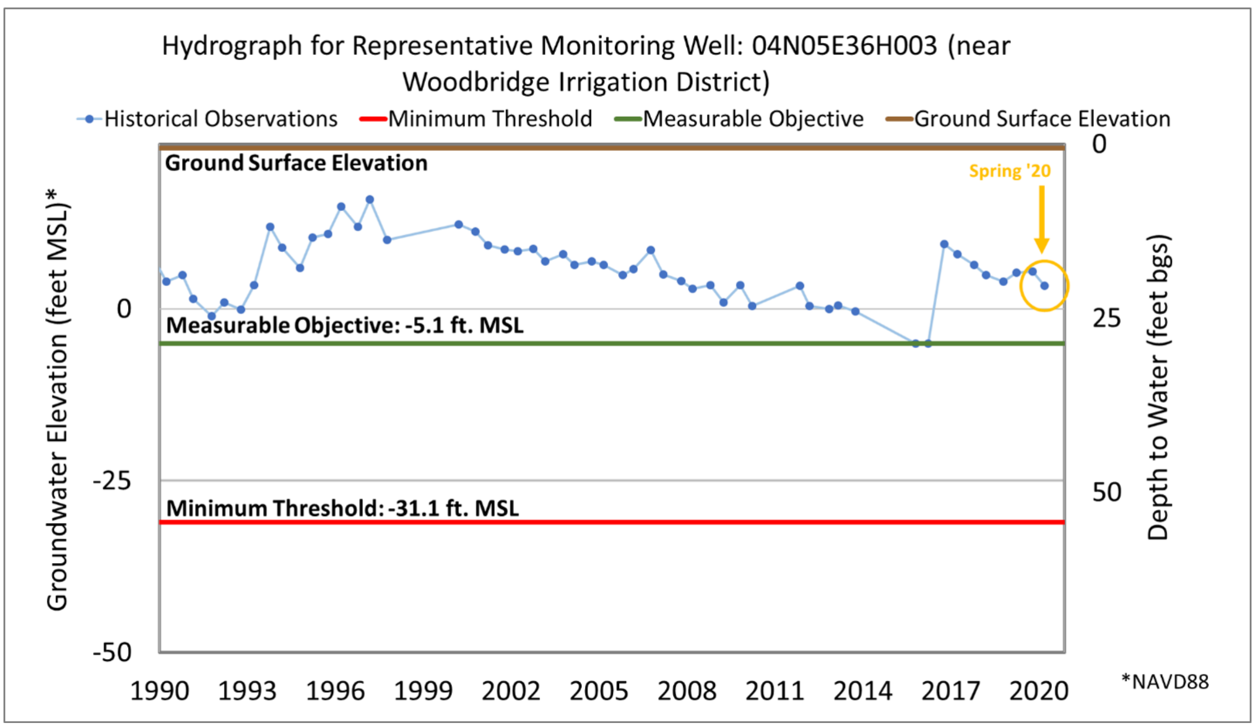

Hydrograph for Representative Monitoring Well: Hirschfeld (OID-8) (GSA: Oakdale Irrigation District)
Historical Observations
Minimum Threshold
Measurable Objective
Ground Surface Elevation
Ground Surface Elevation
Spring '20
Measurable Objective: 36.0 ft. MSL
Minimum Threshold: 12.5 ft. MSL
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
125
100
75
50
25
0
0
25
50
75
100
125
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
*NAVD88

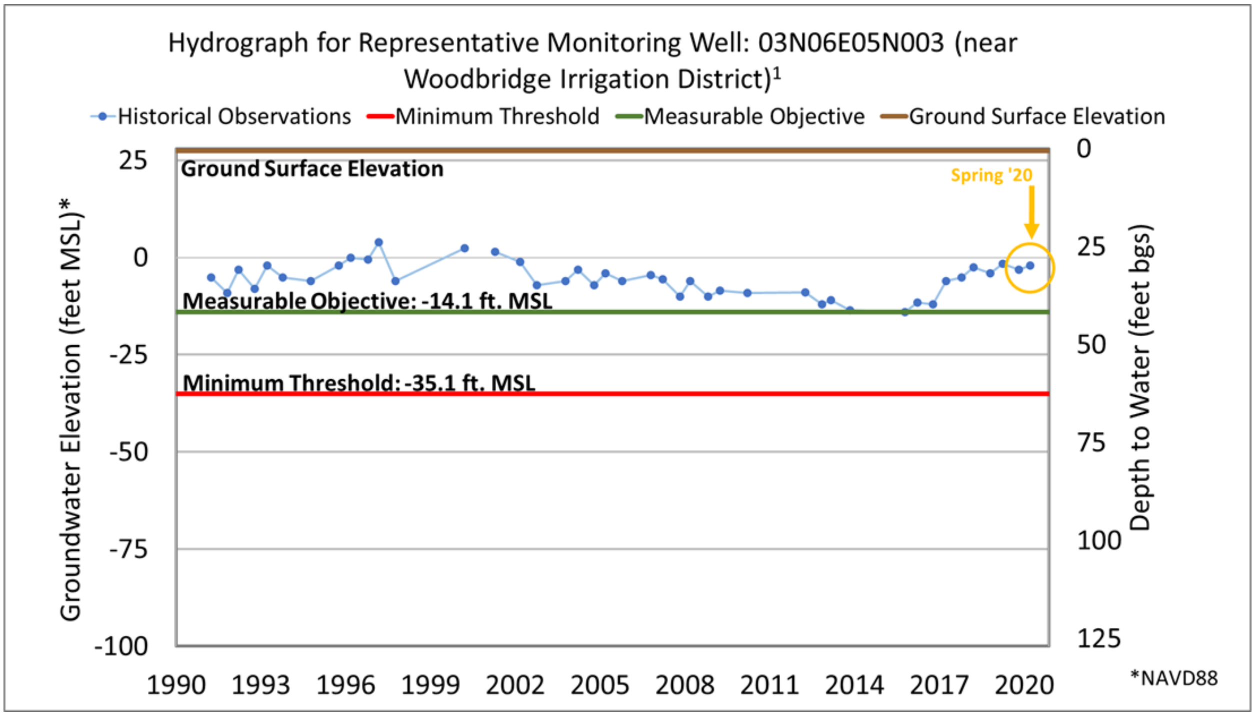

Hydrograph for Representative Monitoring Well: Burnett (OID-4) (GSA: Oakdale Irrigation District)
Historical Observations
Minimum Threshold
Measurable Objective
Ground Surface Elevation
Ground Surface Elevation
Spring '20
Measurable Objective: 79.7 ft. MSL
Minimum Threshold: 60.7 ft. MSL
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
175
150
125
100
75
50
25
0
0
25
50
75
100
125
150
175
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
*NAVD88


Hydrograph for Representative Monitoring Well: 02S08E08A001 (GSA: South San Joaquin GSA)
Historical Observations
Minimum Threshold
Measurable Objective
Ground Surface Elevation
Ground Surface Elevation
Spring '20
Measurable Objective: 24.0 ft. MSL
Minimum Threshold: 0.6 ft. MSL
Groundwater Elevation (ft. MSL)*
Depth to Water (ft. bgs)
50
25
0
0
25
50
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
*NAVD88

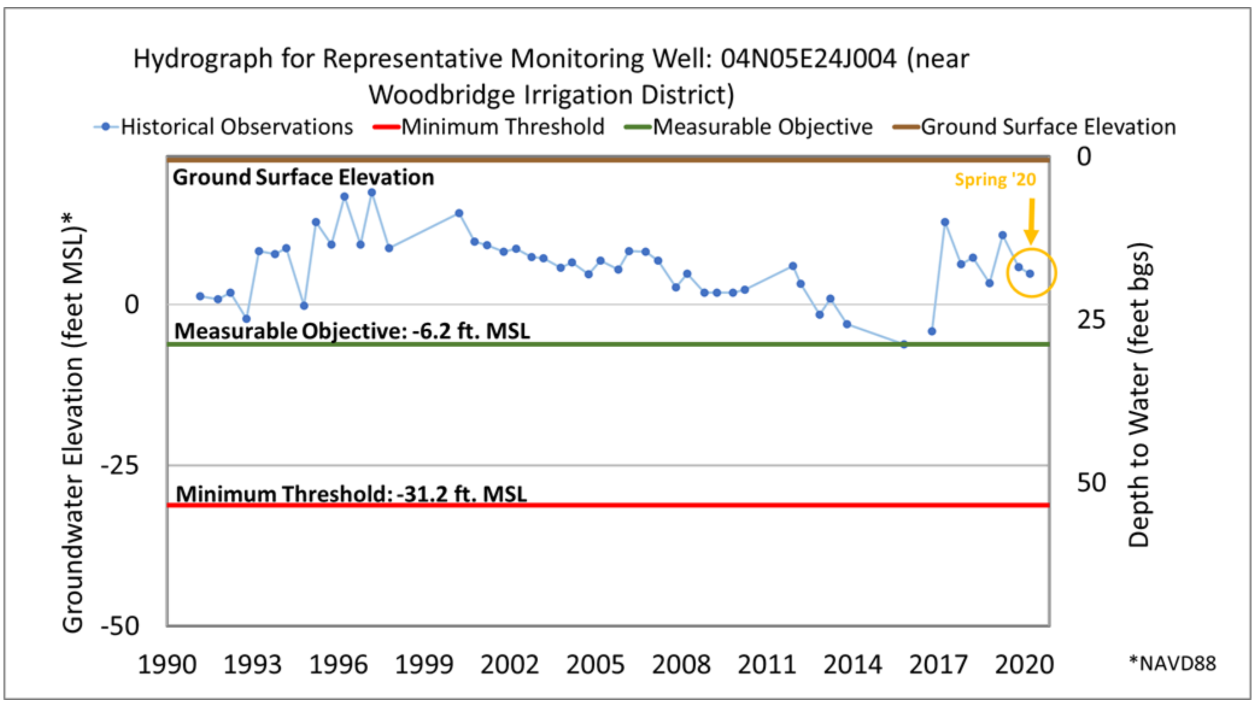


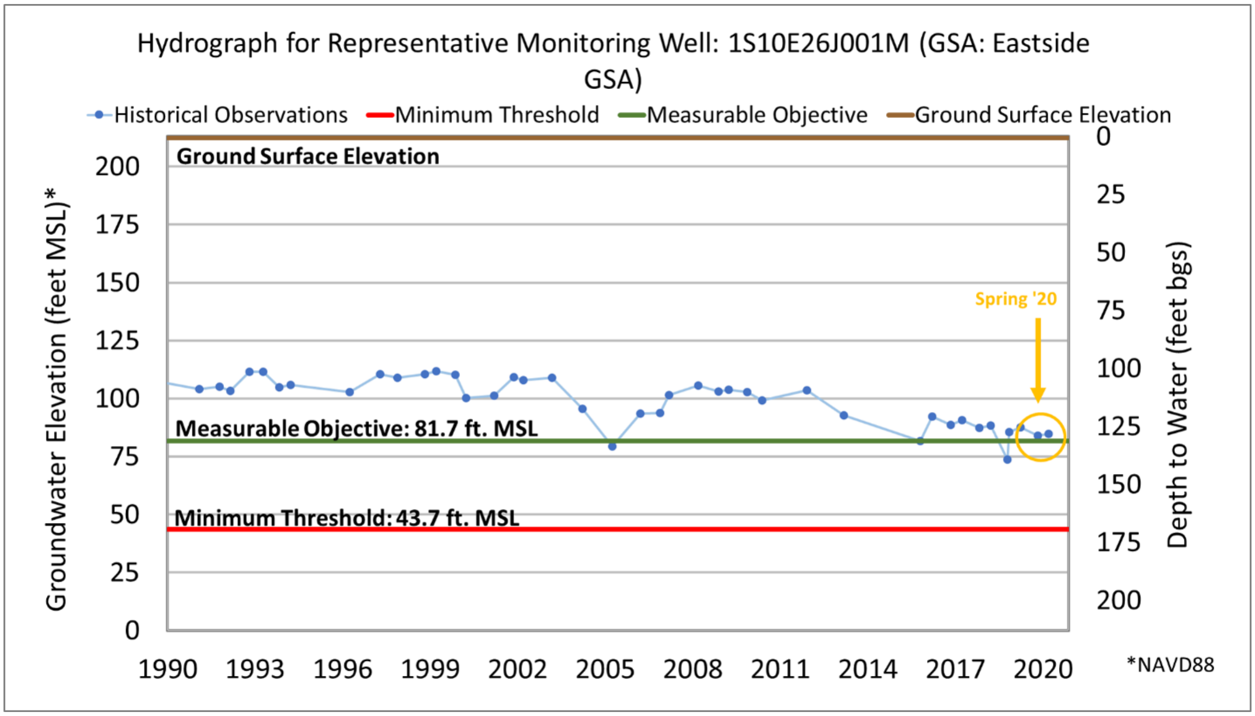
[1]Groundwater level data for Spring 2020 unavailable.

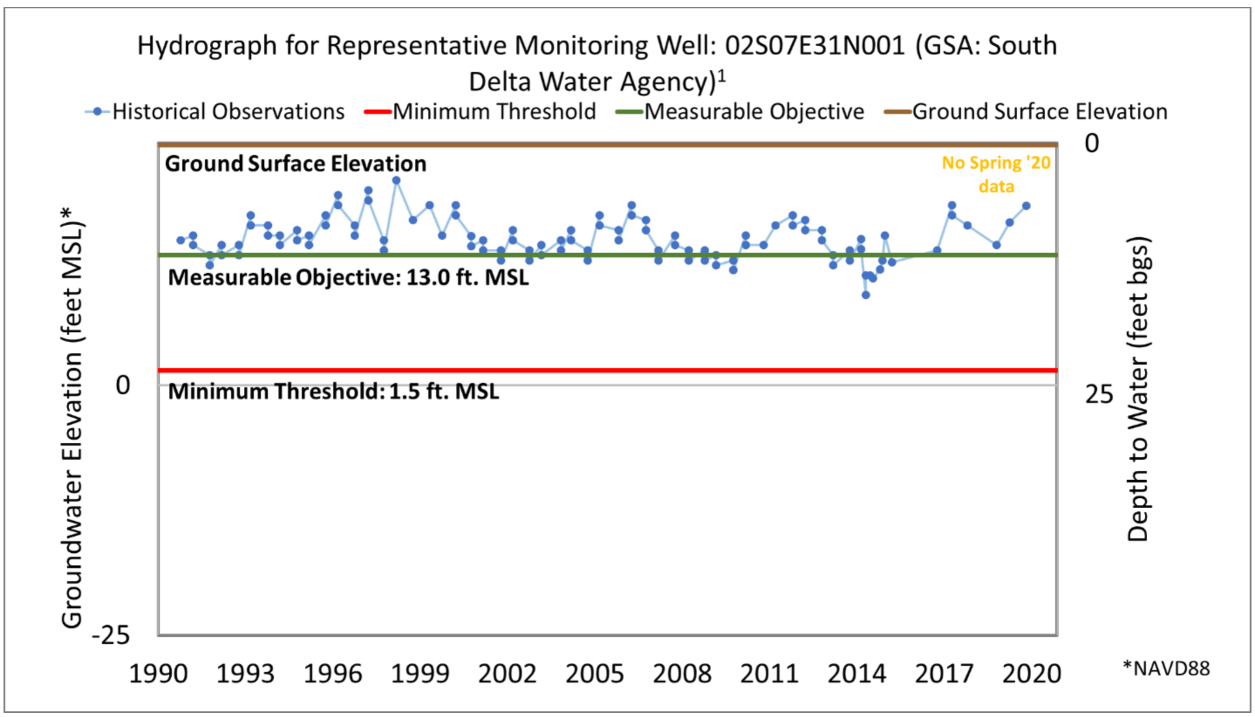




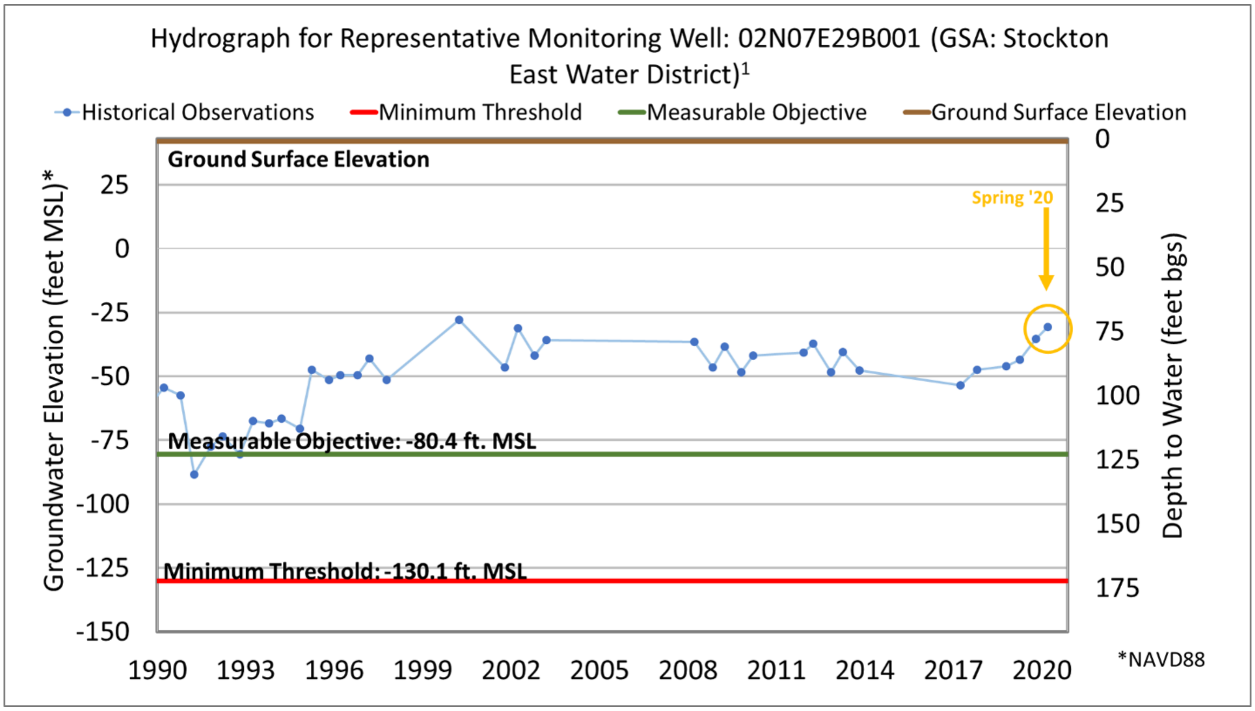
[1]The dataset shown in this hydrograph has been revised to remove the 2000 outlier.



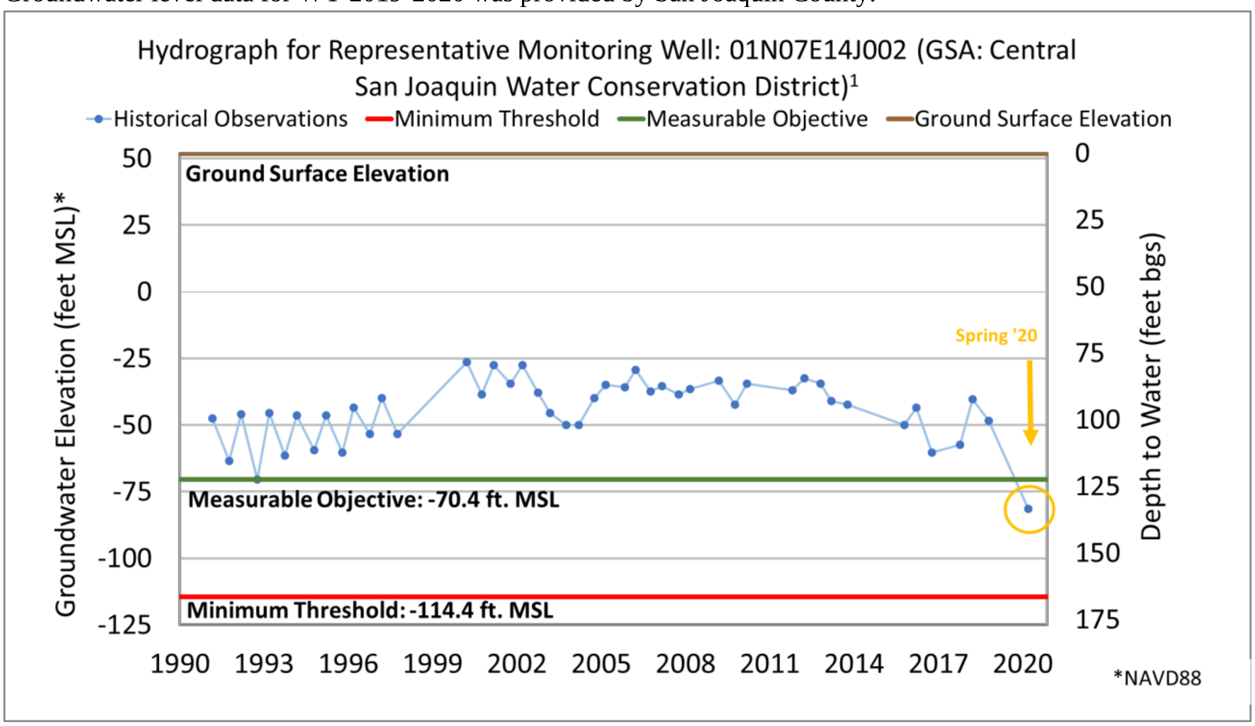




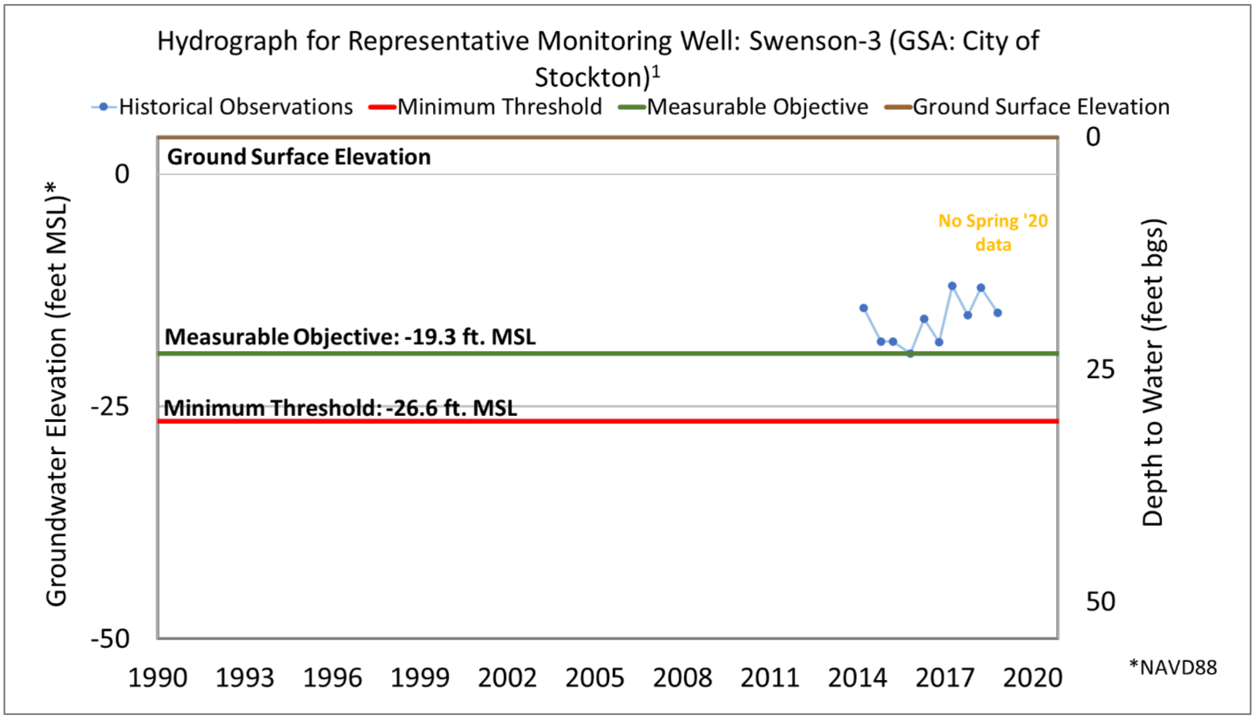
[1]Groundwater level data for WY 1991-2018 was provided by South Delta Water Agency, as reported in the GSP. Groundwater level data for WY 2019 was provided by San Joaquin County. Groundwater level data for Spring 2020 unavailable.



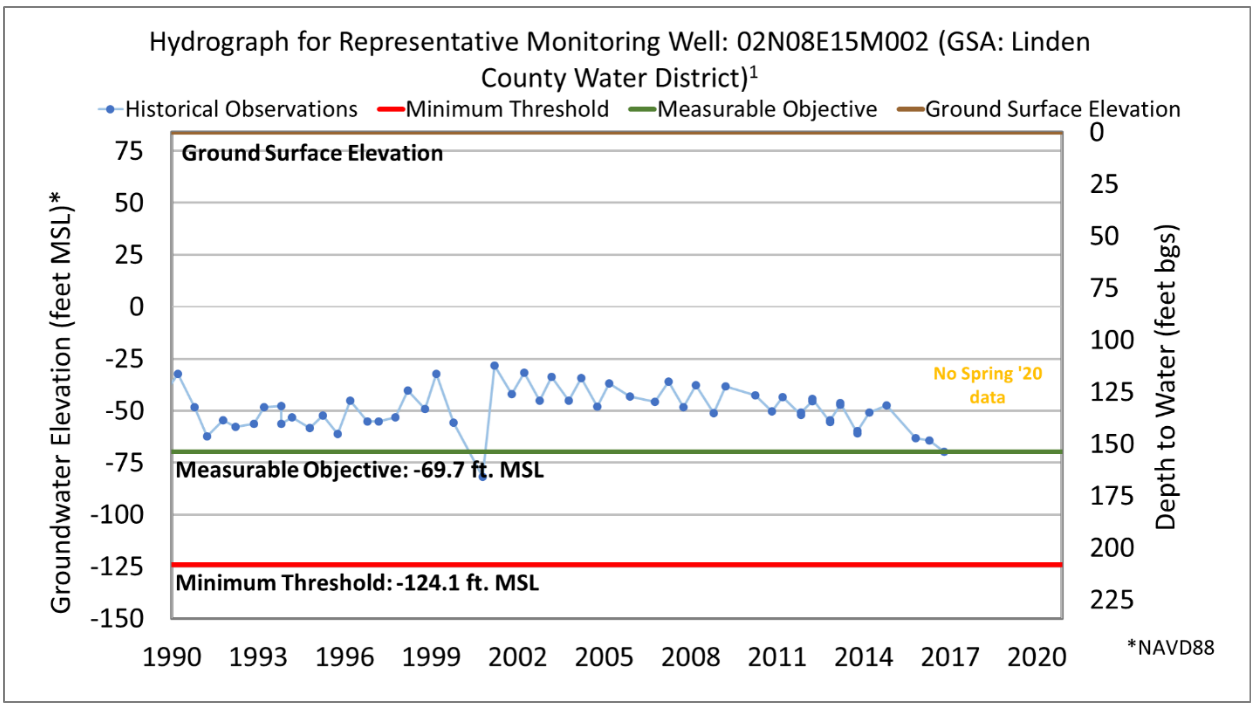
[1]Groundwater level data for WY 1991-2018 was provided by Stockton East Water District, as reported in the GSP. Groundwater level data for WY 2019-2020 was provided by San Joaquin County.



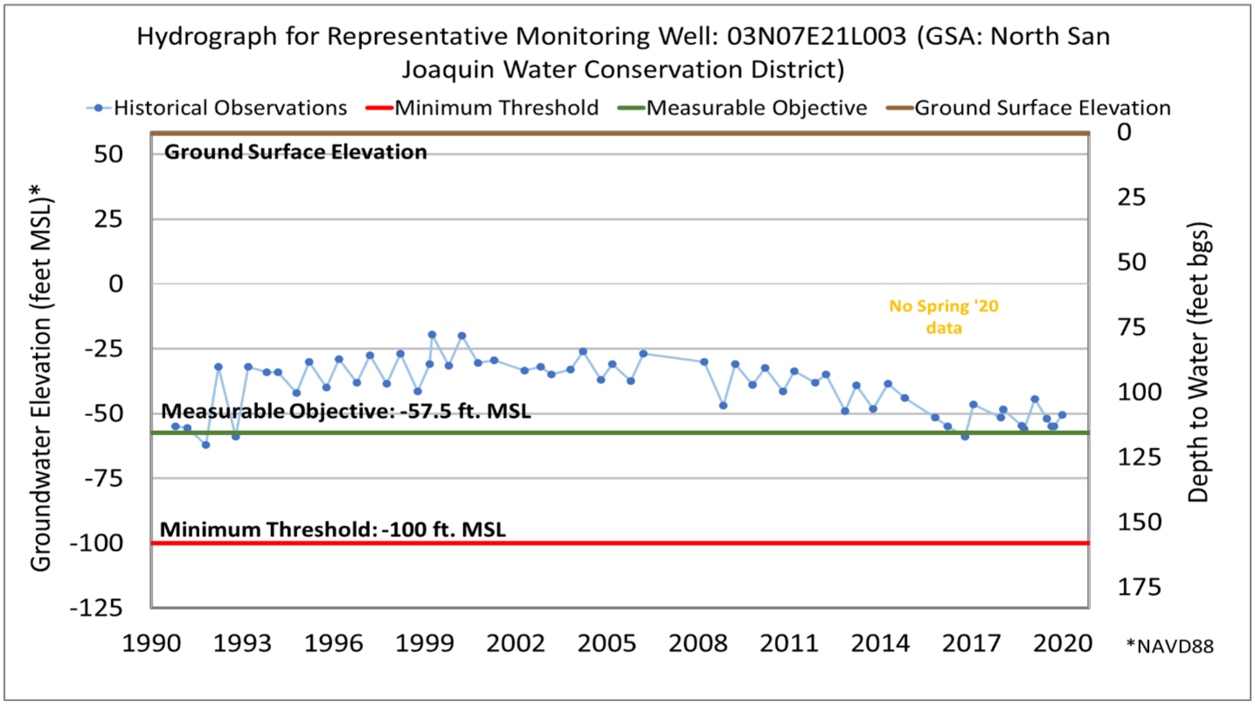
[1]Spring 2020 reading may be questionable.

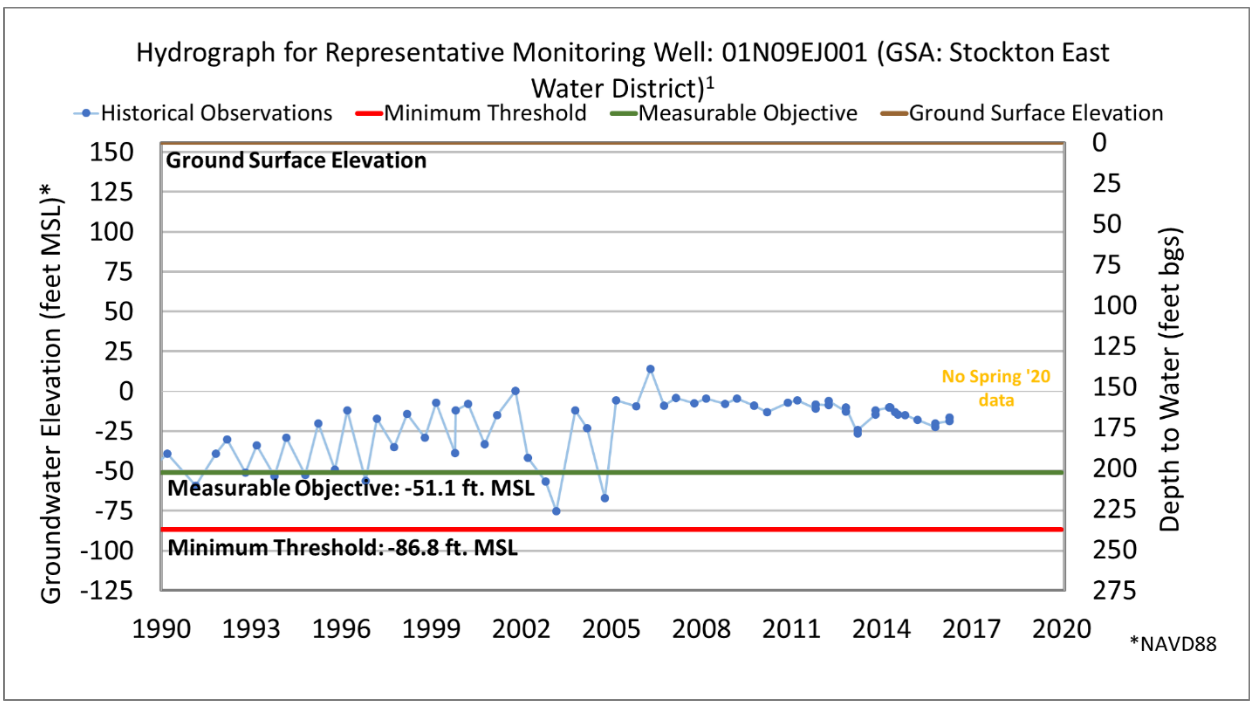


[1]Groundwater level data for WY 2019-2020 unavailable.

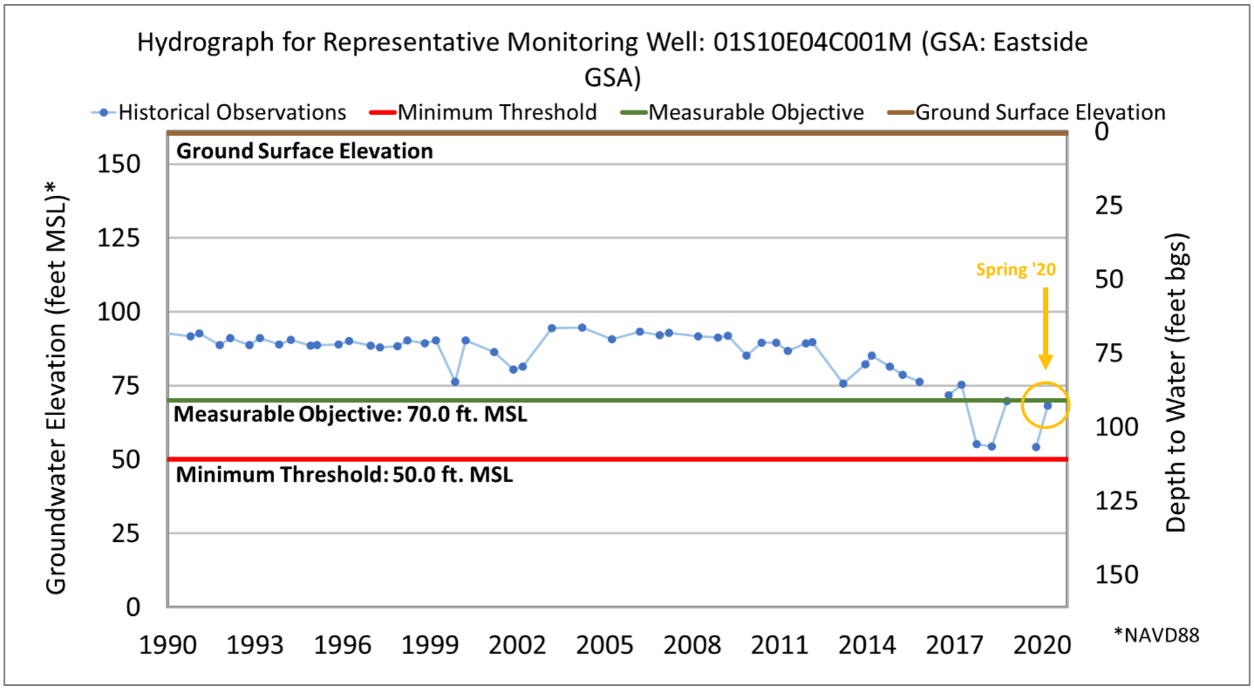


[1]Groundwater level data for WY 2019-2020 unavailable.





[1]Groundwater level data for WY 2019-2020 unavailable.

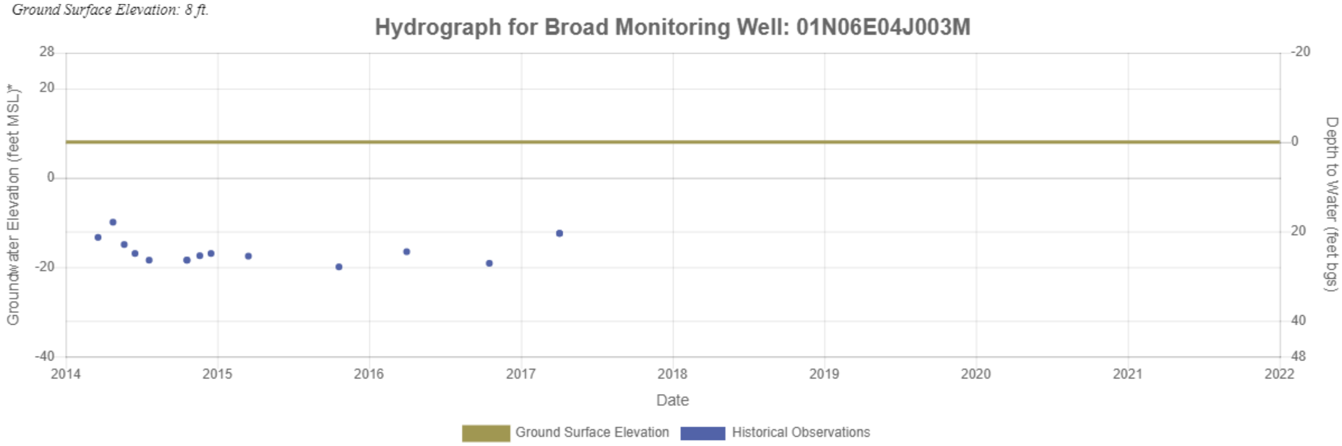

Hydrograph for Representative Monitoring Well: 01S10E04C001M (GSA: Eastside GSA)
Historical Observations
Minimum Threshold
Measurable Objective
Ground Surface Elevation
Ground Surface Elevation
Measurable Objective: 70.0 ft. MSL
Minimum Threshold: 50.0 ft. MSL
Spring '20
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
150
125
100
75
50
25
0
0
25
50
75
100
125
150
1990
1993
1996
1999
2002
2005
2008
2011
2014
2017
2020
*NAVD88

This page left blank intentionally.

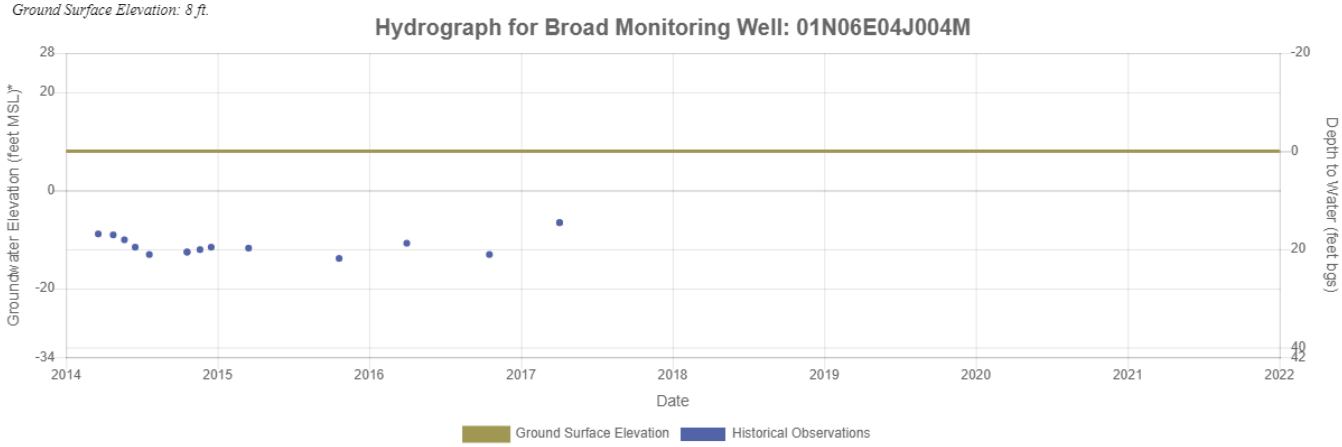
APPENDIX C – BROAD MONITORING NETWORK WELL HYDROGRAPHS

Note: Included in Appendix C are the 76 broad network CASGEM well historical hydrographs and 52 broad network nested well historical hydrographs listed in Appendix 4-A of the GSP. Wells for which historical data are not available are included as hydrographs with no data points. Future annual reports will report on the monitoring carried out at these wells, along with those in the representative monitoring network, as the GSP is implemented. Additionally, 15 local wells that have historically been monitored for water quality will also be monitored for water levels as the GSP is further implemented. These data will also be reported on in future annual reports.

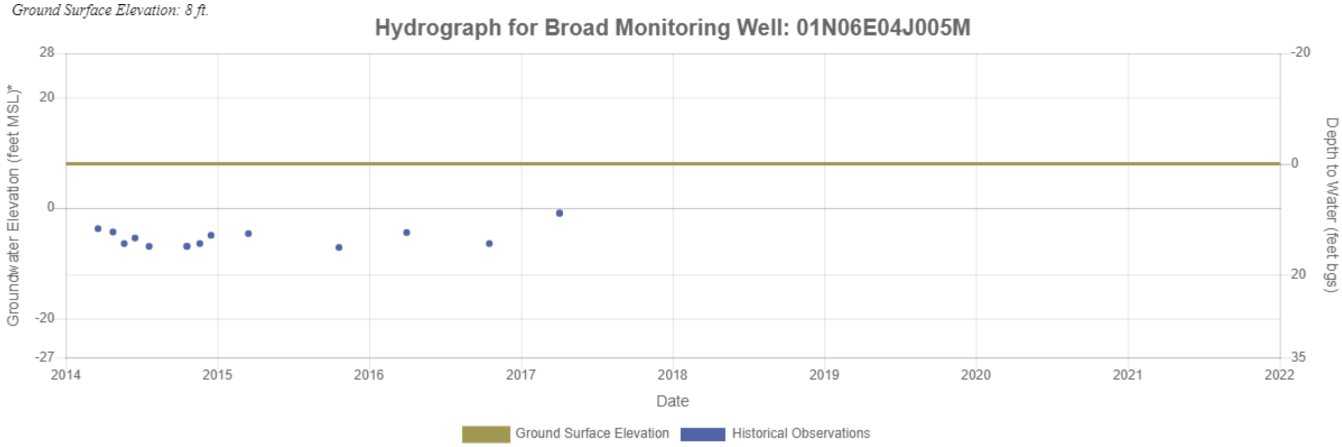
Ground Surface Elevation: 8 ft.



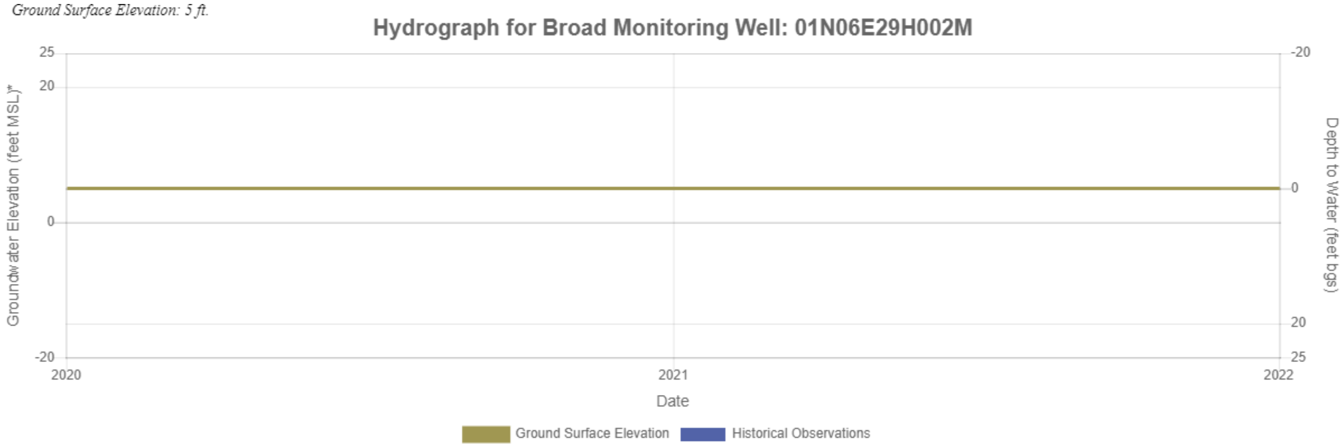
Ground Surface Elevation: 8 ft.

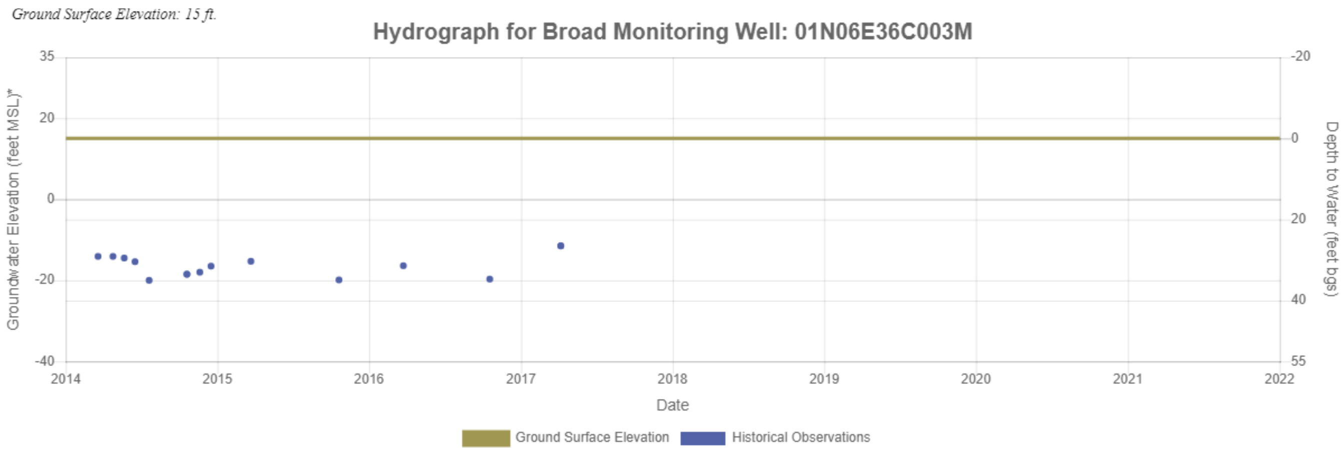


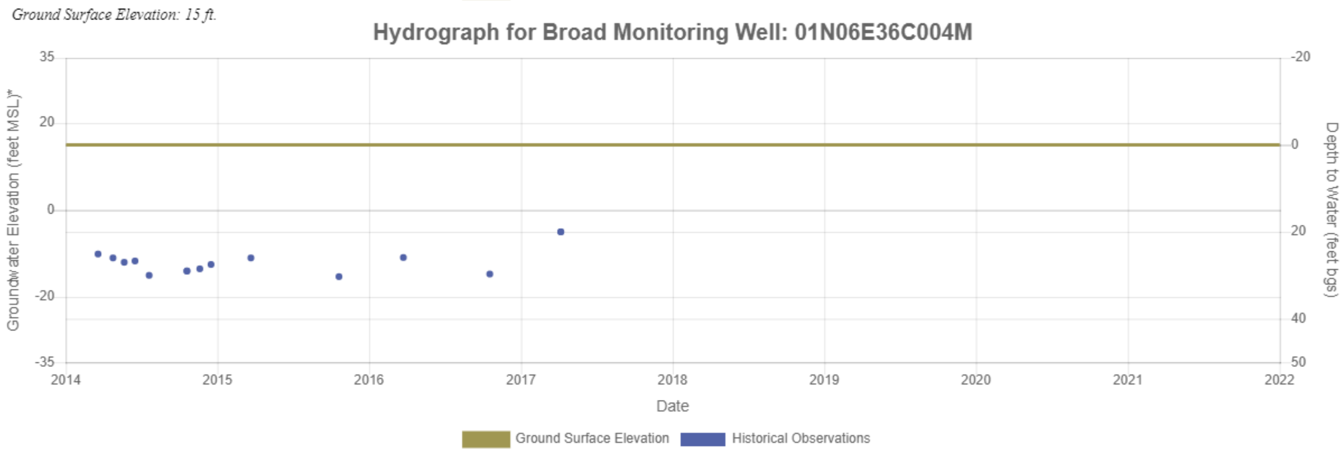
Ground Surface Elevation: 8 ft.

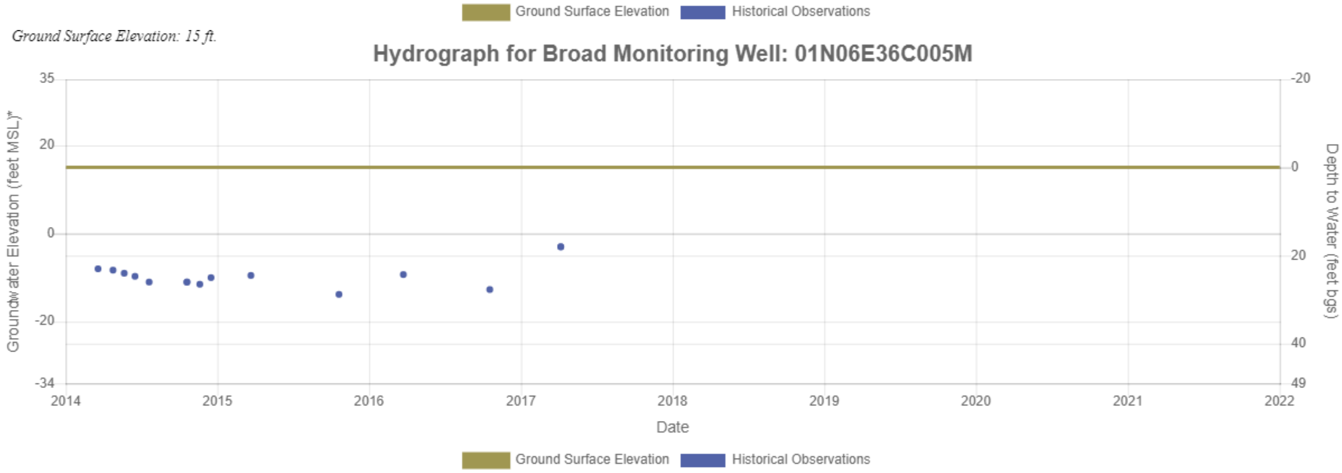


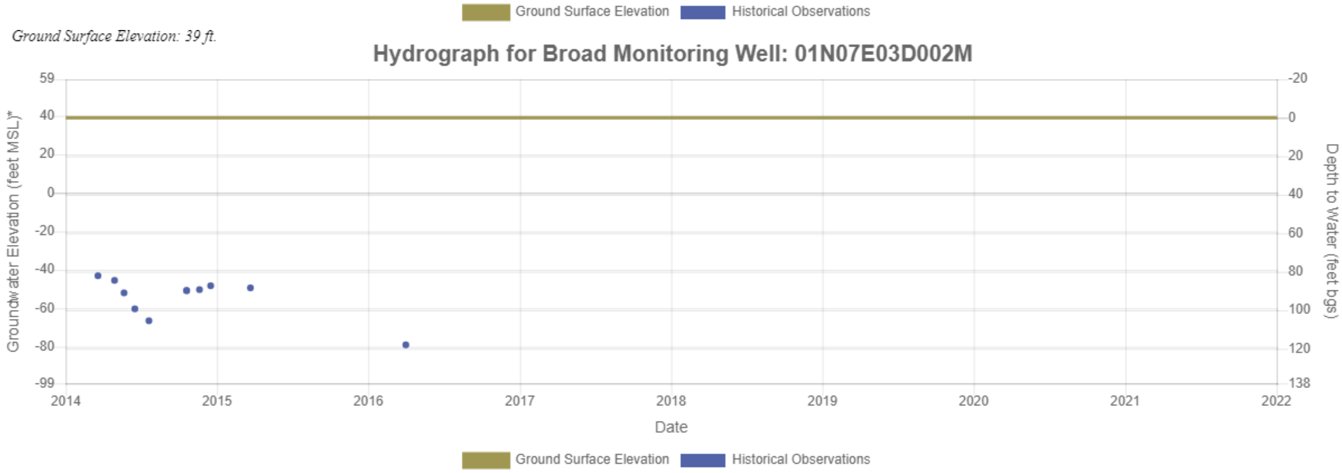
Ground Surface Elevation: 5 ft.

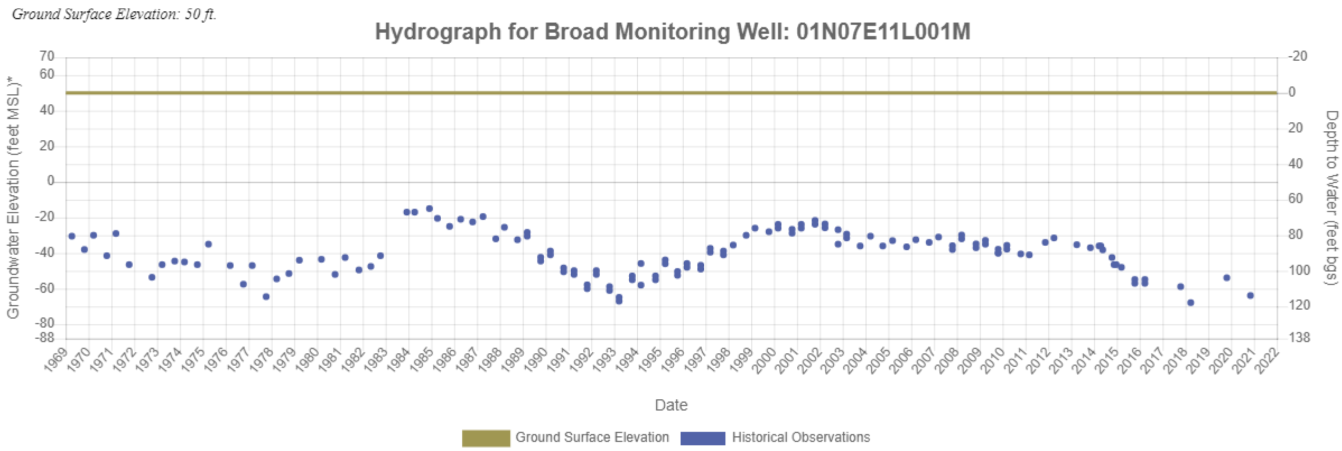


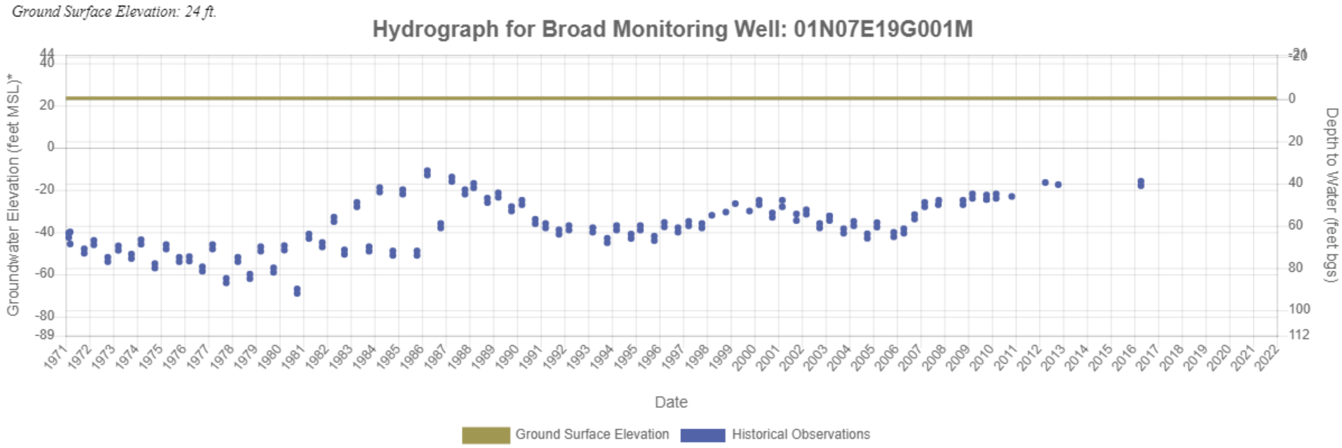

Ground Surface Elevation: 15 ft.
Hydrograph for Broad Monitoring Well: 01N06E36C003M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
35
20
0
-20
-40
-20
0
20
40
55
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

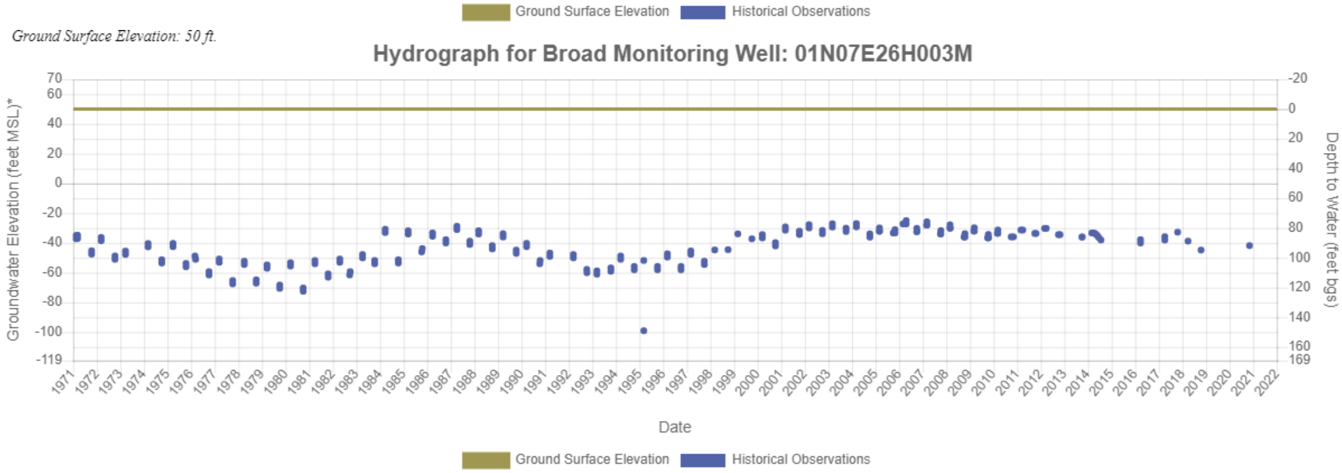

Ground Surface Elevation: 15 ft.
Hydrograph for Broad Monitoring Well: 01N06E36C004M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
35
20
0
-20
-35
-20
0
20
40
50
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

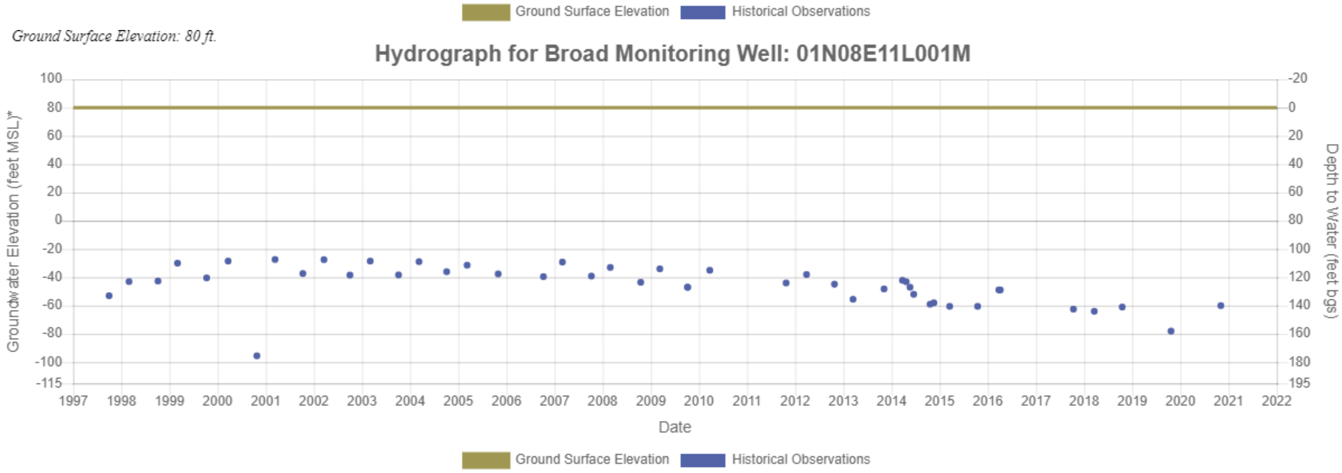

Ground Surface Elevation: 15 ft.
Hydrograph for Broad Monitoring Well: 01N06E36C005M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
35
20
0
-20
-34
-20
0
20
40
49
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 39 ft.
Hydrograph for Broad Monitoring Well: 01N07E03D002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
59
40
20
0
-20
-40
-60
-80
-99
-20
0
20
40
60
80
100
120
138
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 50 ft.
Hydrograph for Broad Monitoring Well: 01N07E11L001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

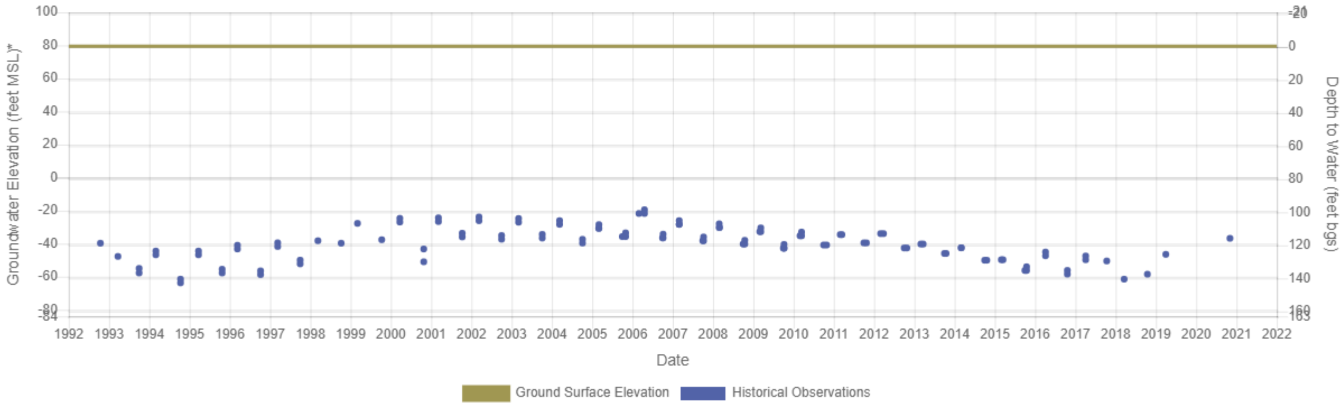

Ground Surface Elevation: 24 ft.
Hydrograph for Broad Monitoring Well: 01N07E19G001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 50 ft.
Hydrograph for Broad Monitoring Well: 01N07E26H003M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 80 ft.
Hydrograph for Broad Monitoring Well: 01N08E11L001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

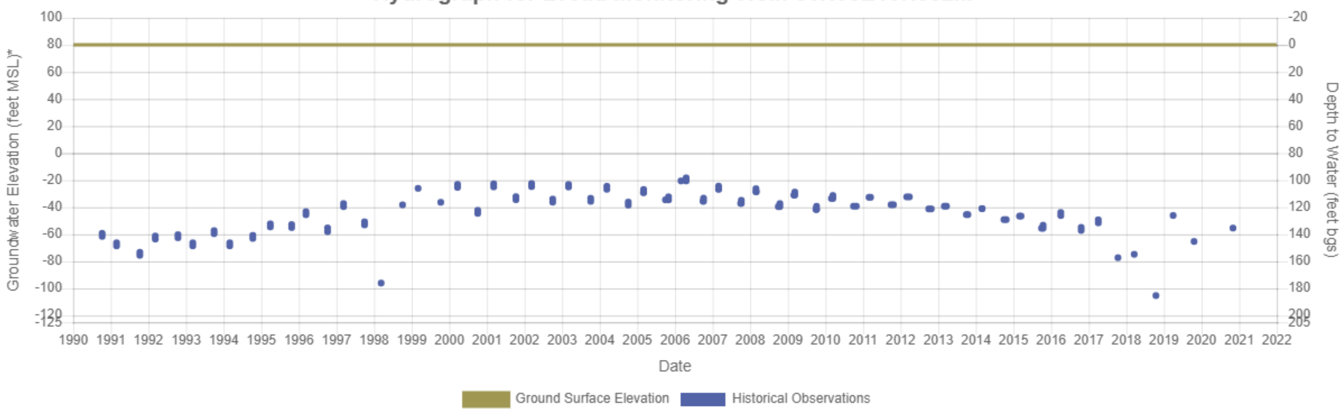
Ground Surface Elevation: 80 ft.

Hydrograph for Broad Monitoring Well: 01N08E16G001M



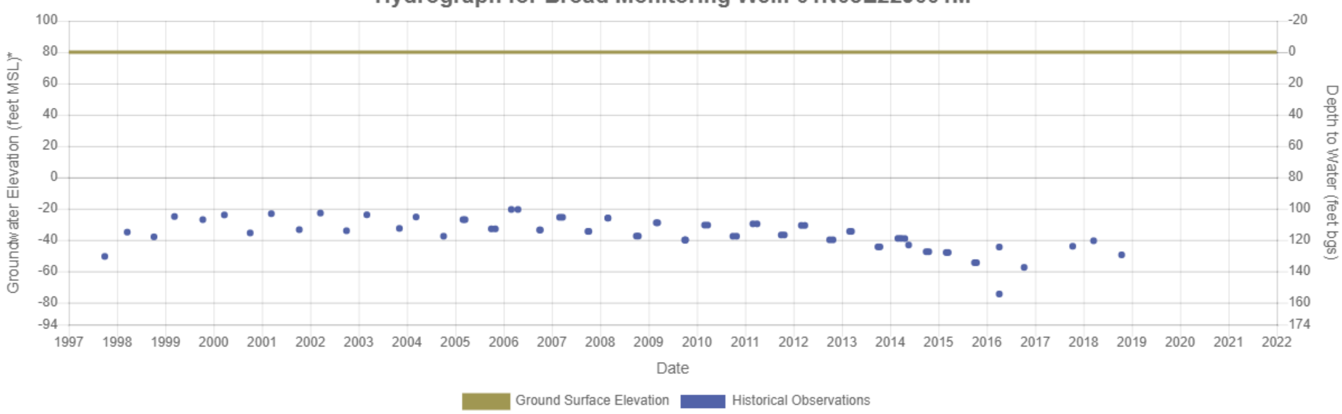
Ground Surface Elevation: 80 ft.

Hydrograph for Broad Monitoring Well: 01N08E16H002M



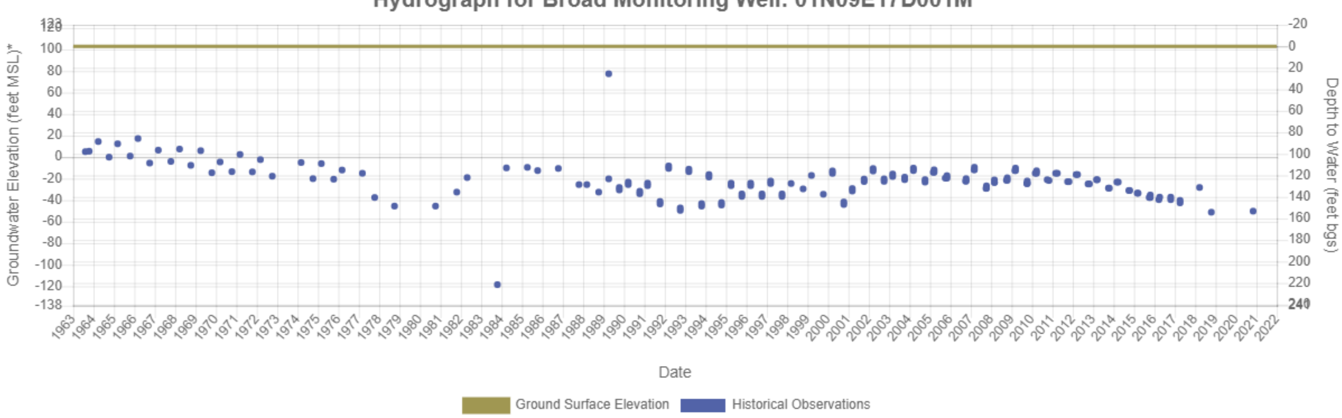
Ground Surface Elevation: 80 ft.

Hydrograph for Broad Monitoring Well: 01N08E22J001M

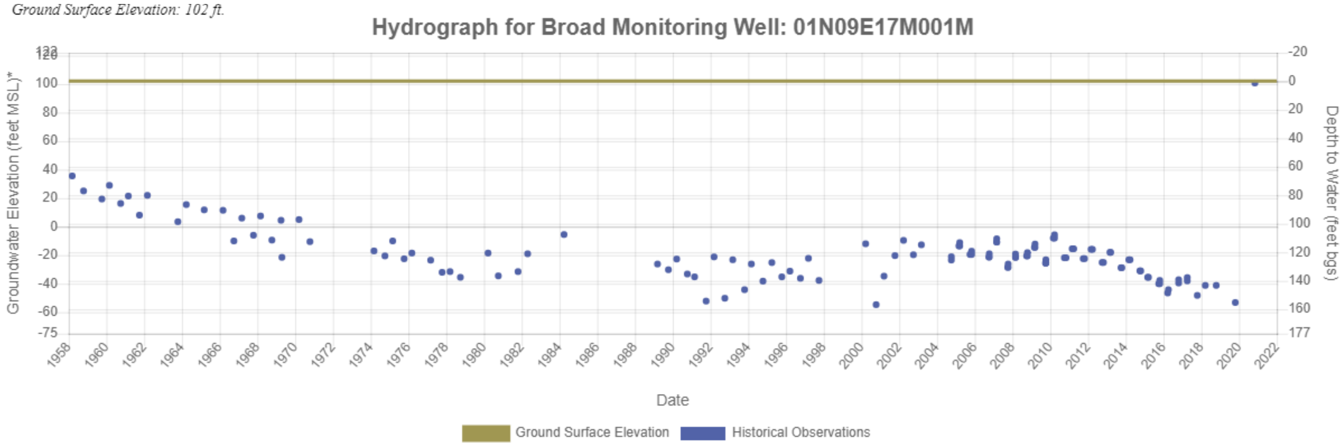


Ground Surface Elevation: 103 ft.

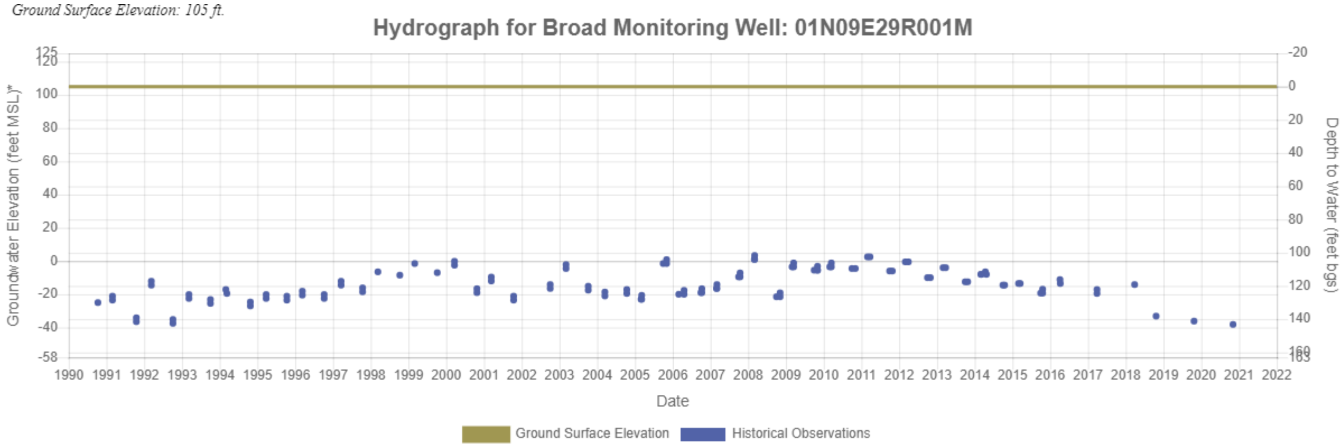
Hydrograph for Broad Monitoring Well: 01N09E17D001M



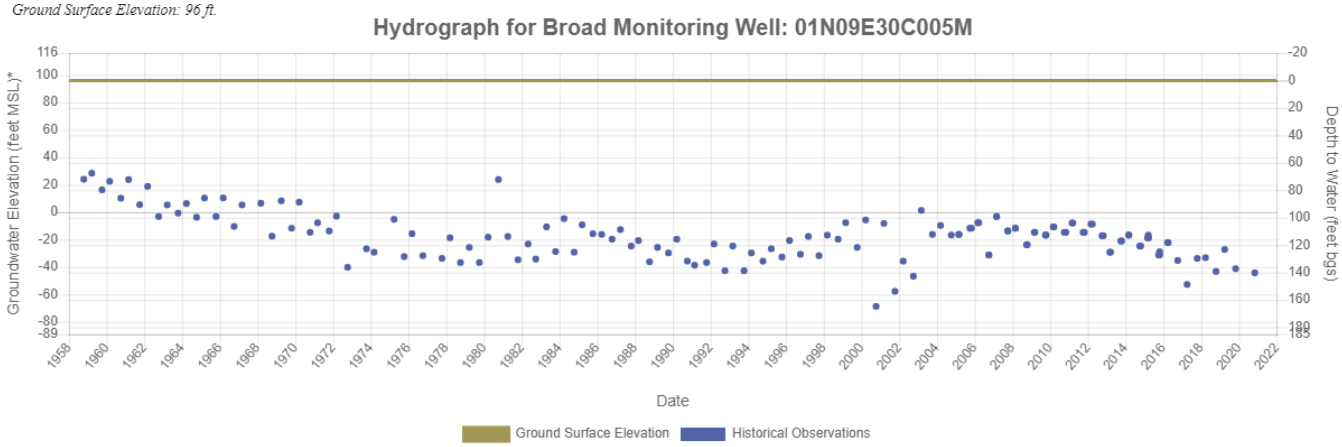
Ground Surface Elevation: 102 ft.



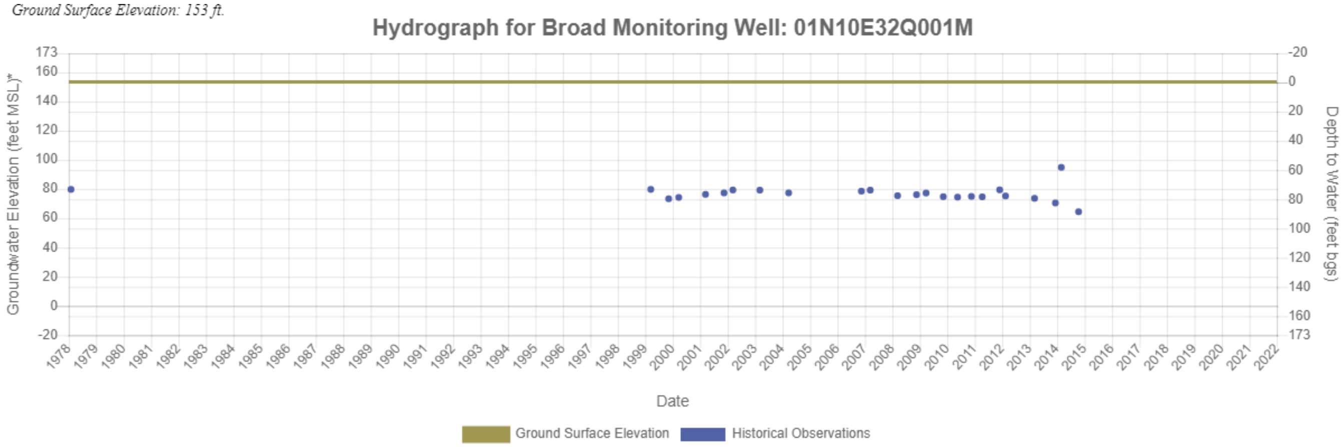
Ground Surface Elevation: 105 ft.

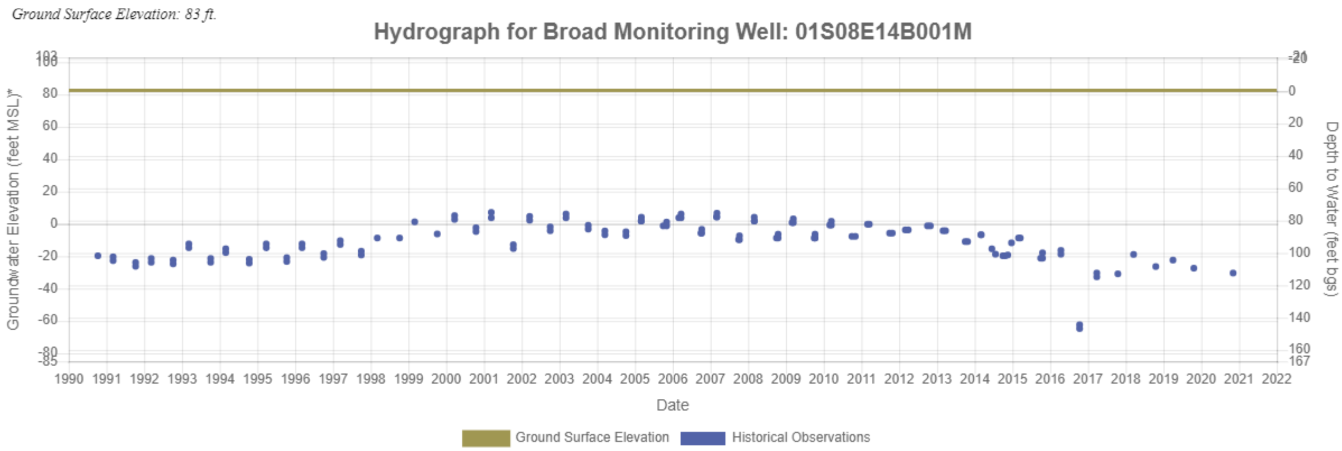


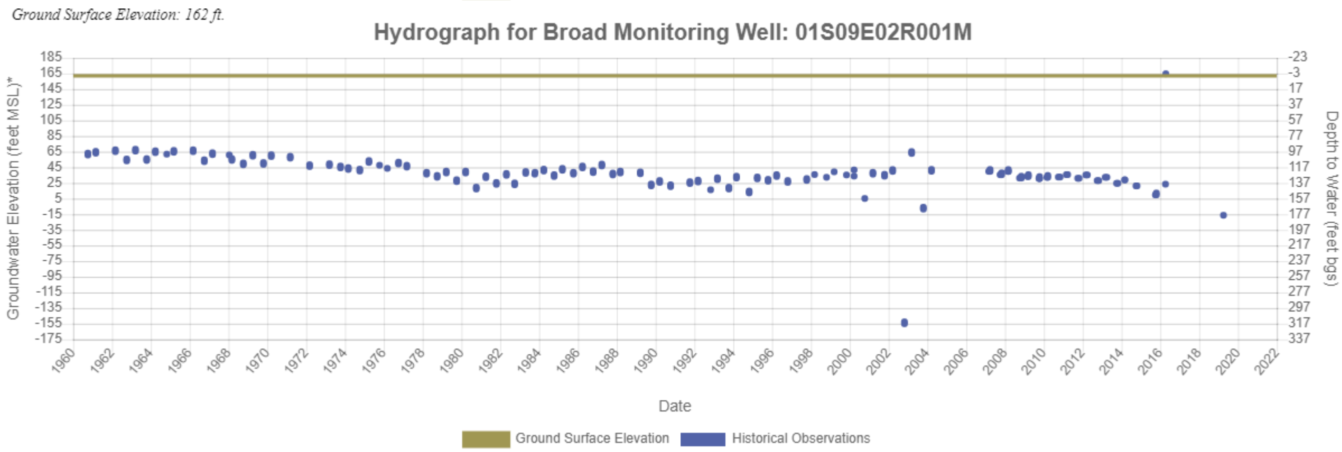
Ground Surface Elevation: 96 ft.

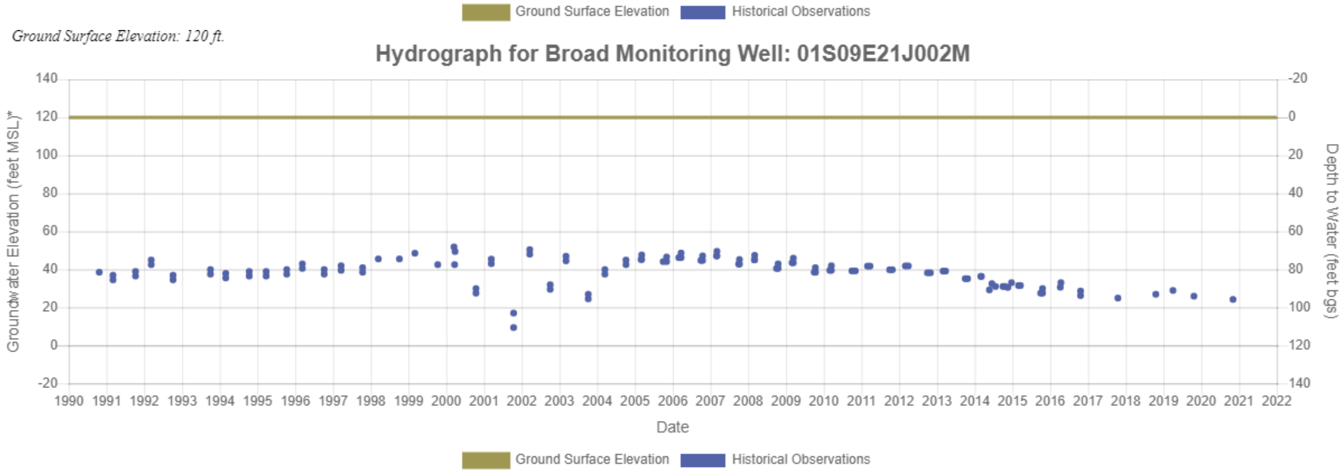


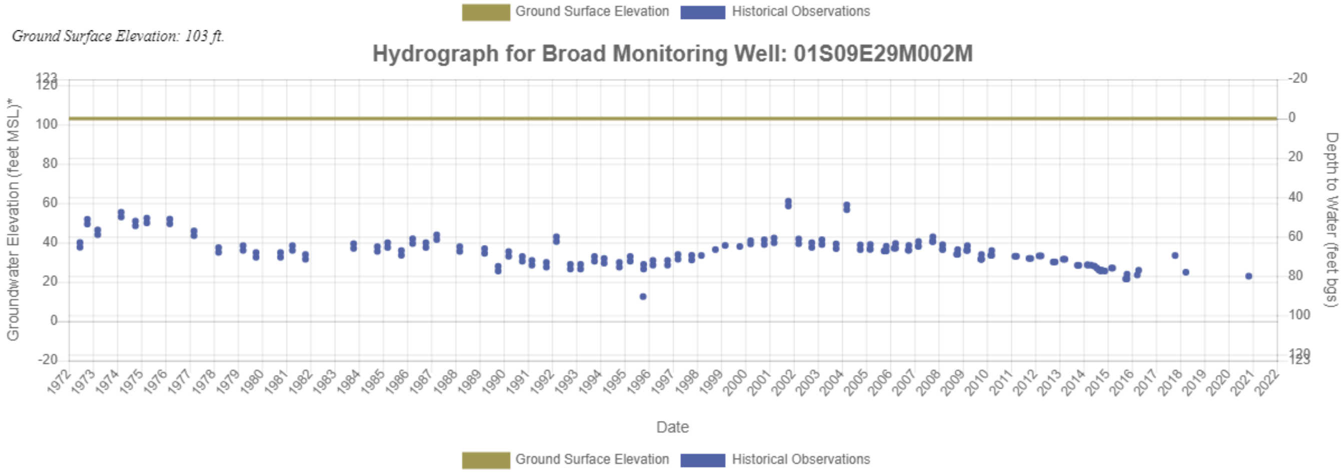
Ground Surface Elevation: 153 ft.



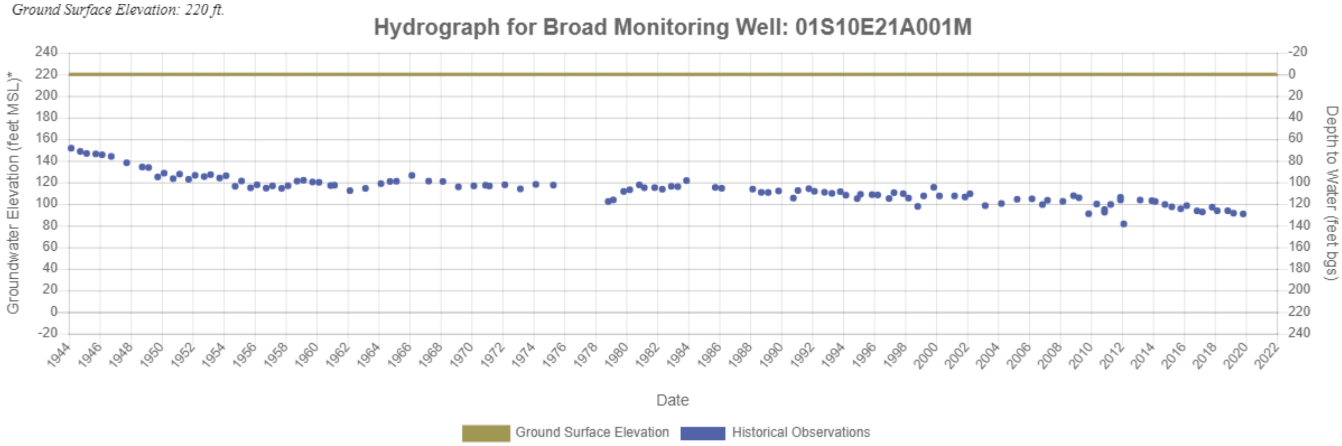

Ground Surface Elevation: 83 ft.
Hydrograph for Broad Monitoring Well: 01S08E14B001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 162 ft.
Hydrograph for Broad Monitoring Well: 01S09E02R001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

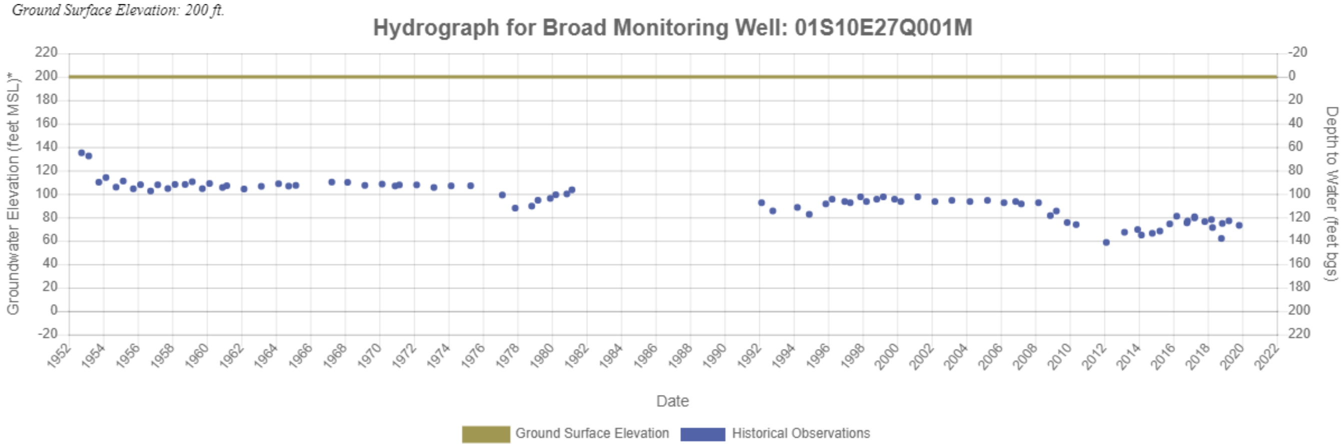

Ground Surface Elevation: 120 ft.
Hydrograph for Broad Monitoring Well: 01S09E21J002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 103 ft.
Hydrograph for Broad Monitoring Well: 01S09E29M002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

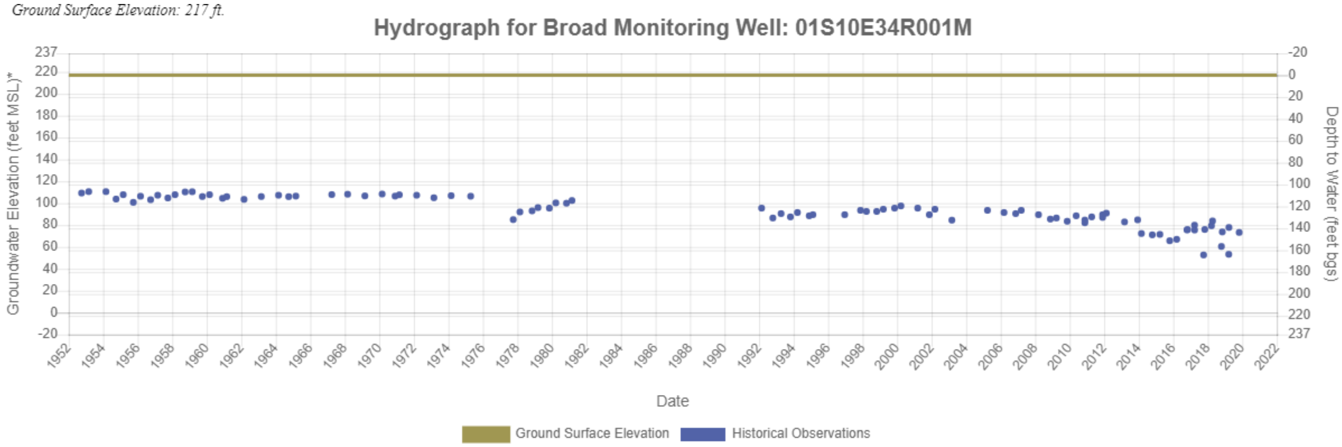
Ground Surface Elevation: 220 ft.



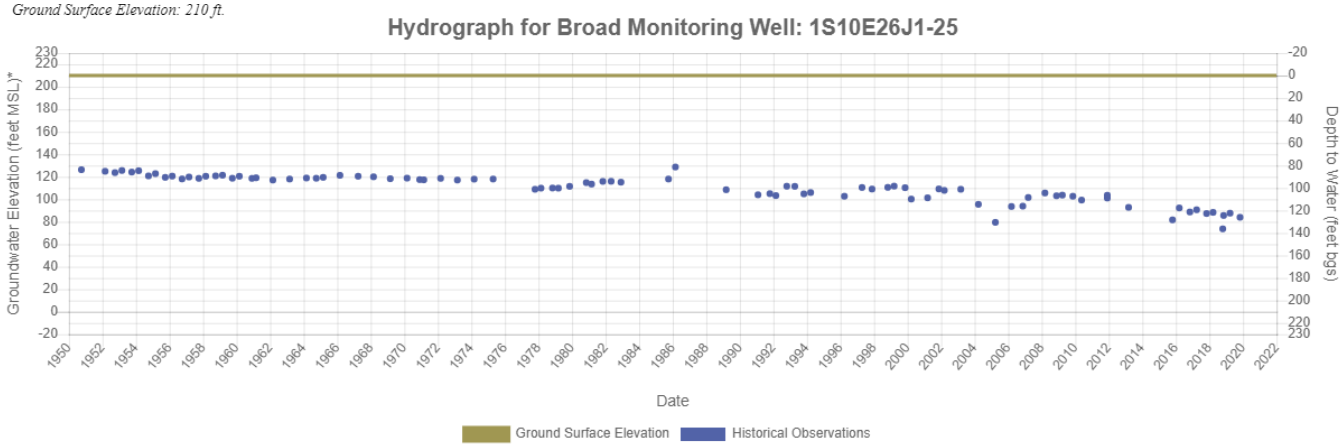
Ground Surface Elevation: 200 ft.

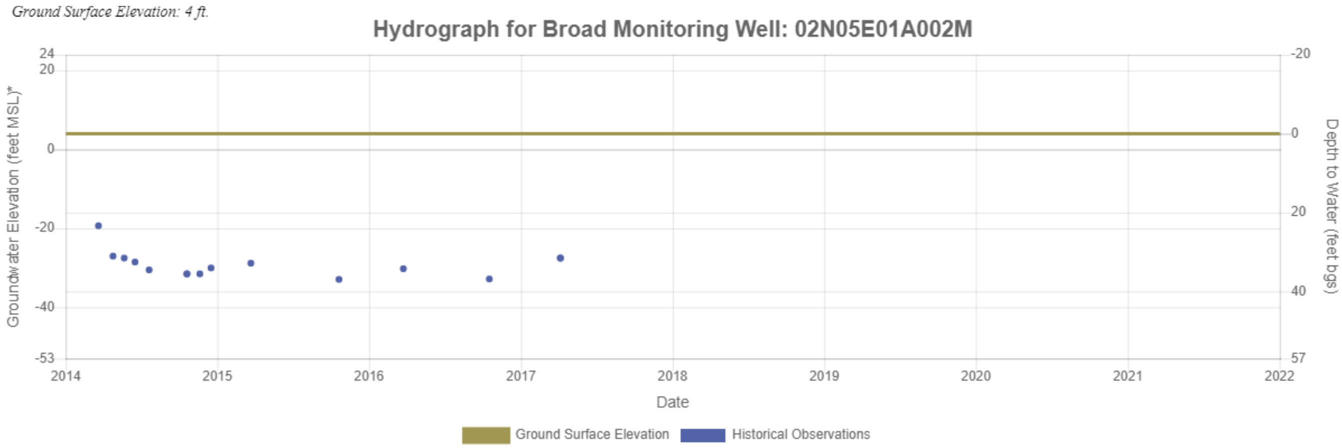


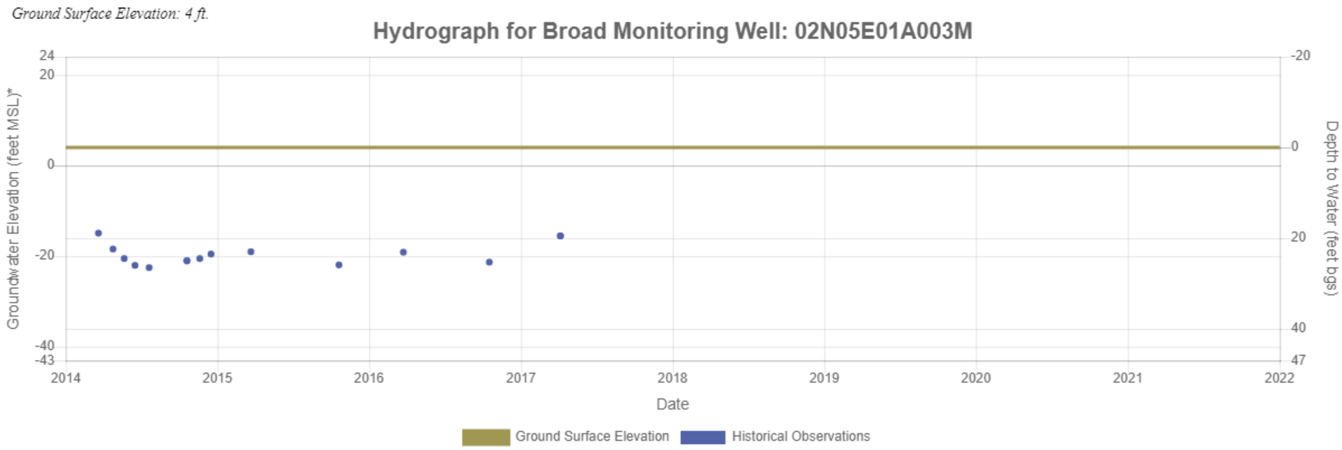
Ground Surface Elevation: 217 ft.

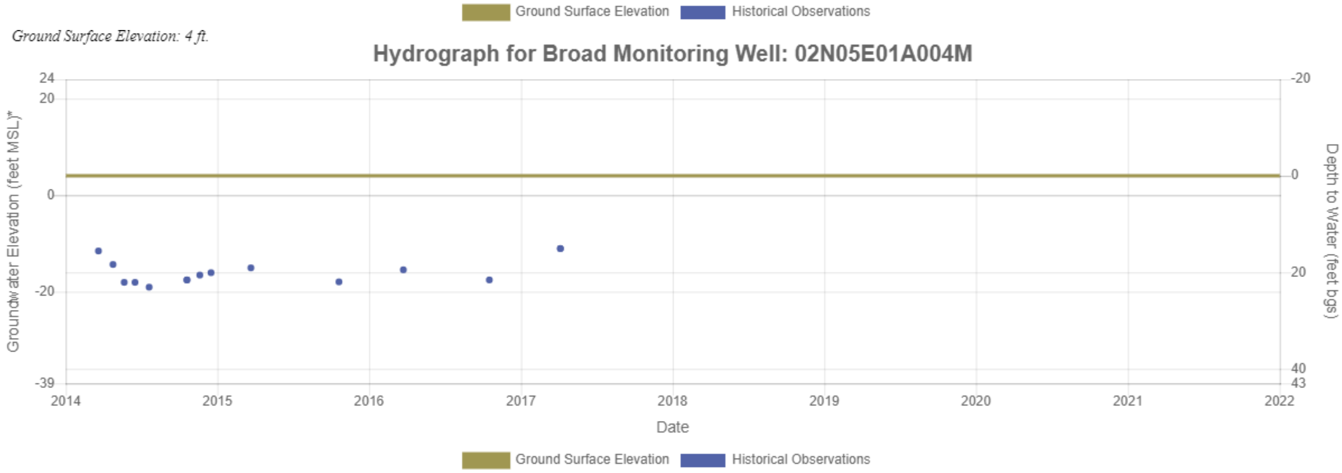


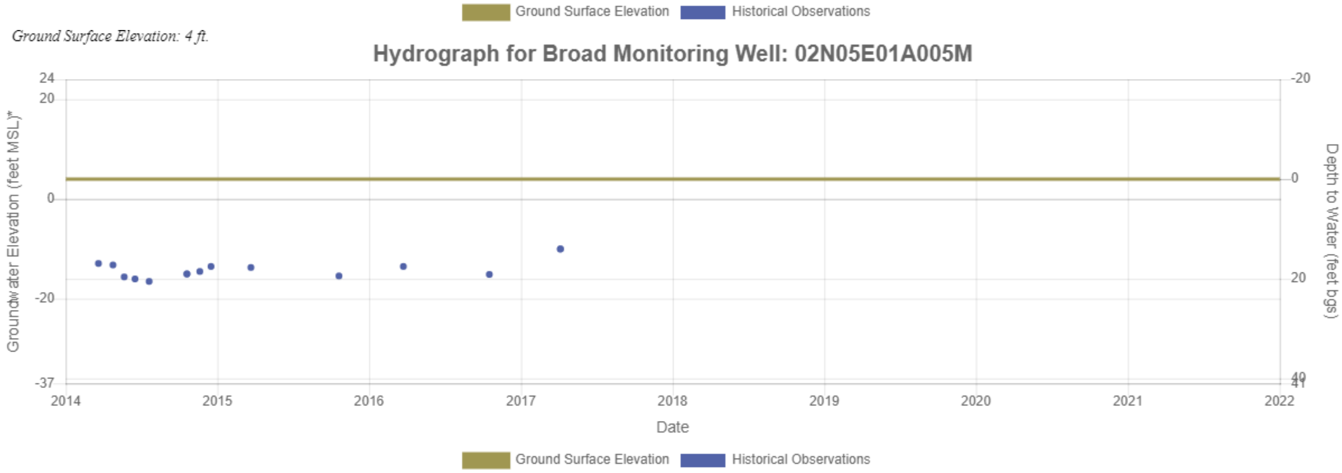
Ground Surface Elevation: 210 ft.

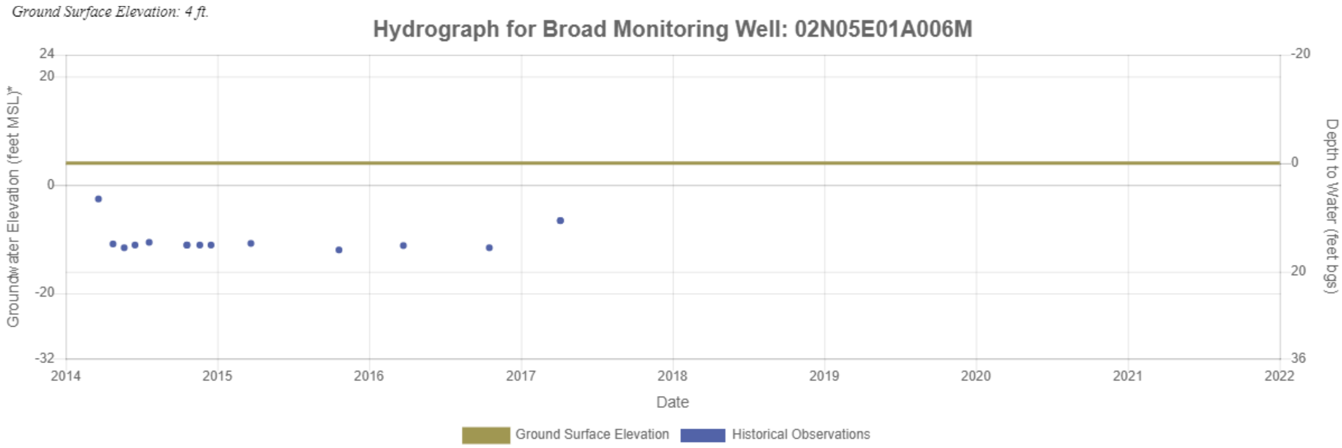


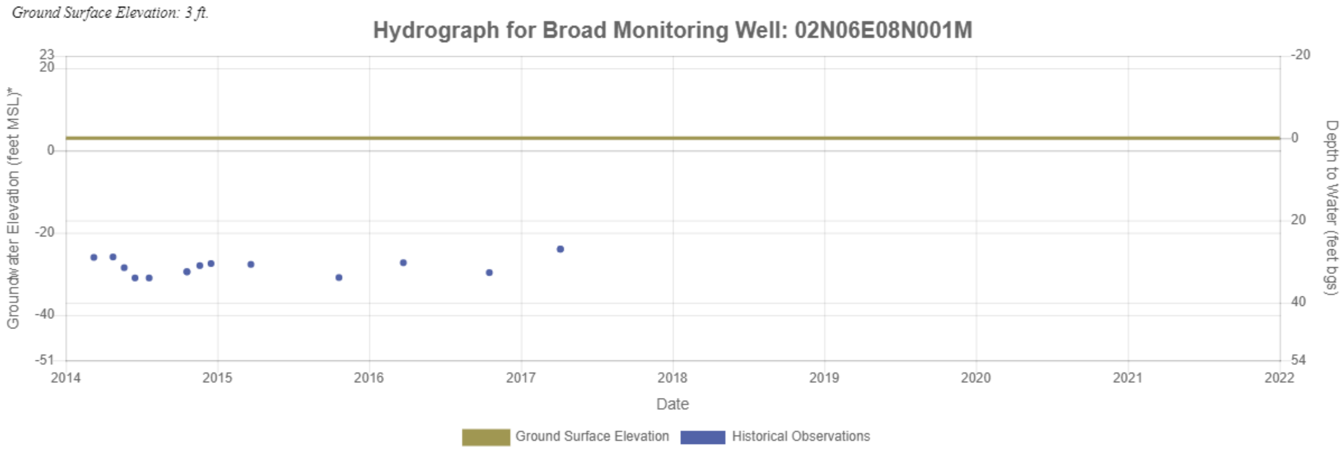

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N05E01A002M
Groundwater Elevation (feet MSL)*
24
20
0
-20
-40
-53
Depth to Water (feet bgs)
-20
0
20
40
57
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

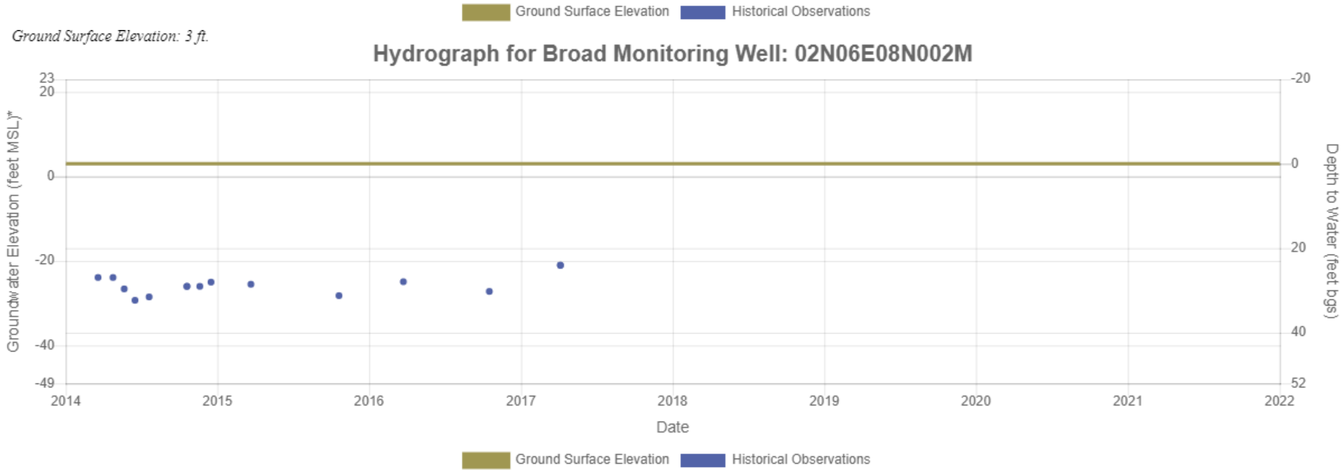

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N05E01A003M
Groundwater Elevation (feet MSL)*
24
20
0
-20
-40
-43
Depth to Water (feet bgs)
-20
0
20
40
47
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

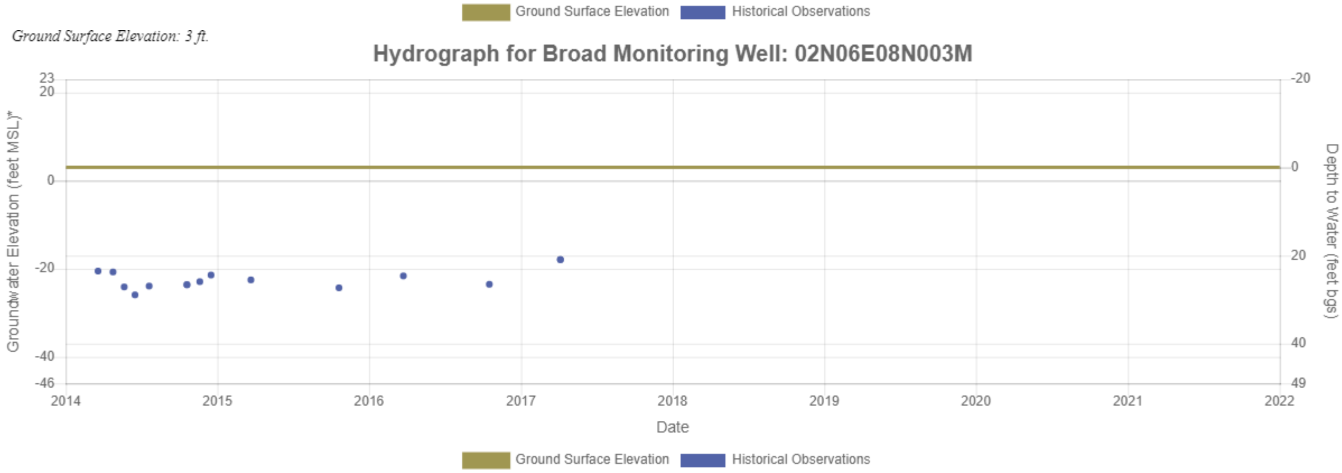

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N05E01A004M
Groundwater Elevation (feet MSL)*
24
20
0
-20
-39
Depth to Water (feet bgs)
-20
0
20
40
43
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

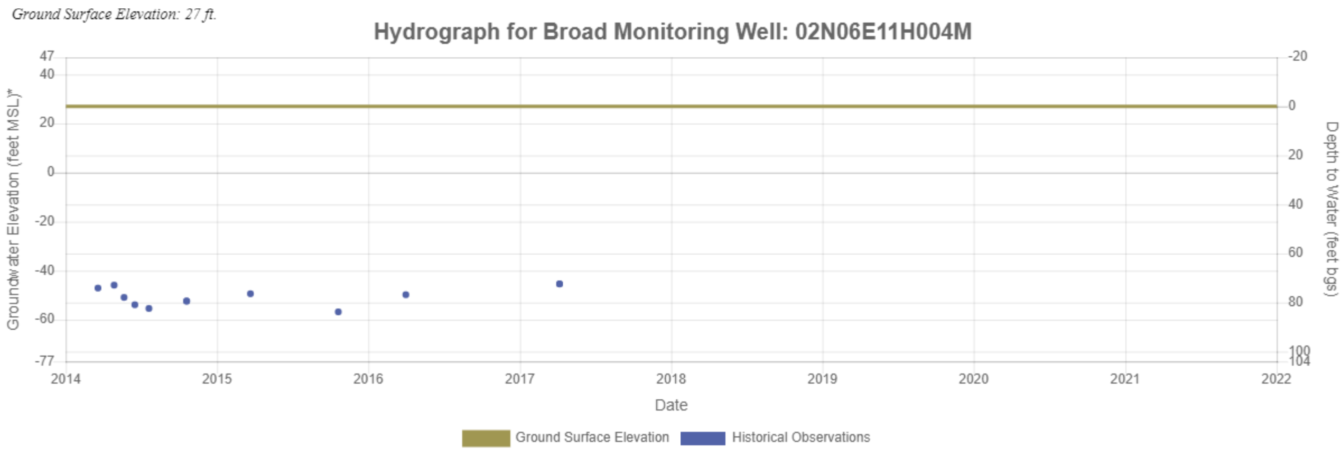

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N05E01A005M
Groundwater Elevation (feet MSL)*
24
20
0
-20
-37
Depth to Water (feet bgs)
-20
0
20
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

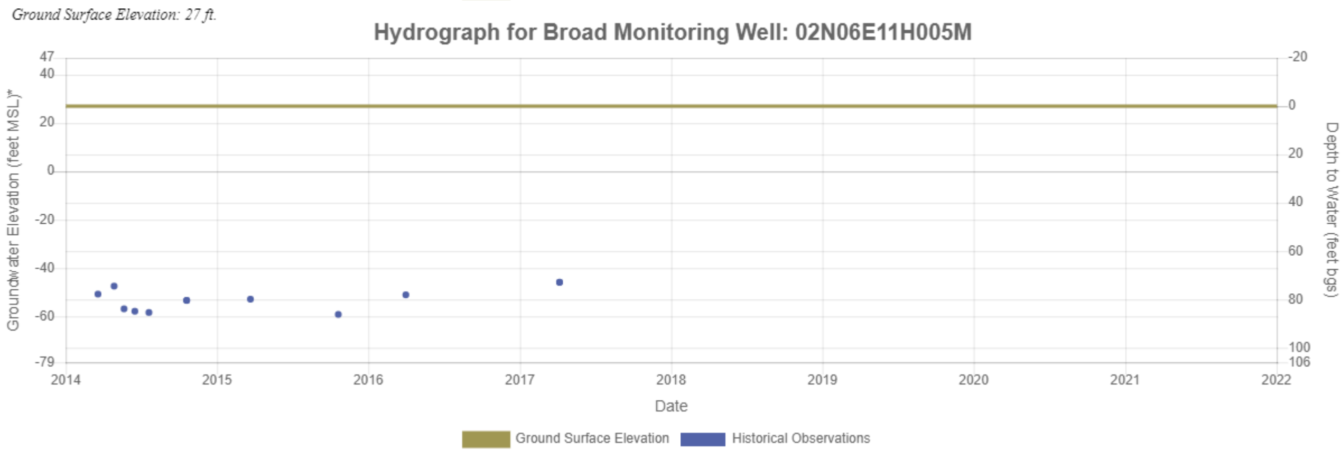

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N05E01A006M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

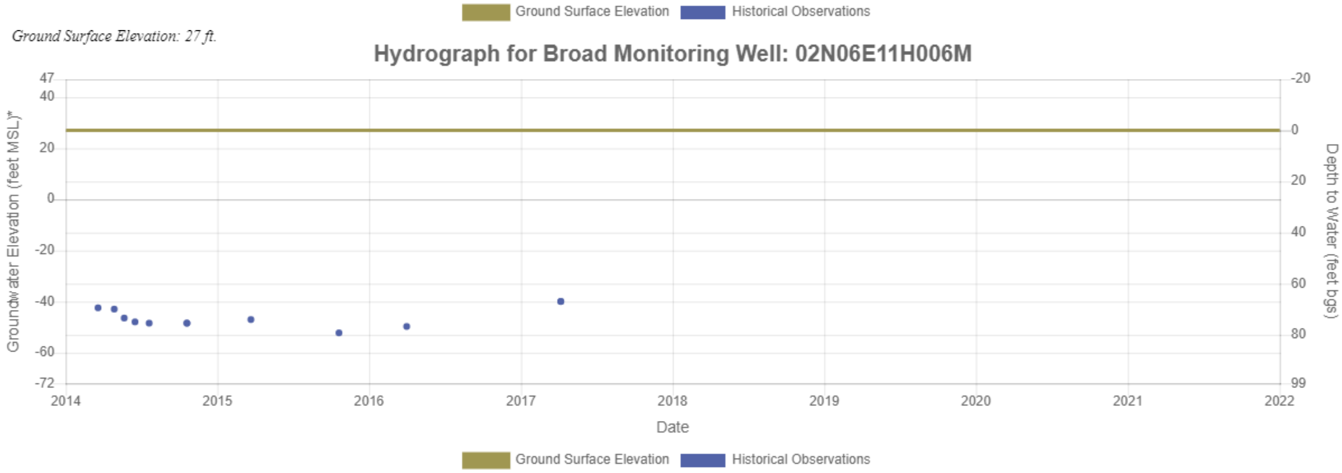

Ground Surface Elevation: 3 ft.
Hydrograph for Broad Monitoring Well: 02N06E08N001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

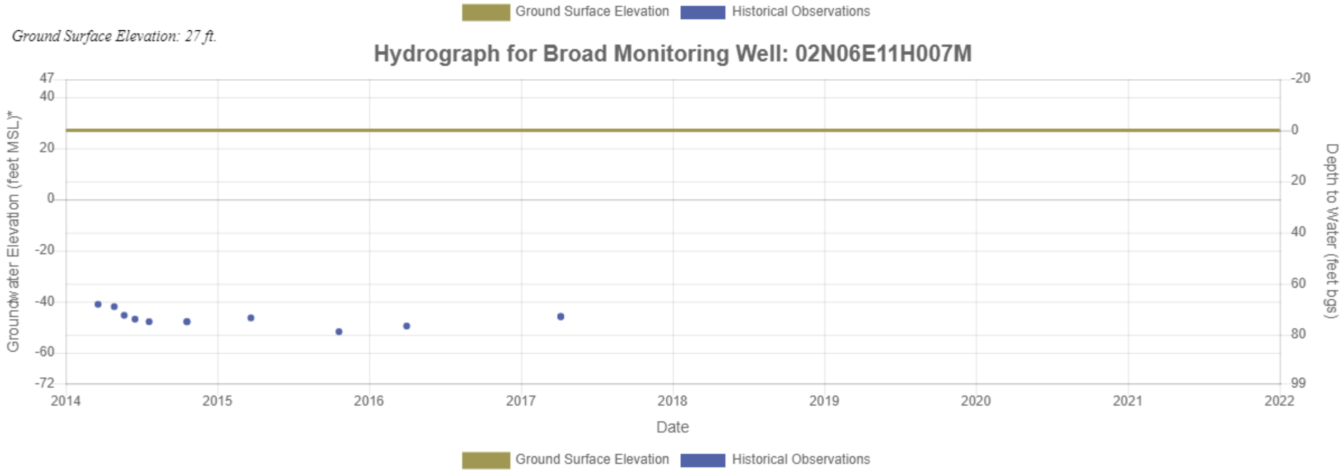

Ground Surface Elevation: 3 ft.
Hydrograph for Broad Monitoring Well: 02N06E08N002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

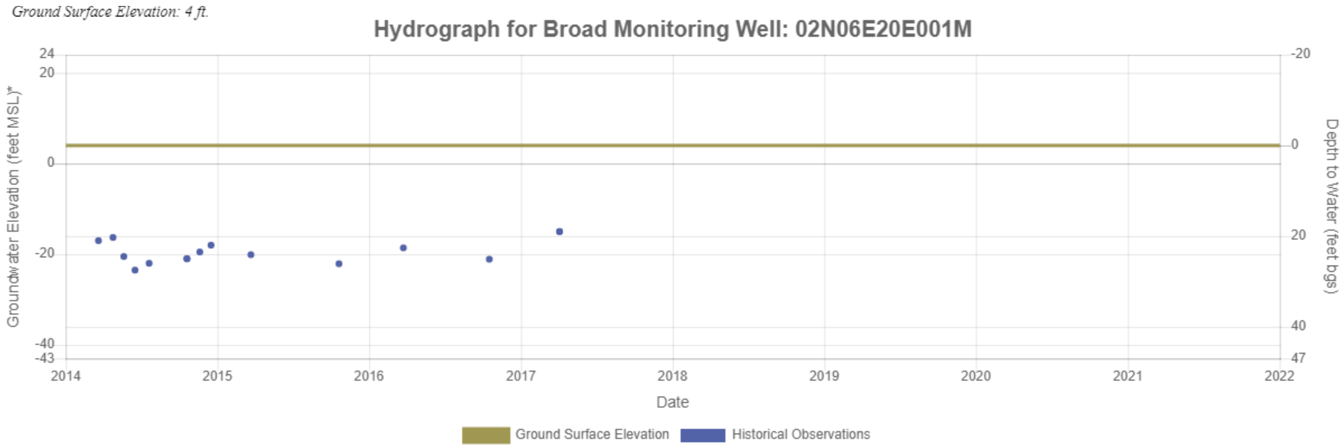

Ground Surface Elevation: 3 ft.
Hydrograph for Broad Monitoring Well: 02N06E08N003M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

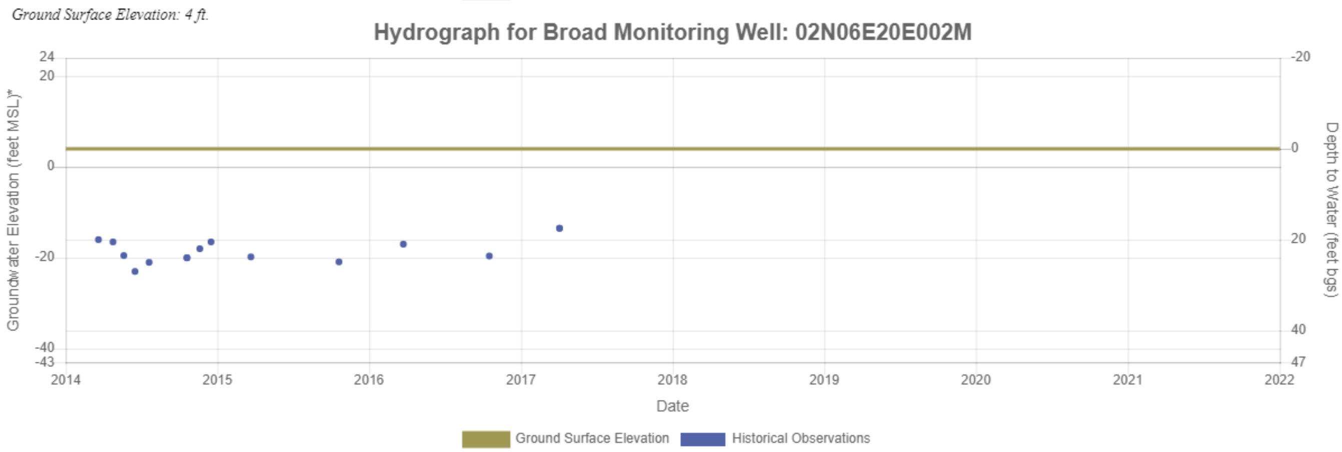

Ground Surface Elevation: 27 ft.
Hydrograph for Broad Monitoring Well: 02N06E11H004M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

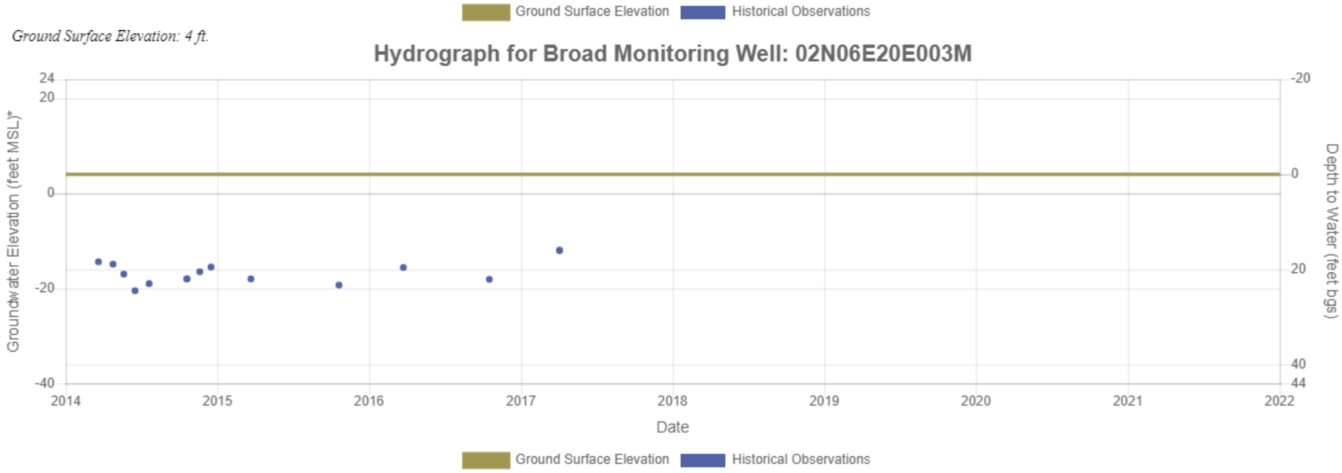

Ground Surface Elevation: 27 ft.
Hydrograph for Broad Monitoring Well: 02N06E11H005M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

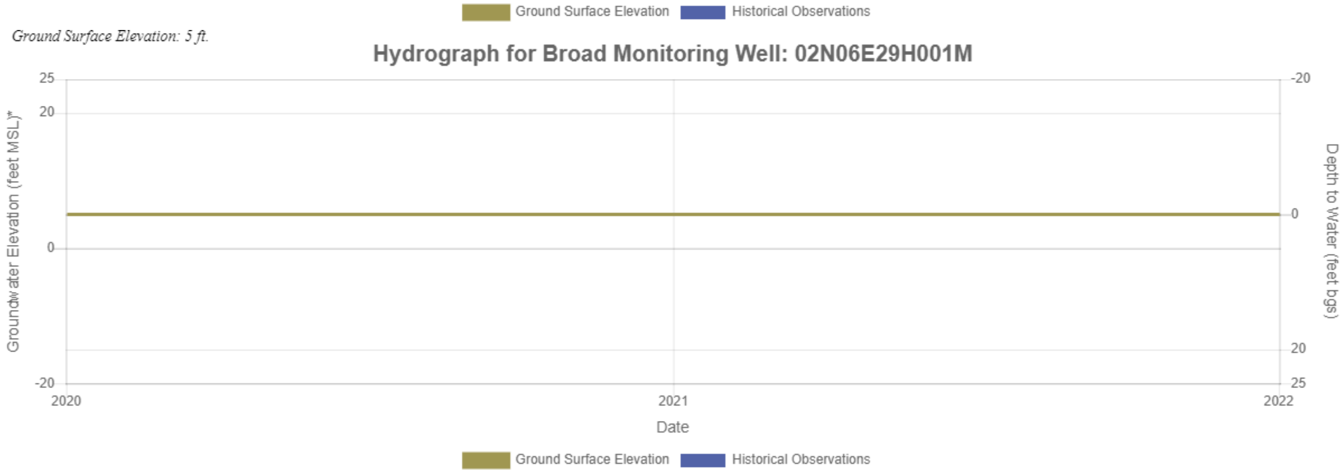

Ground Surface Elevation: 27 ft.
Hydrograph for Broad Monitoring Well: 02N06E11H006M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 27 ft.
Hydrograph for Broad Monitoring Well: 02N06E11H007M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

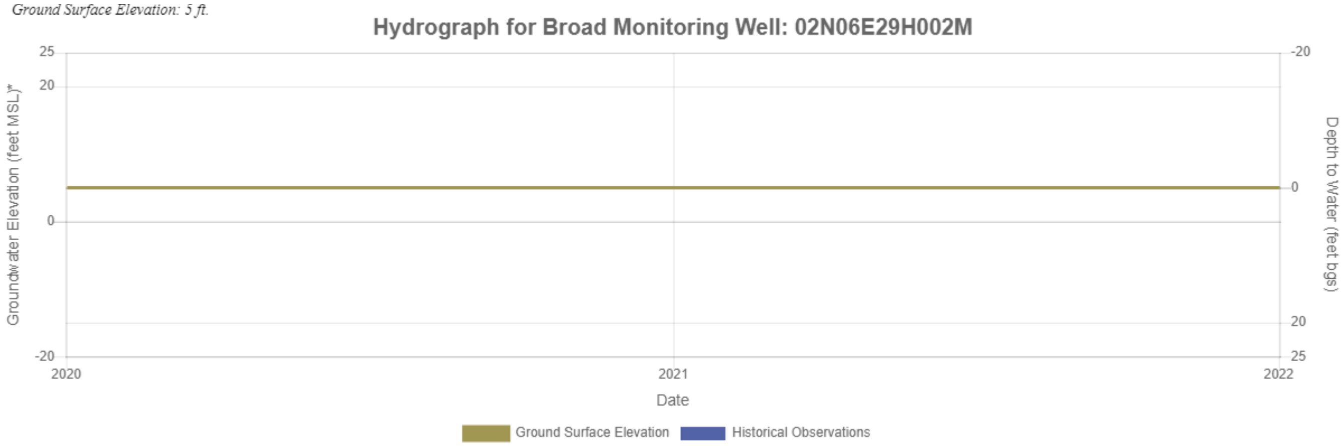

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N06E20E001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
24
20
0
-20
-40
-43
-20
0
20
40
47
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N06E20E002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
24
20
0
-20
-40
-43
-20
0
20
40
47
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

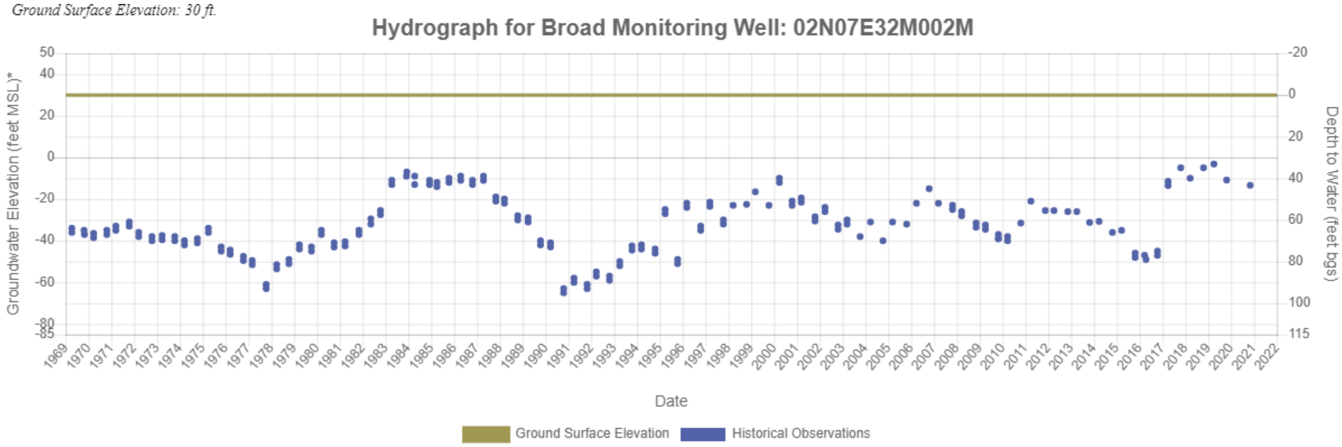

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: 02N06E20E003M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
24
20
0
-20
-40
-20
0
20
40
44
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 5 ft.
Hydrograph for Broad Monitoring Well: 02N06E29H001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
25
20
0
-20
-20
0
20
25
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

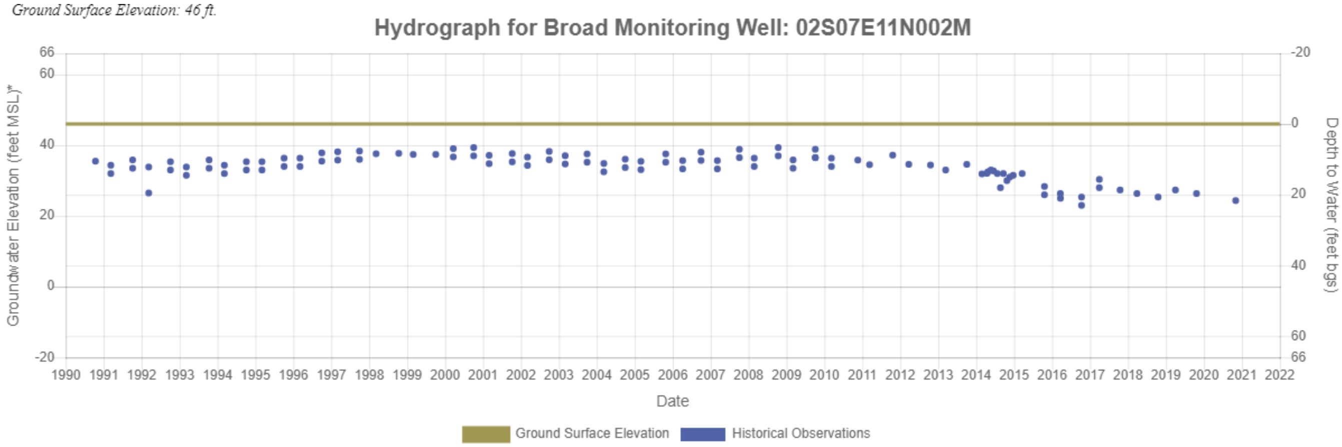
Ground Surface Elevation: 5 ft.



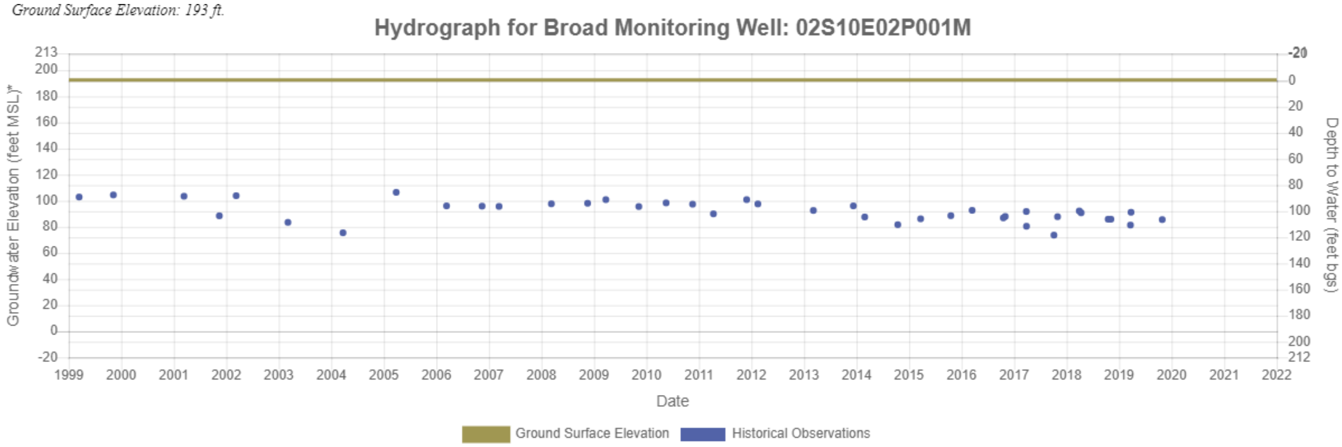
Ground Surface Elevation: 30 ft.



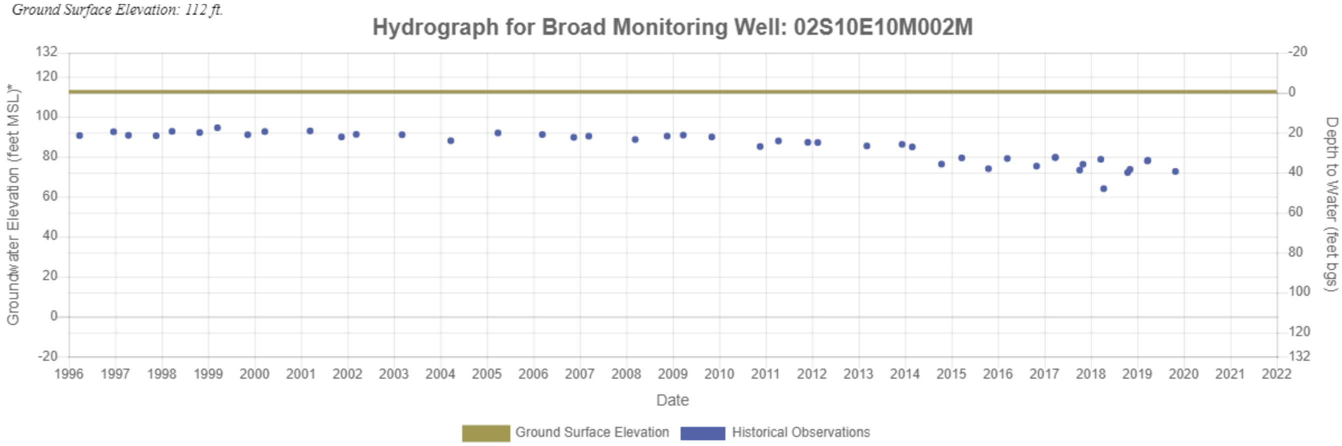
Ground Surface Elevation: 46 ft.



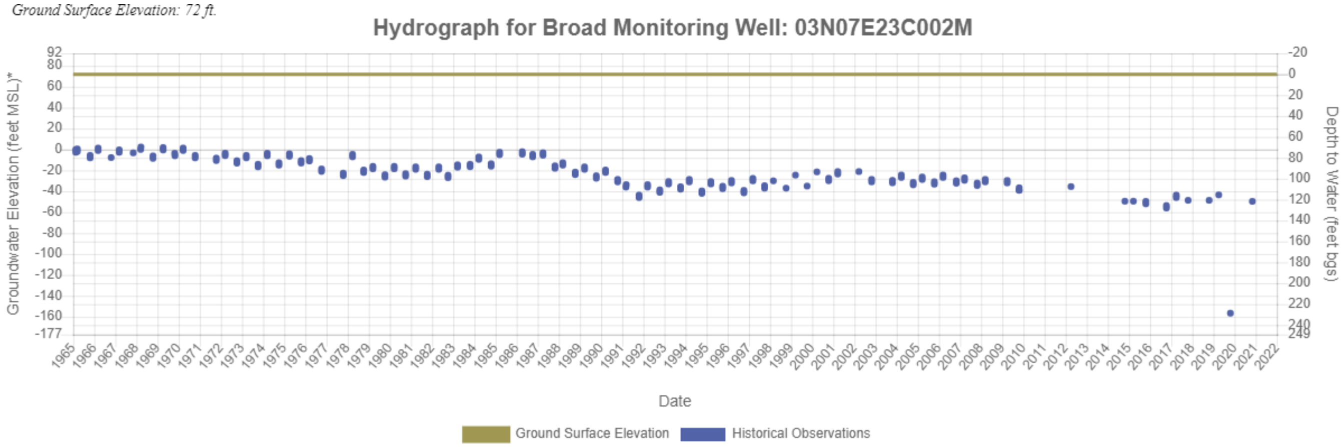
Ground Surface Elevation: 193 ft.



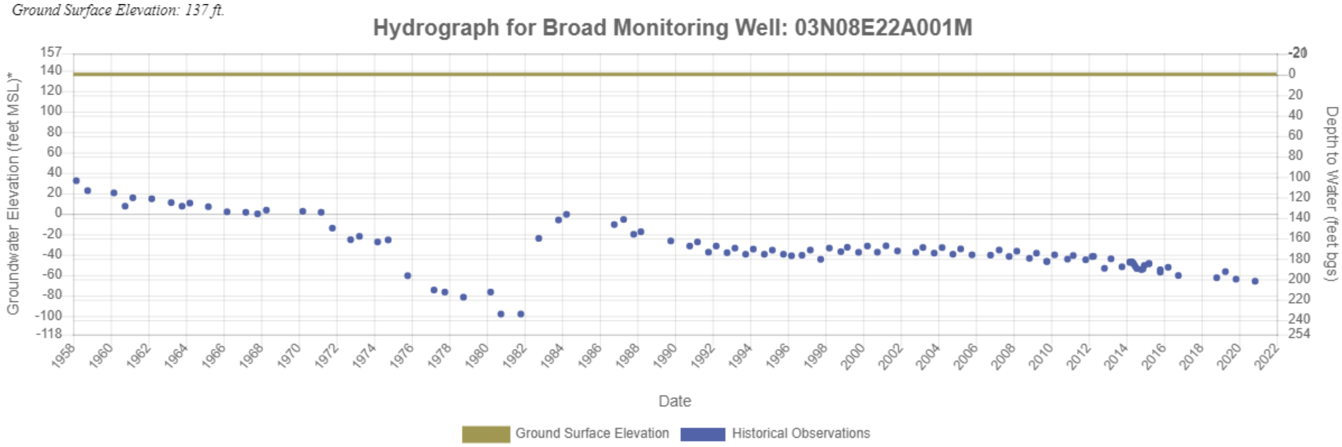
Ground Surface Elevation: 112 ft.



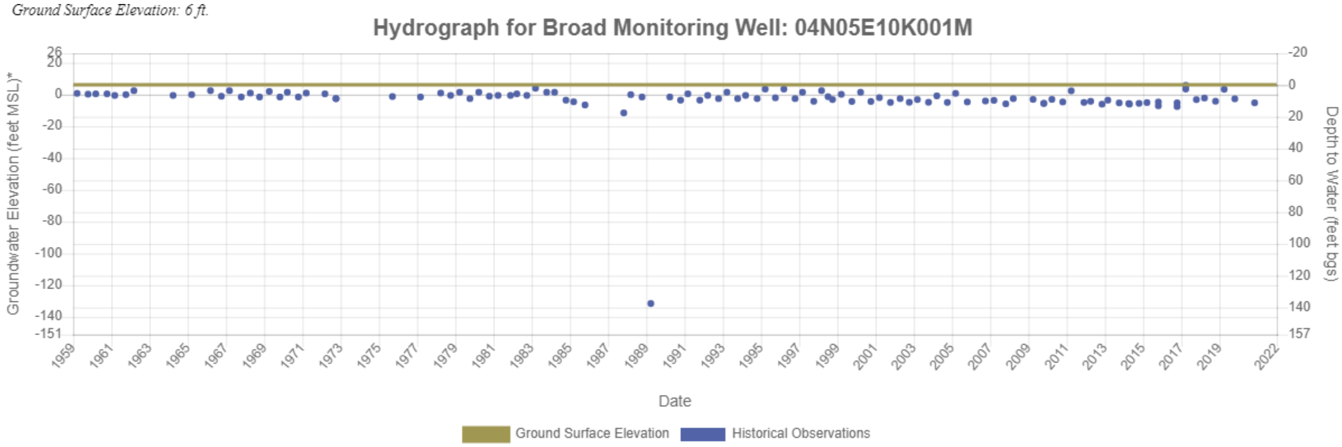
Ground Surface Elevation: 72 ft.

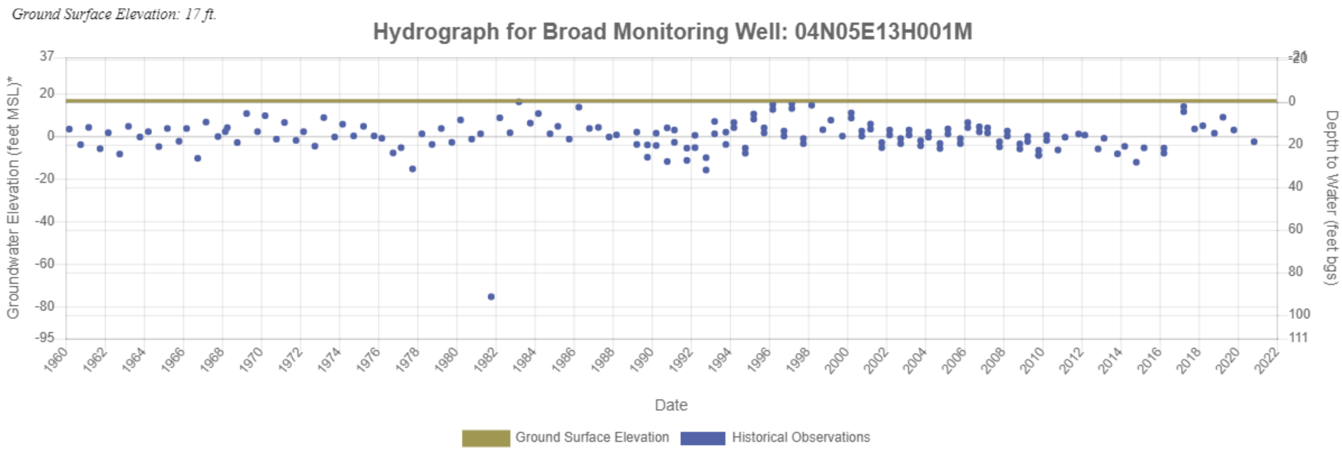


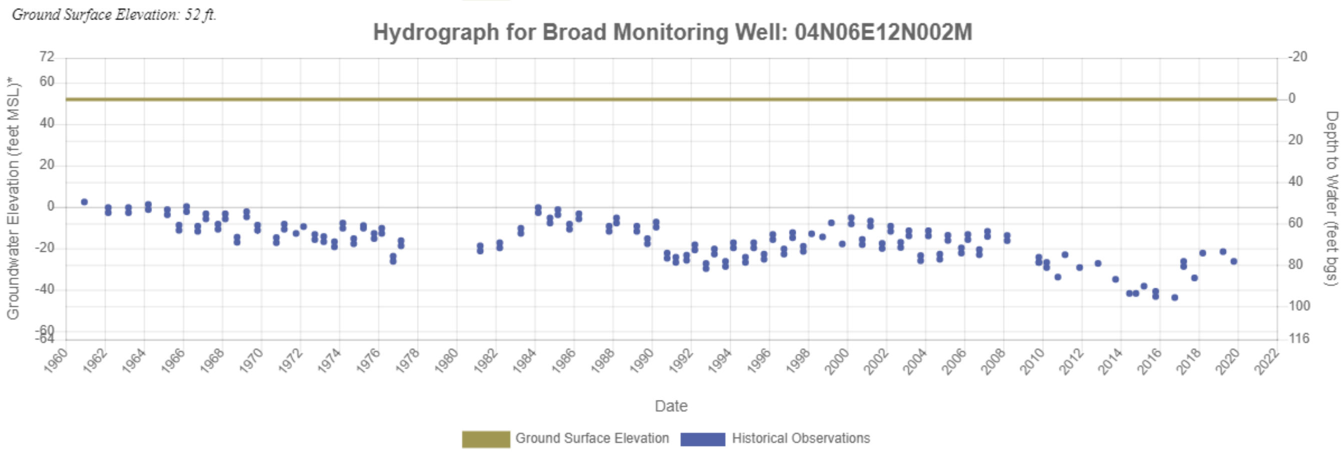
Ground Surface Elevation: 137 ft.

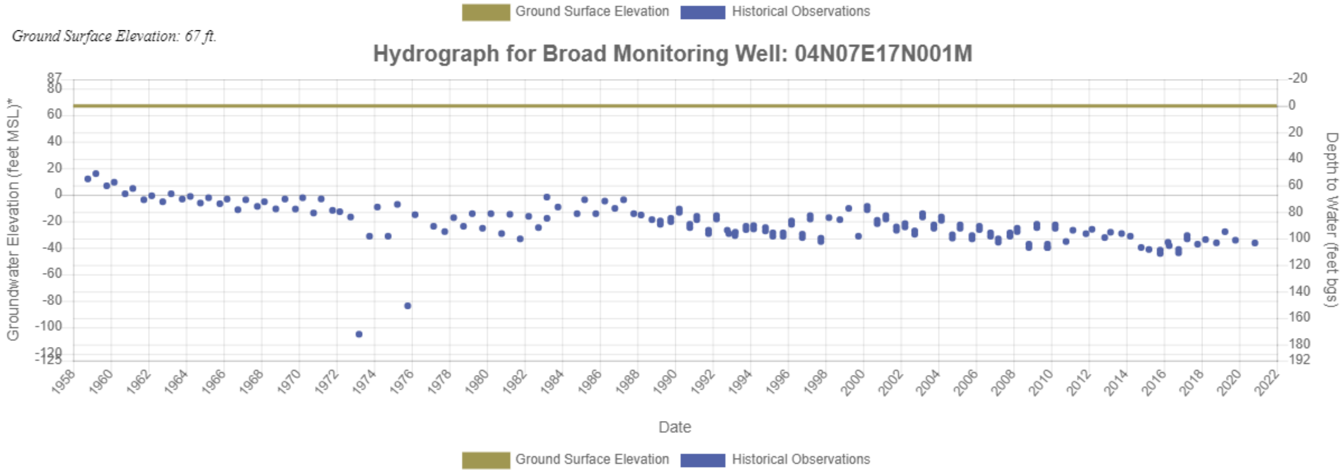


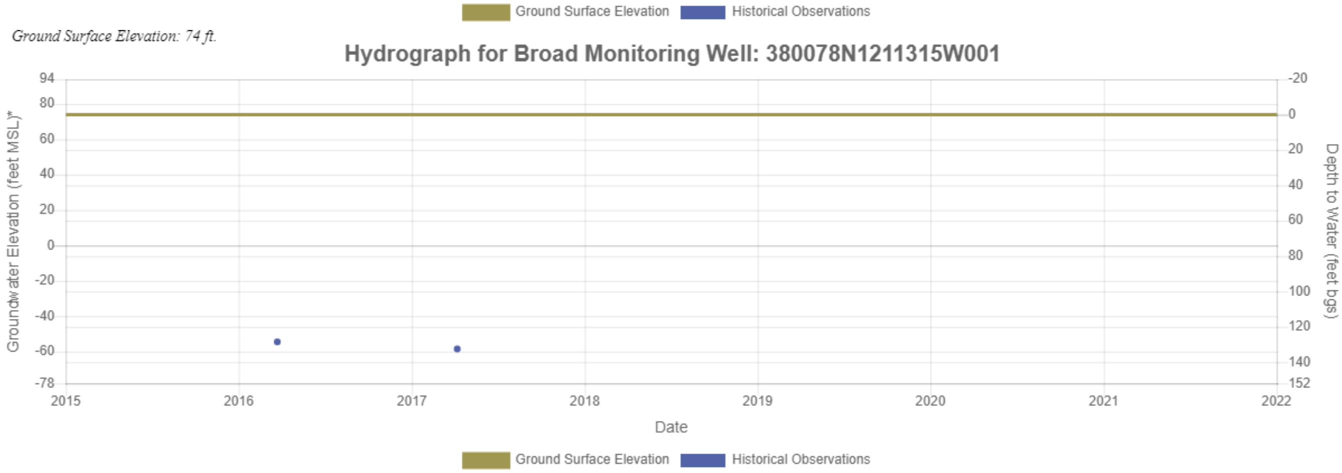
Ground Surface Elevation: 6 ft.

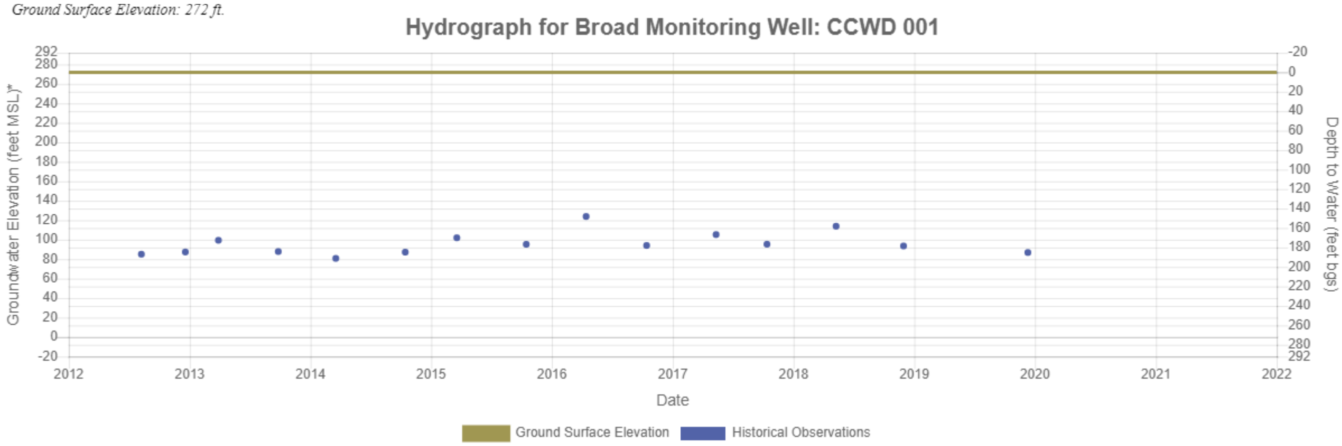


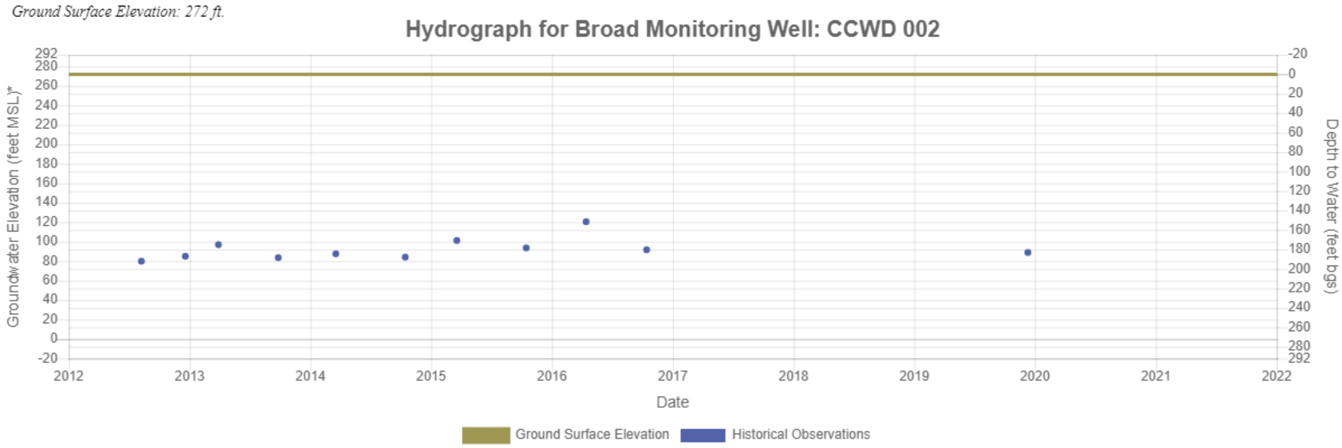

Ground Surface Elevation: 17 ft.
Hydrograph for Broad Monitoring Well: 04N05E13H001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

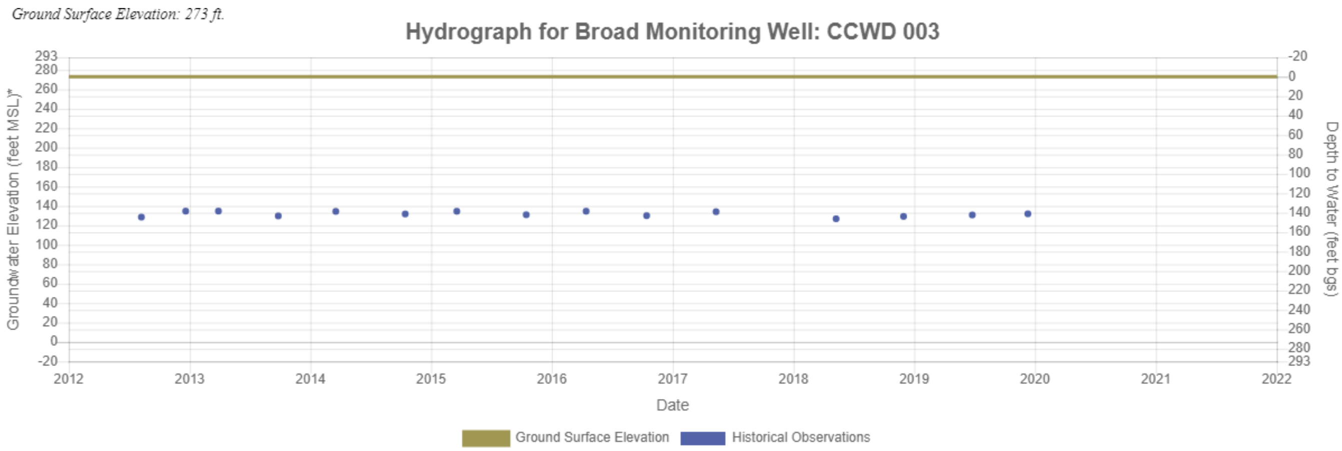

Ground Surface Elevation: 52 ft.
Hydrograph for Broad Monitoring Well: 04N06E12N002M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

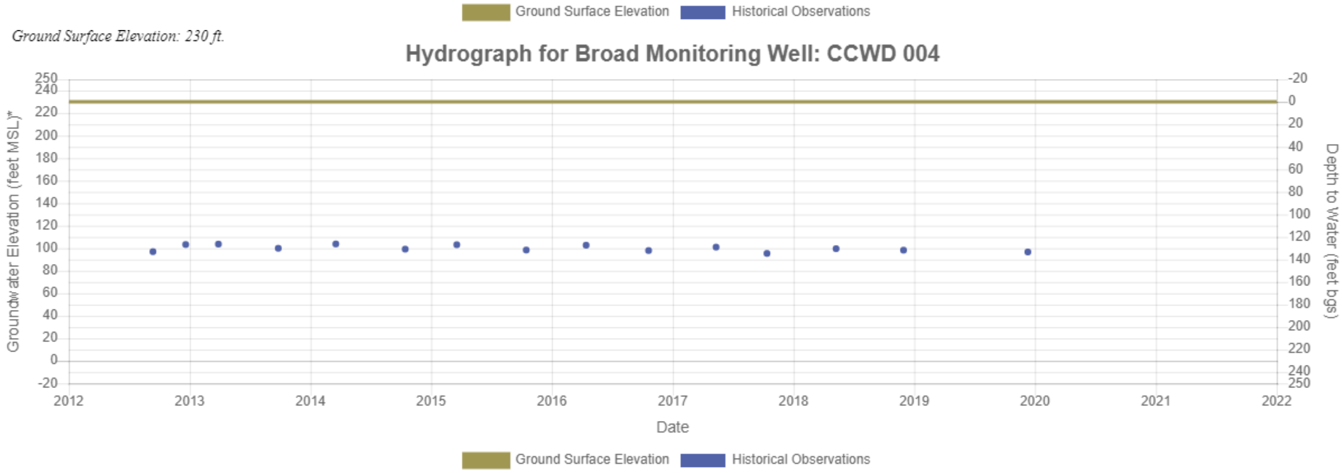

Ground Surface Elevation: 67 ft.
Hydrograph for Broad Monitoring Well: 04N07E17N001M
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

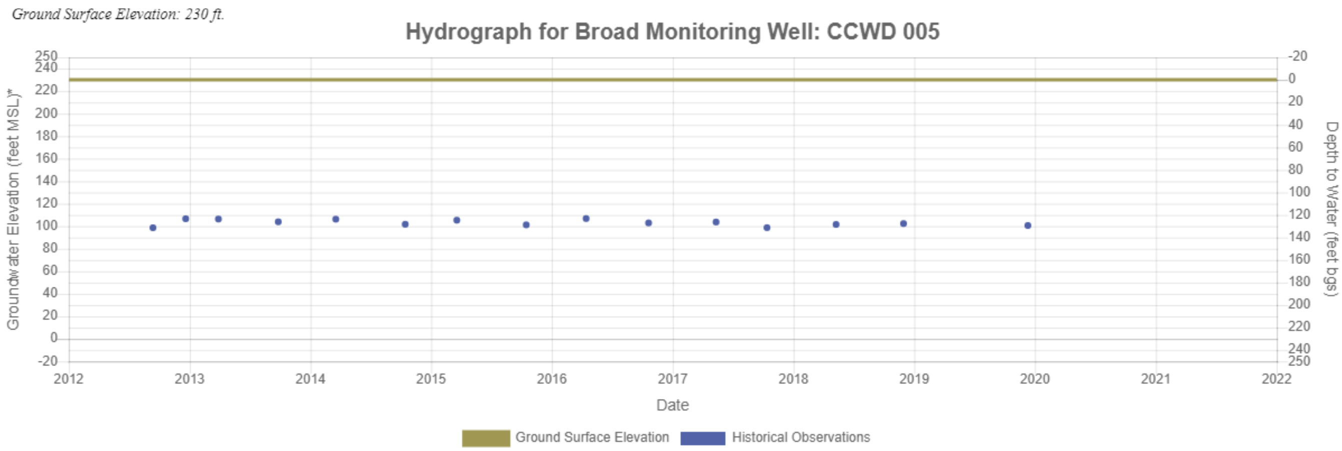

Ground Surface Elevation: 74 ft.
Hydrograph for Broad Monitoring Well: 380078N1211315W001
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

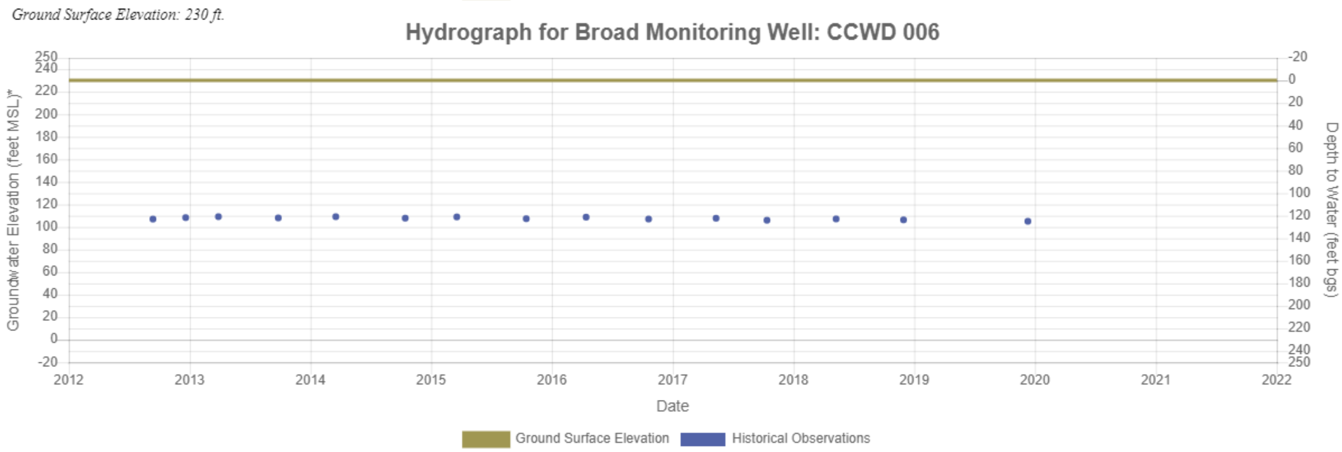

Ground Surface Elevation: 272 ft.
Hydrograph for Broad Monitoring Well: CCWD 001
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

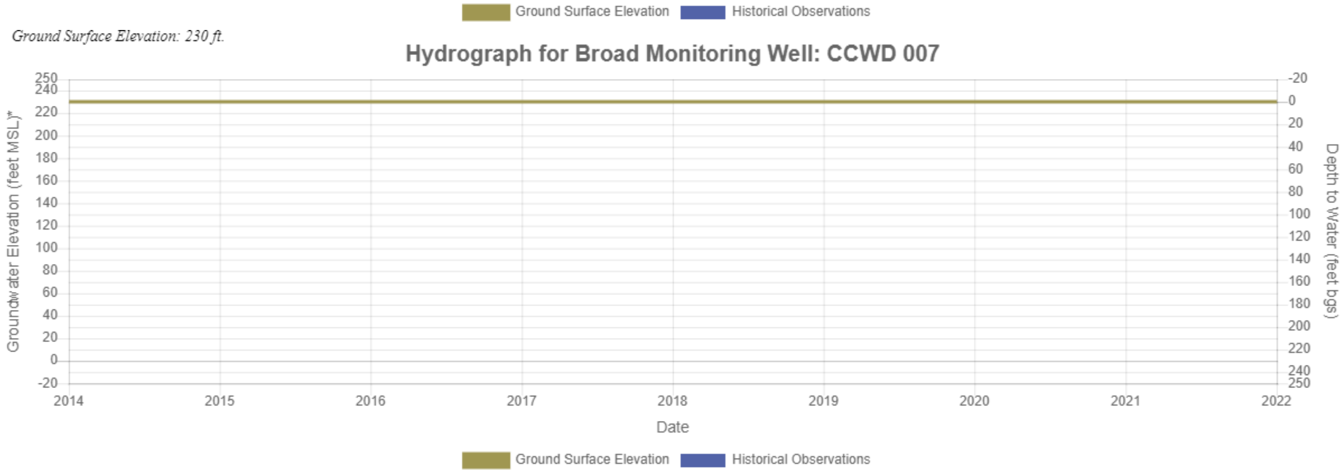

Ground Surface Elevation: 272 ft.
Hydrograph for Broad Monitoring Well: CCWD 002
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

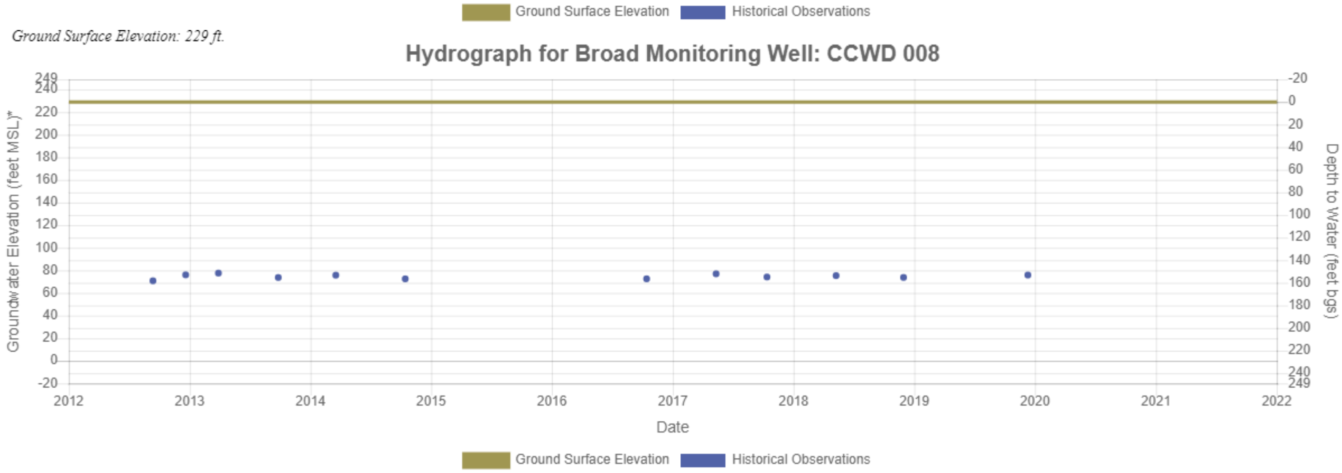

Ground Surface Elevation: 273 ft.
Hydrograph for Broad Monitoring Well: CCWD 003
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 230 ft.
Hydrograph for Broad Monitoring Well: CCWD 004
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

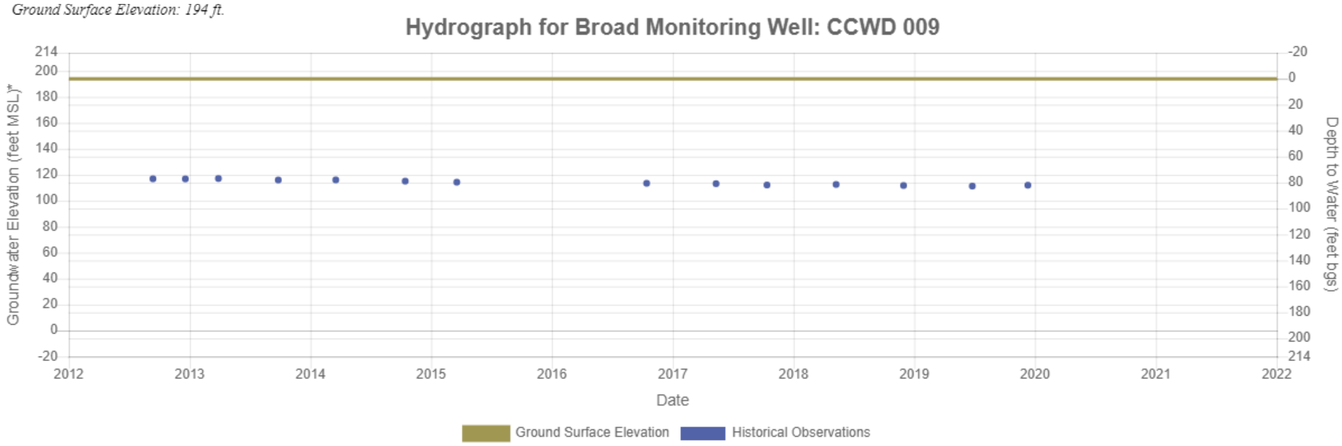

Ground Surface Elevation: 230 ft.
Hydrograph for Broad Monitoring Well: CCWD 005
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 230 ft.
Hydrograph for Broad Monitoring Well: CCWD 006
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

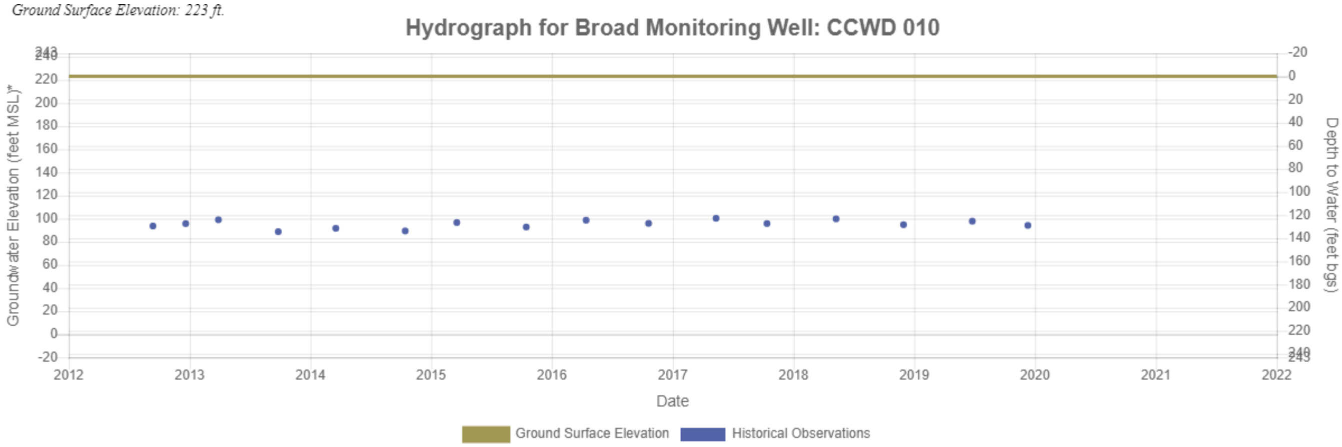

Ground Surface Elevation: 230 ft.
Hydrograph for Broad Monitoring Well: CCWD 007
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 229 ft.
Hydrograph for Broad Monitoring Well: CCWD 008
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

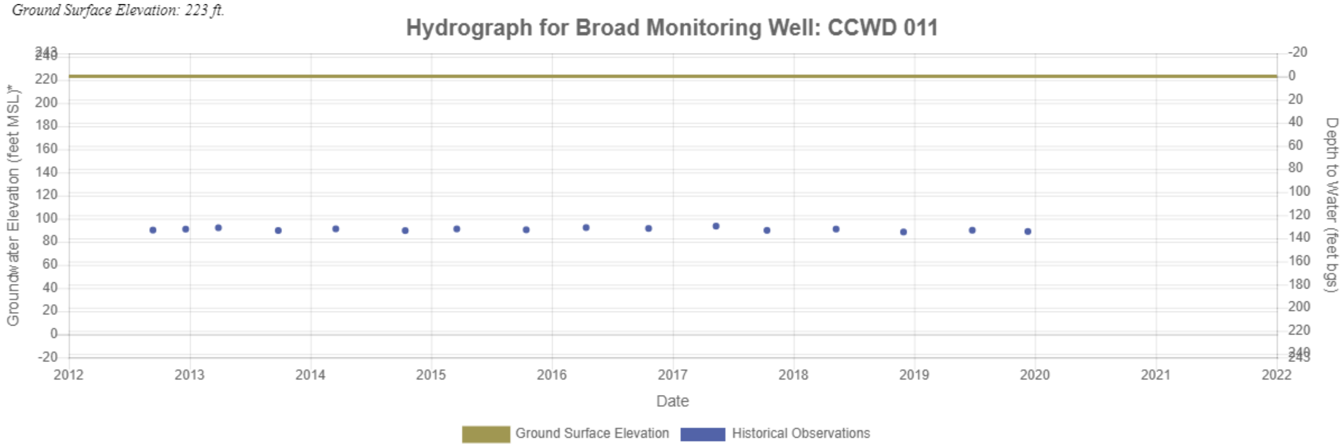
Ground Surface Elevation: 194 ft.



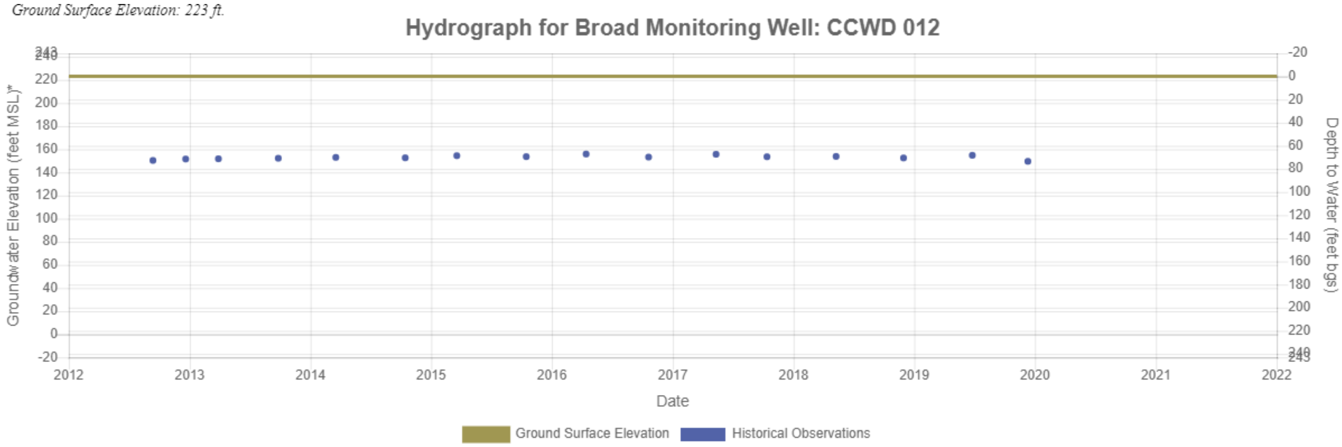
Ground Surface Elevation: 223 ft.



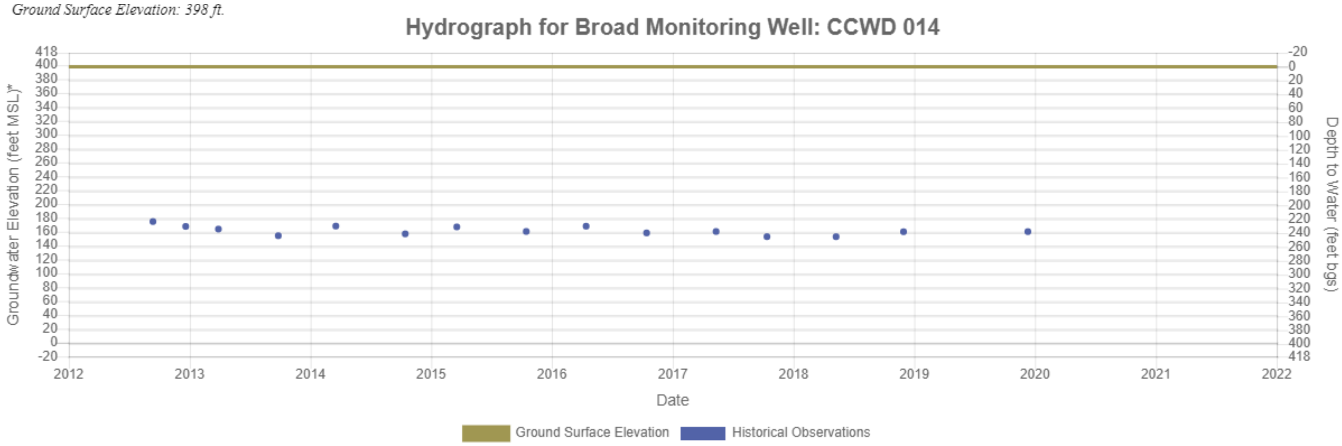
Ground Surface Elevation: 223 ft.



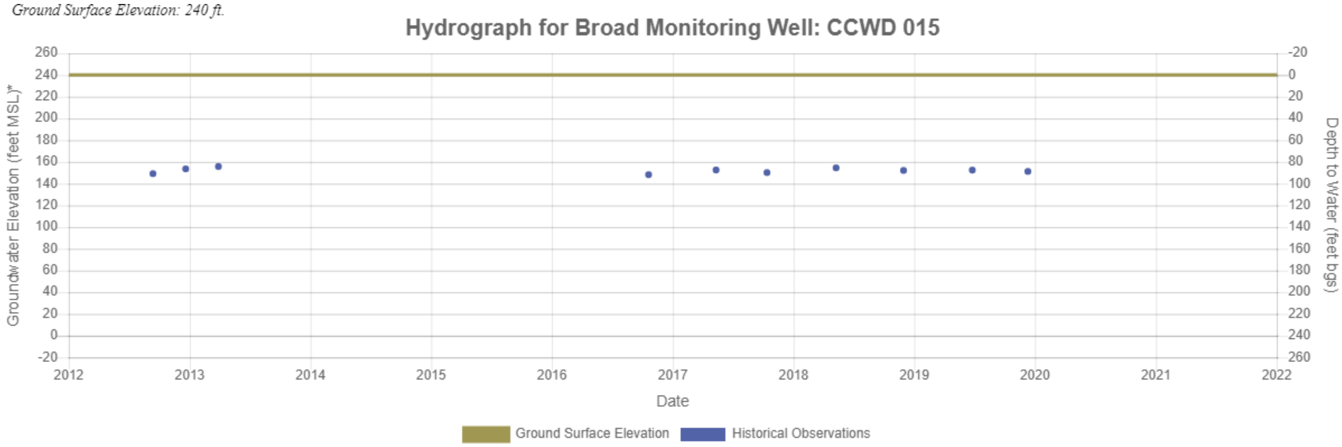
Ground Surface Elevation: 223 ft.



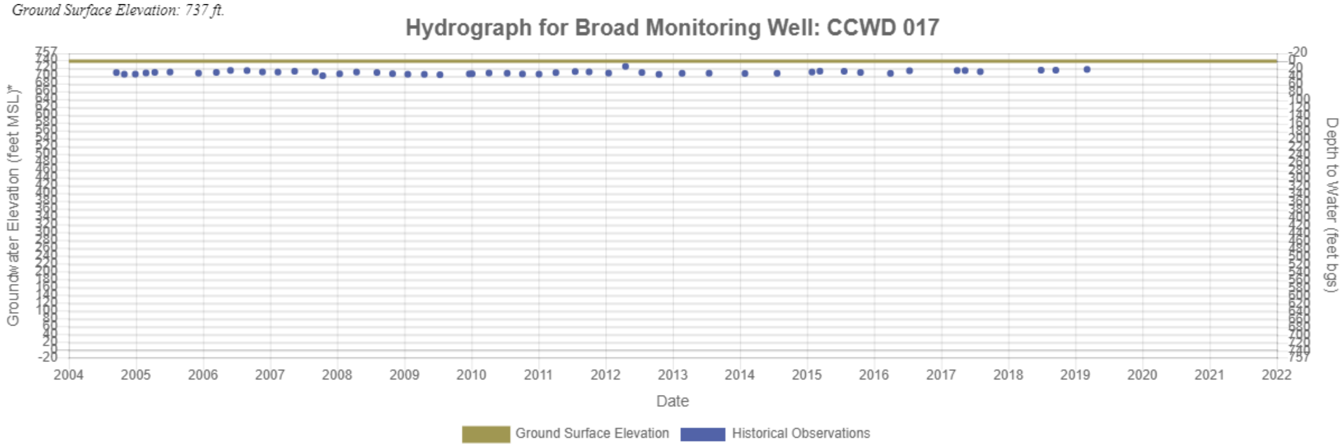
Ground Surface Elevation: 398 ft.



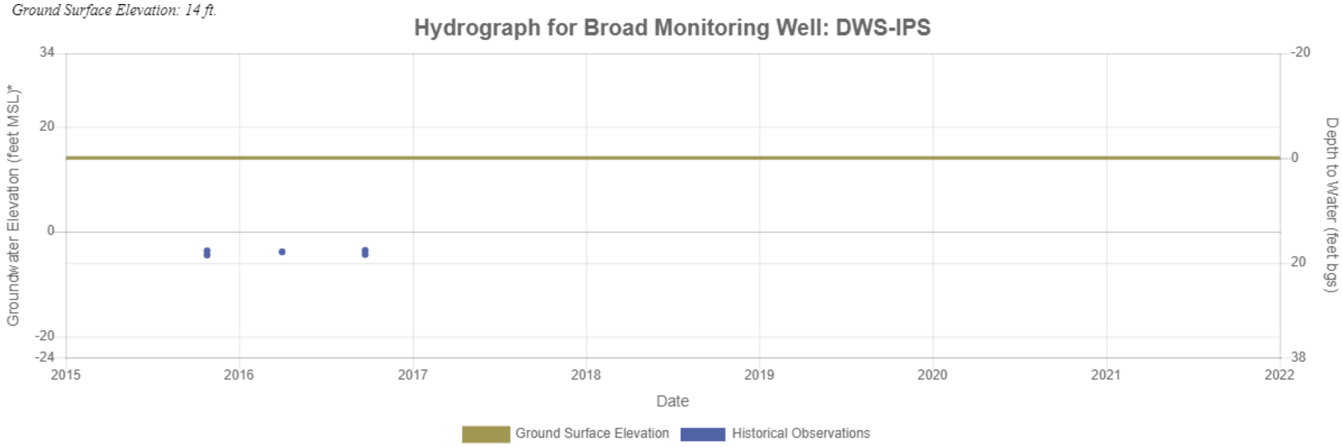
Ground Surface Elevation: 240 ft.

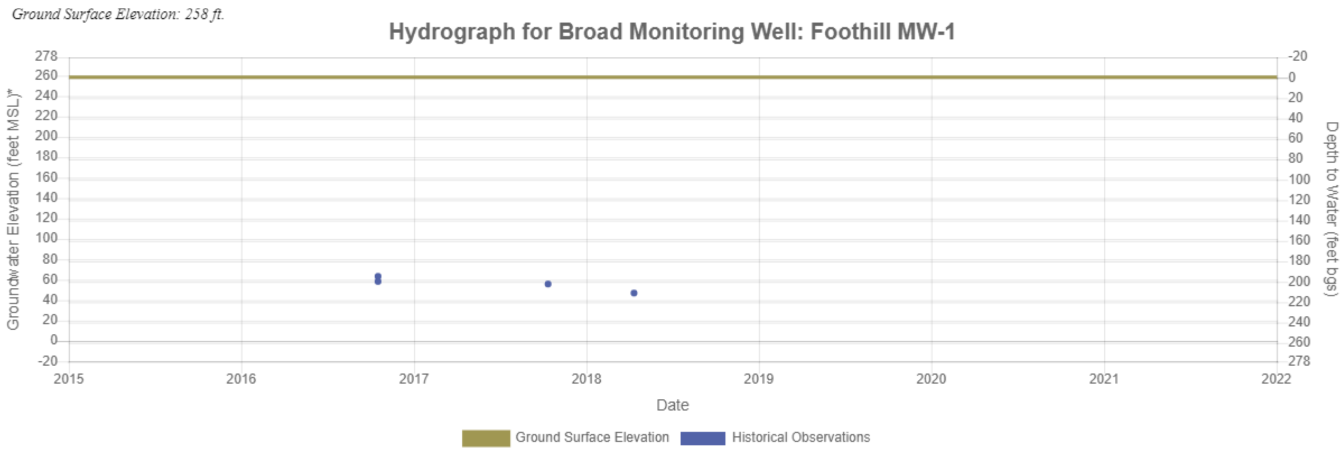


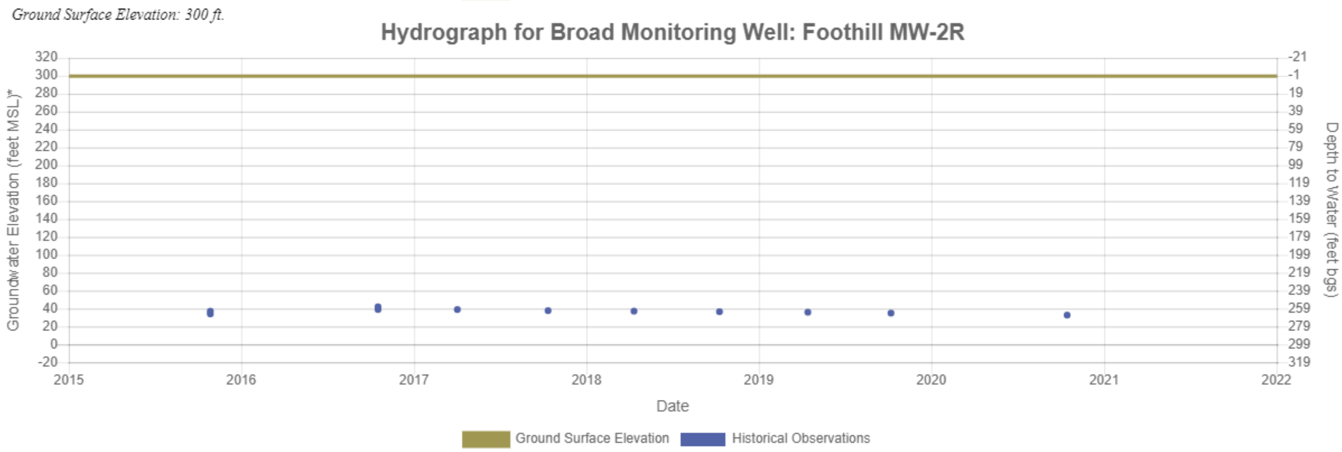
Ground Surface Elevation: 737 ft.

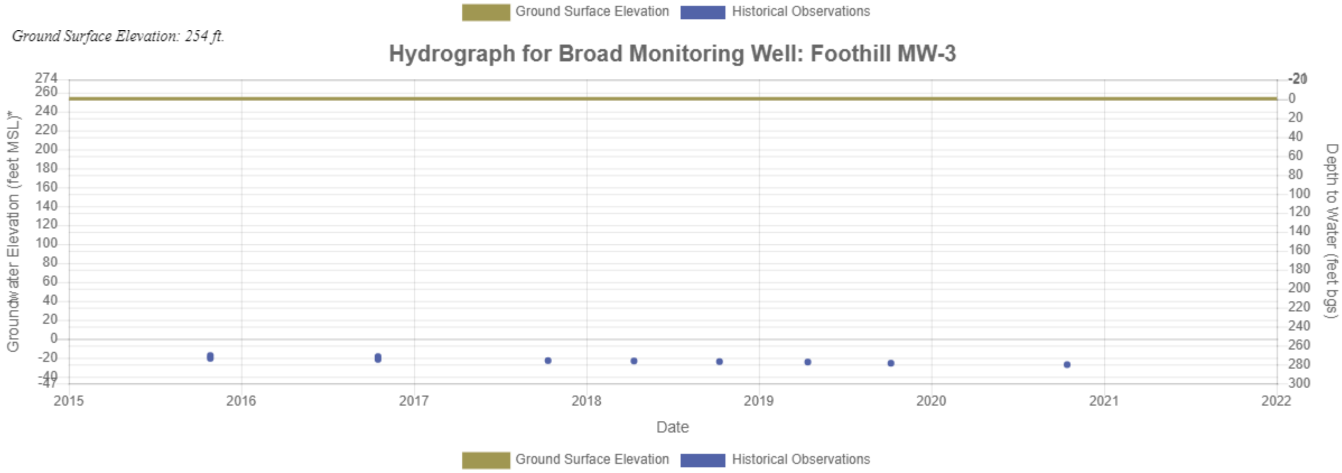


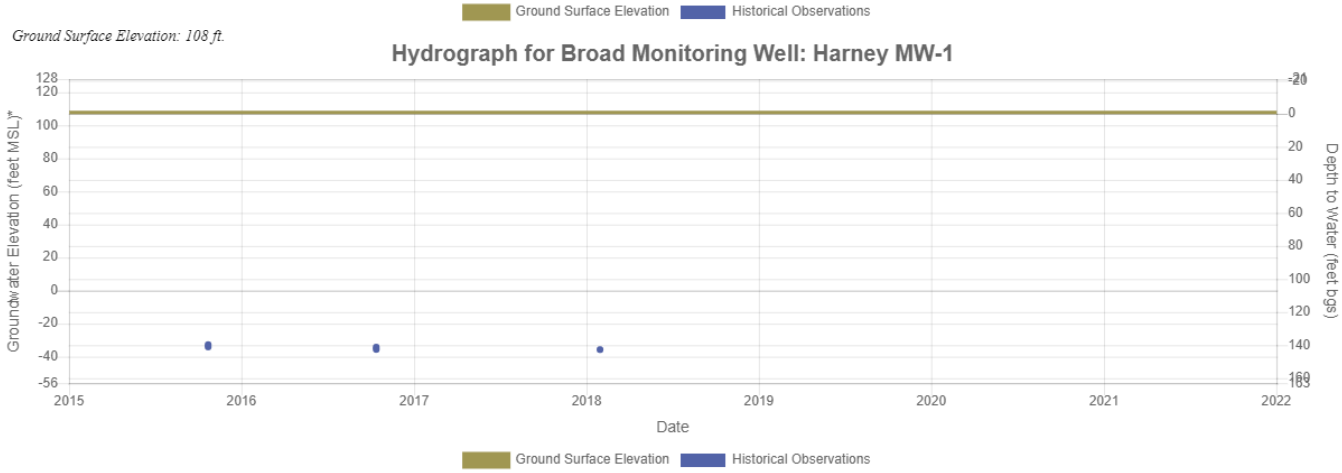
Ground Surface Elevation: 14 ft.

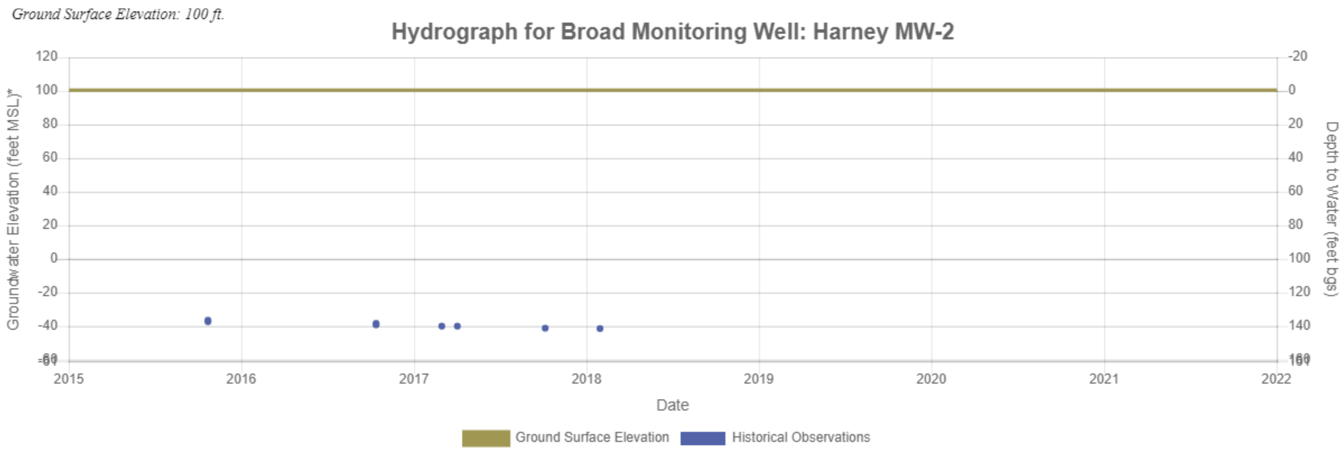


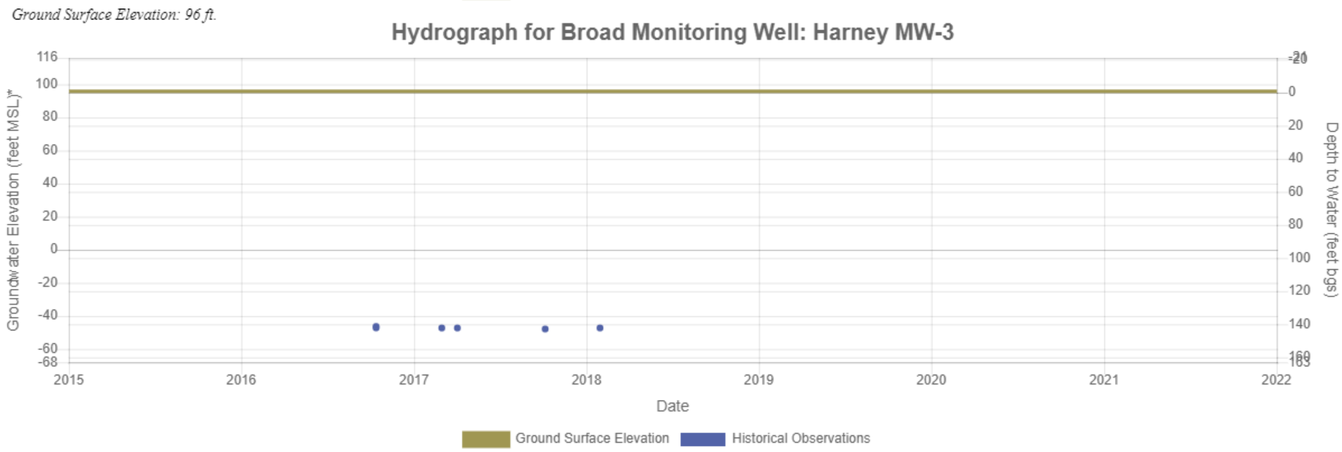

Ground Surface Elevation: 258 ft.
Hydrograph for Broad Monitoring Well: Foothill MW-1
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
2015 2016 2017 2018 2019 2020 2021 2022
Ground Surface Elevation
Historical Observations

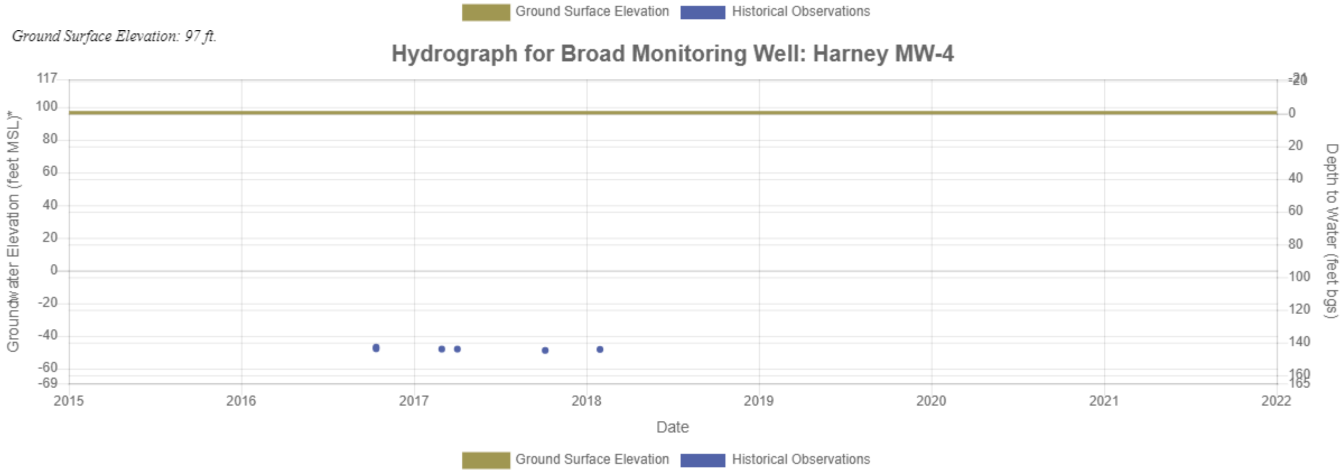

Ground Surface Elevation: 300 ft.
Hydrograph for Broad Monitoring Well: Foothill MW-2R
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
2015 2016 2017 2018 2019 2020 2021 2022
Ground Surface Elevation
Historical Observations

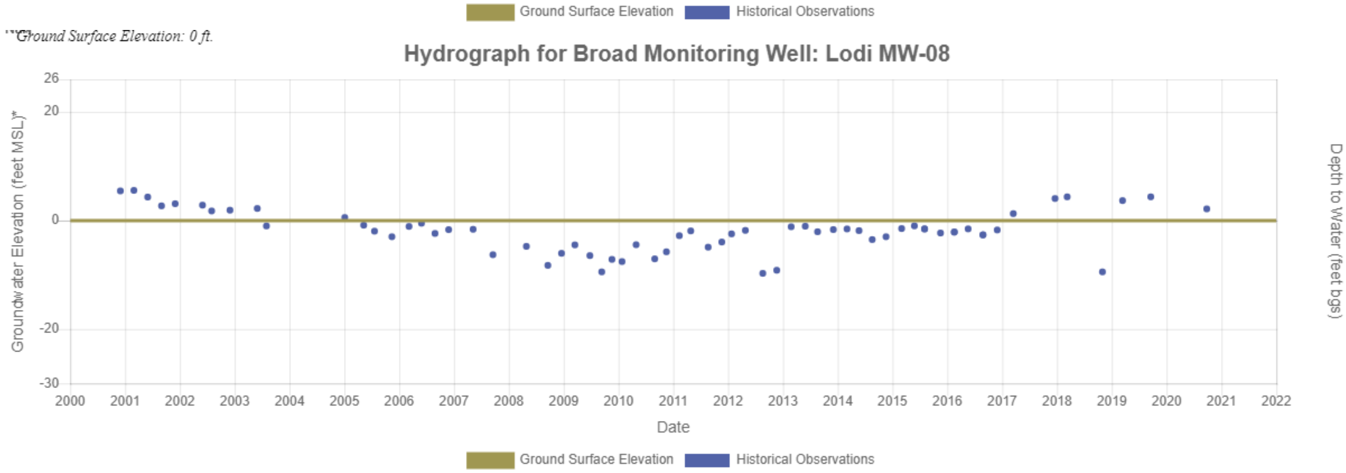

Ground Surface Elevation: 254 ft.
Hydrograph for Broad Monitoring Well: Foothill MW-3
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
2015 2016 2017 2018 2019 2020 2021 2022
Ground Surface Elevation
Historical Observations

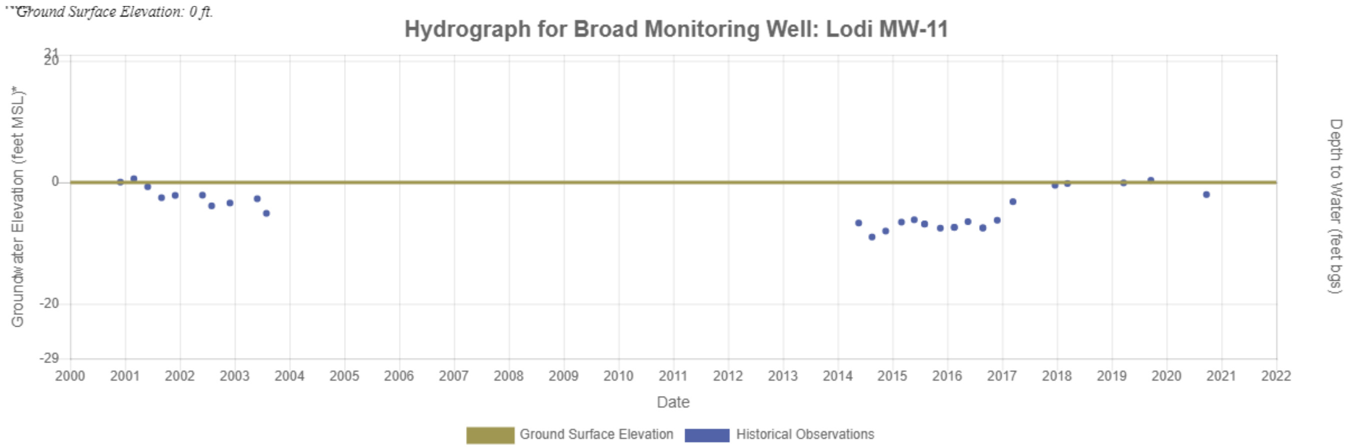

Ground Surface Elevation: 108 ft.
Hydrograph for Broad Monitoring Well: Harney MW-1
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
2015 2016 2017 2018 2019 2020 2021 2022
Ground Surface Elevation
Historical Observations

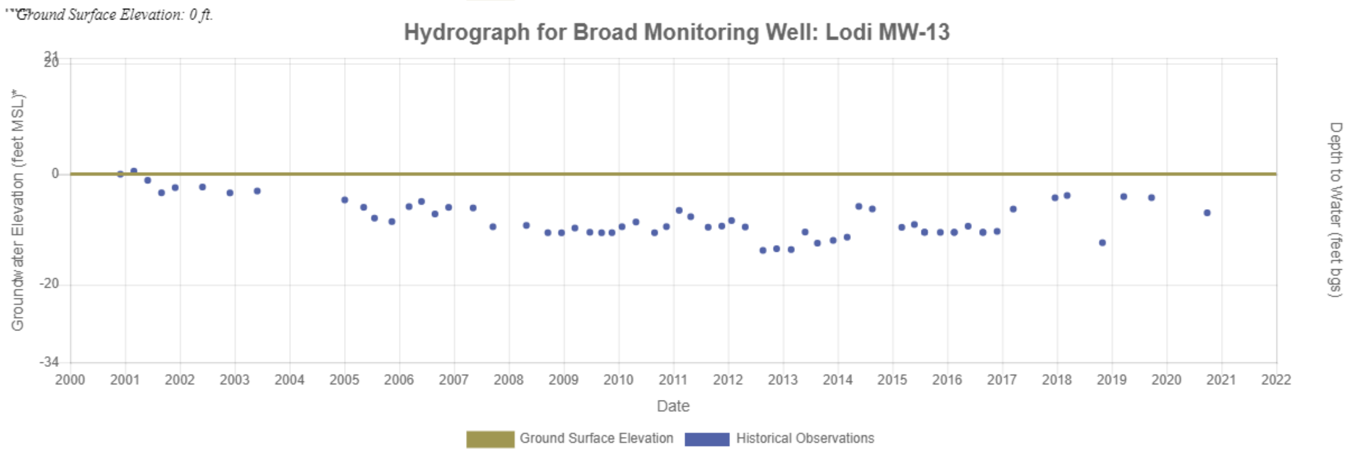

Ground Surface Elevation: 100 ft.
Hydrograph for Broad Monitoring Well: Harney MW-2
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

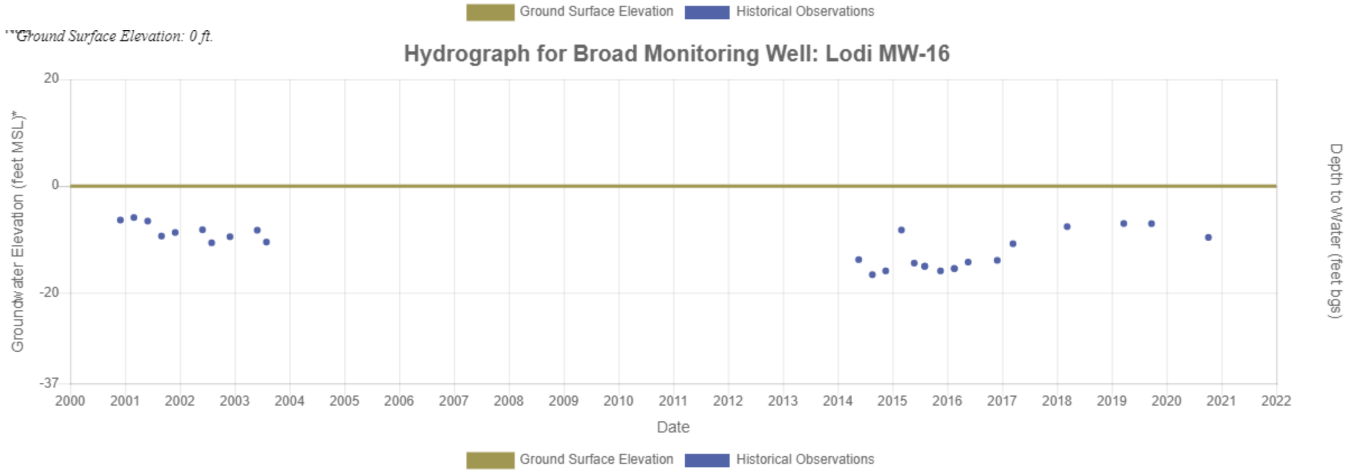

Ground Surface Elevation: 96 ft.
Hydrograph for Broad Monitoring Well: Harney MW-3
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

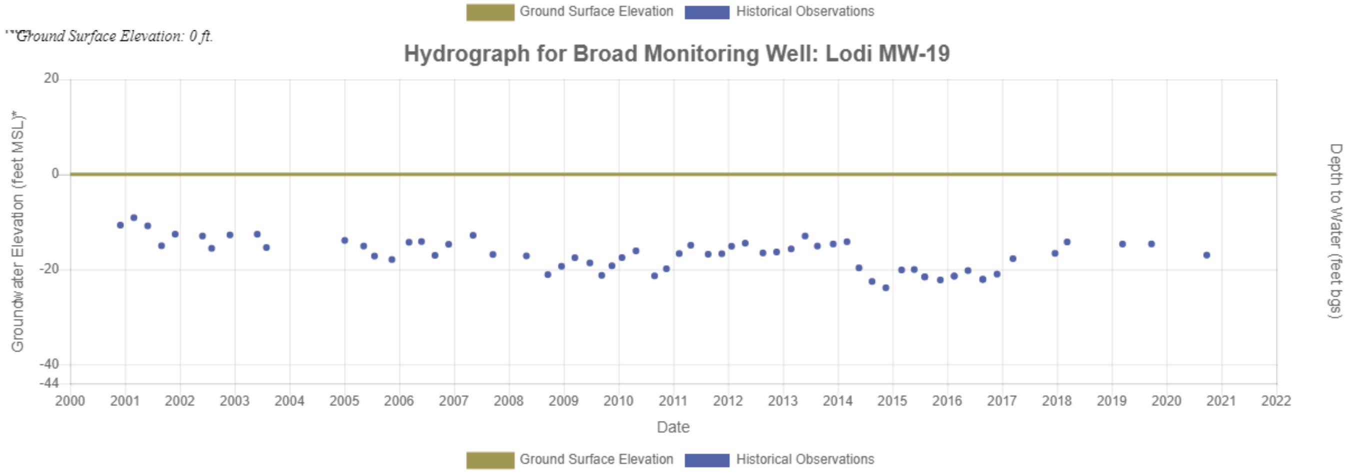

Ground Surface Elevation: 97 ft.
Hydrograph for Broad Monitoring Well: Harney MW-4
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

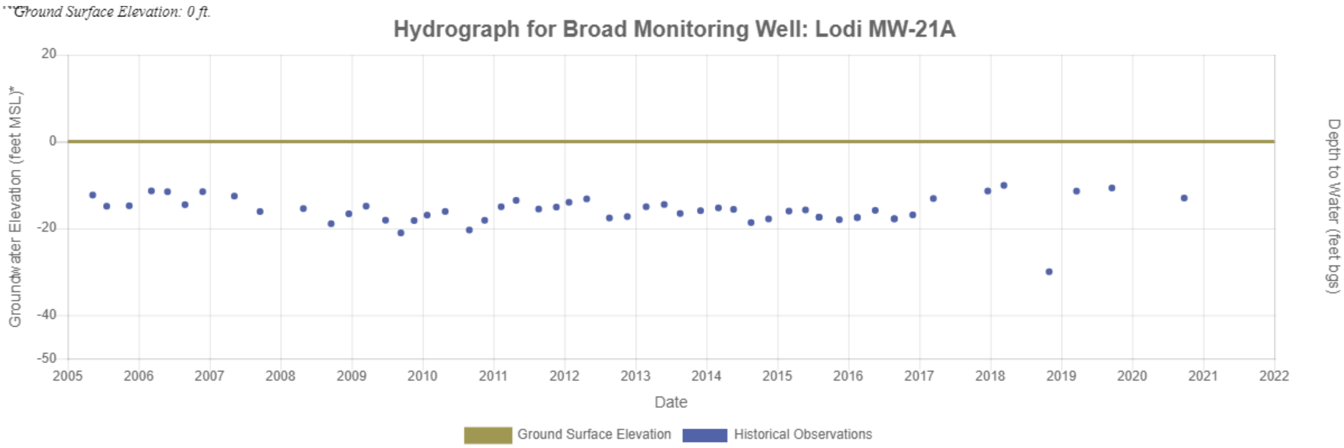

Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-08
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

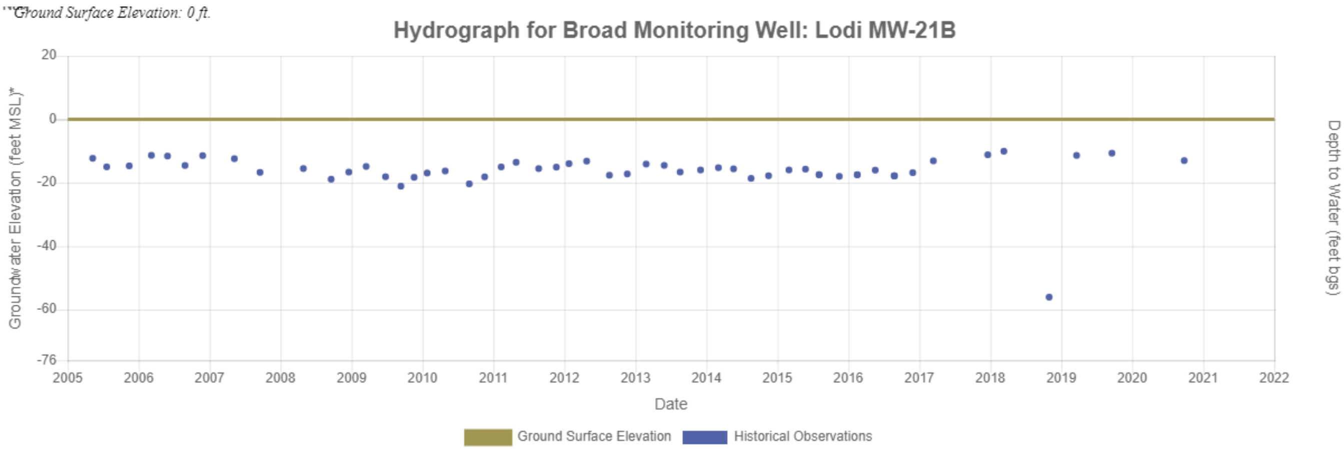

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-11
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

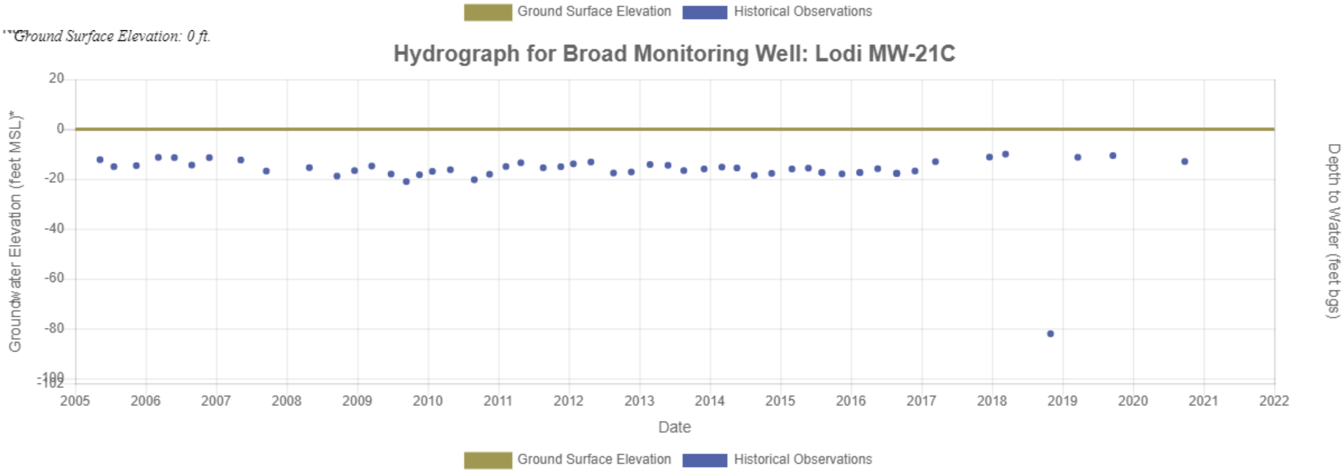

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-13
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

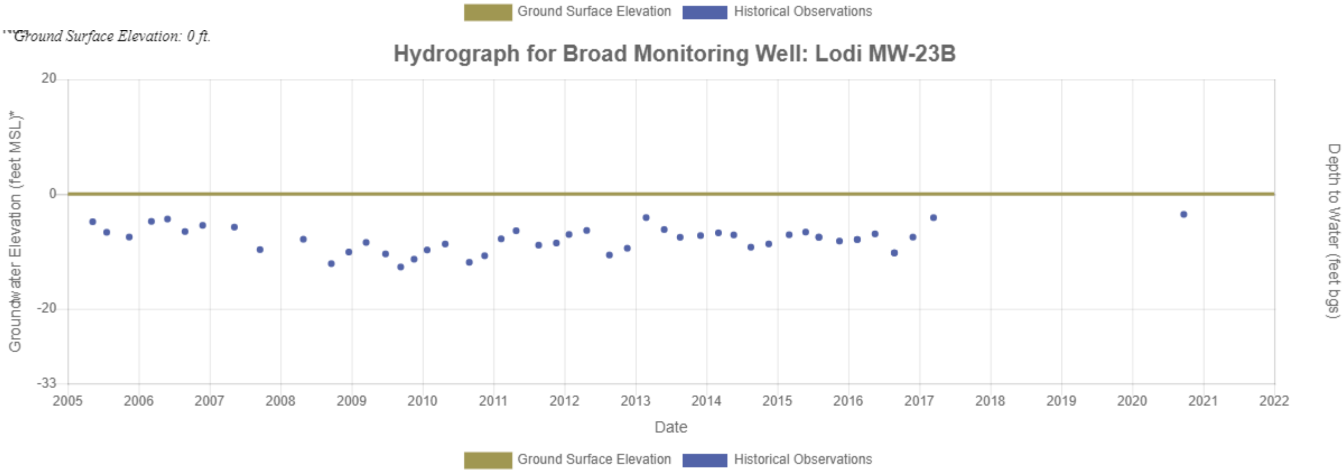

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-16
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-19
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

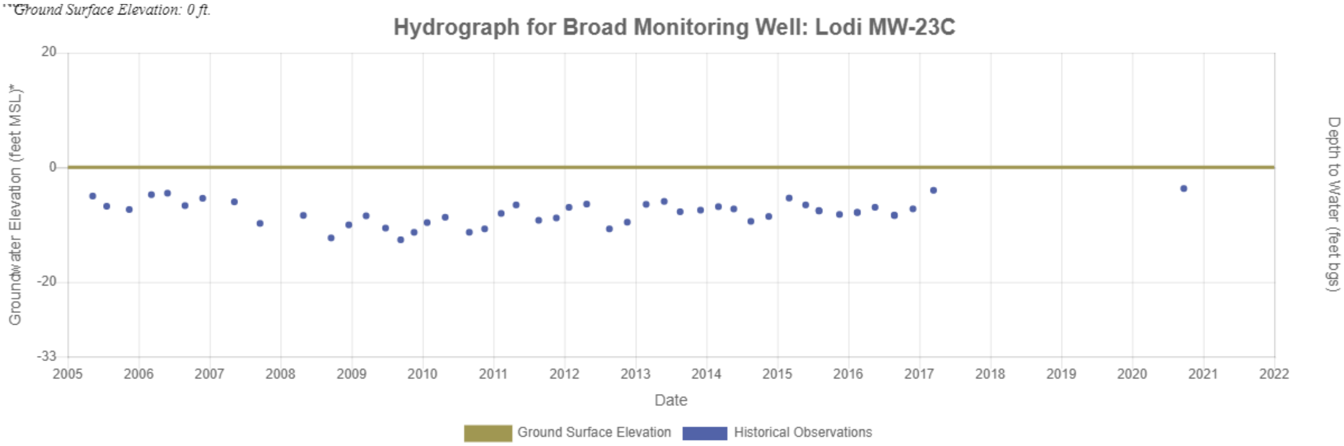

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-21A
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-21B
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

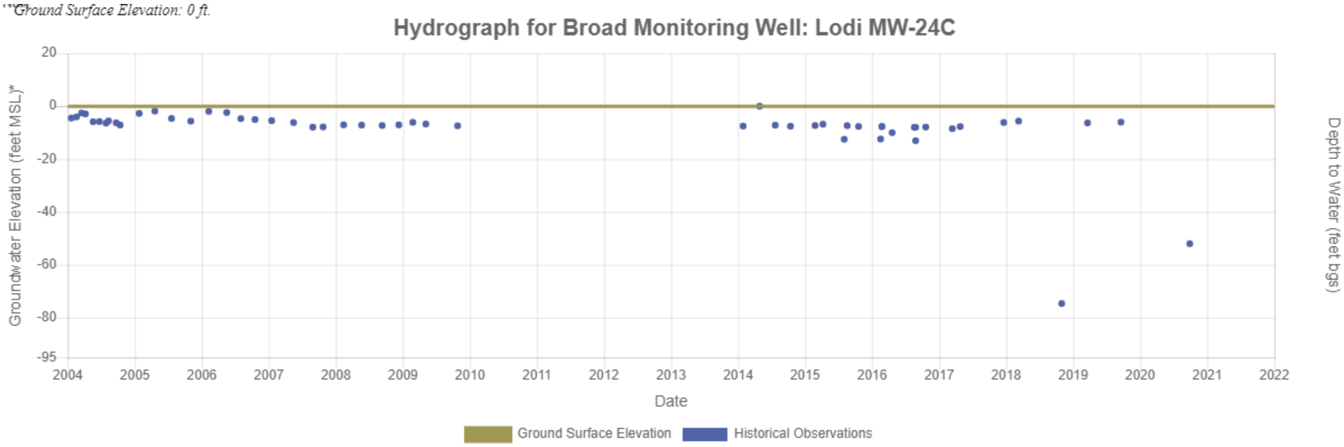

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-21C
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations


*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-23B
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

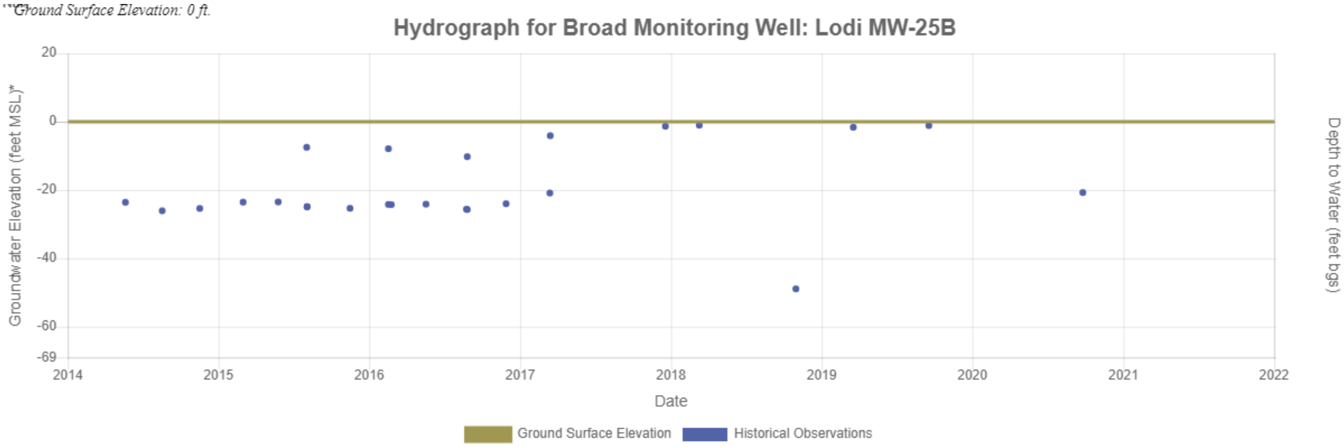
Ground Surface Elevation: 0 ft.



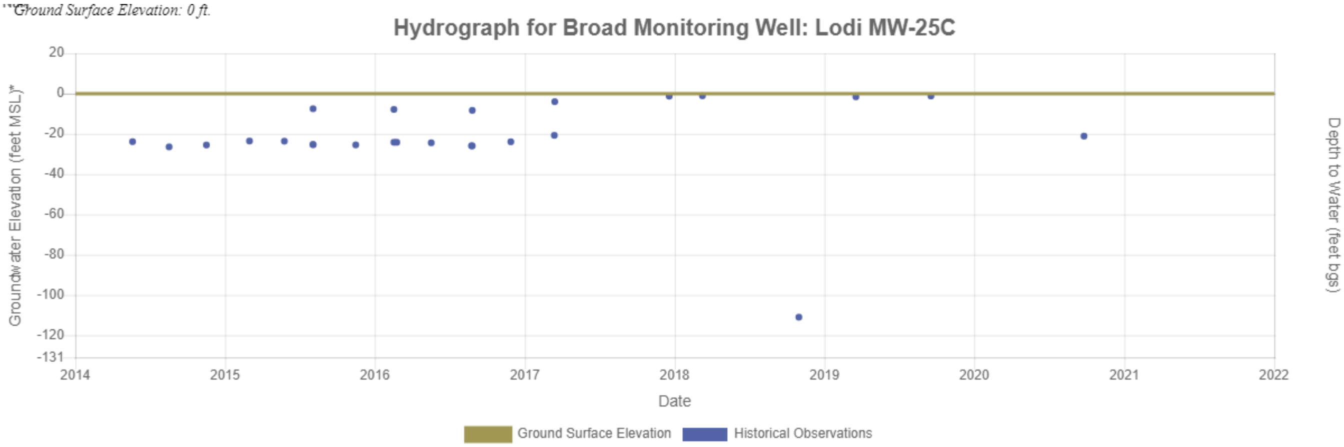
Ground Surface Elevation: 0 ft.

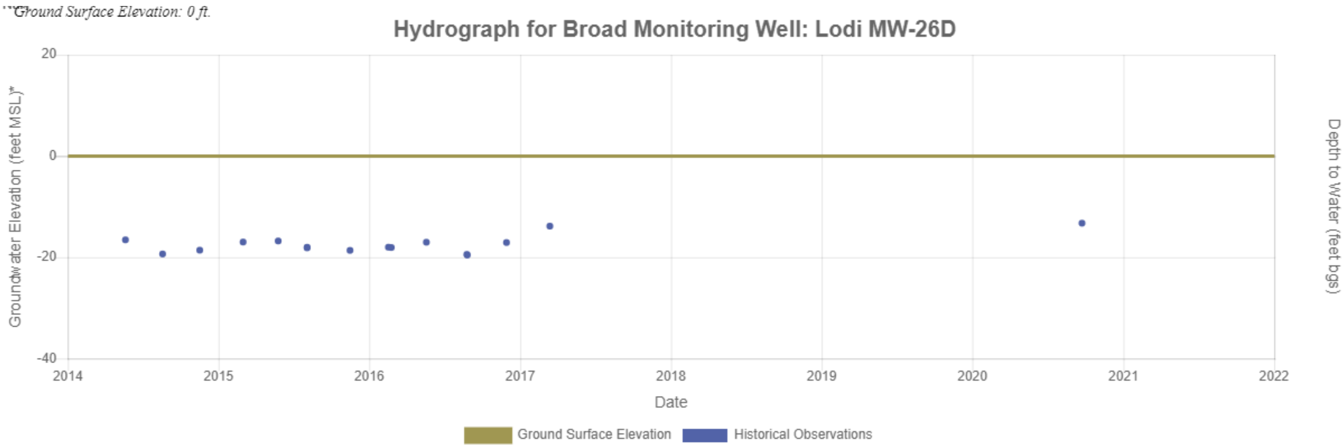


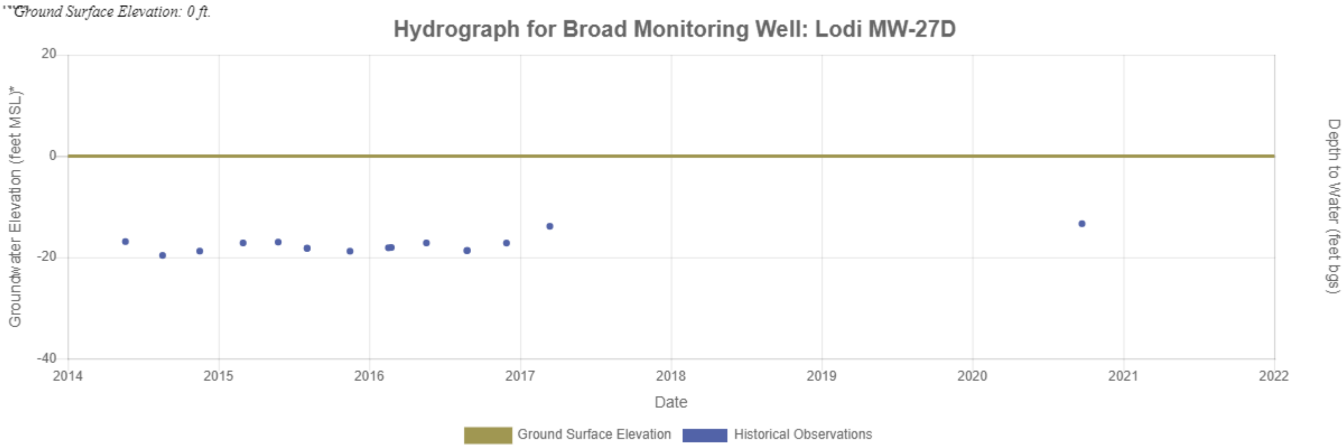
Ground Surface Elevation: 0 ft.

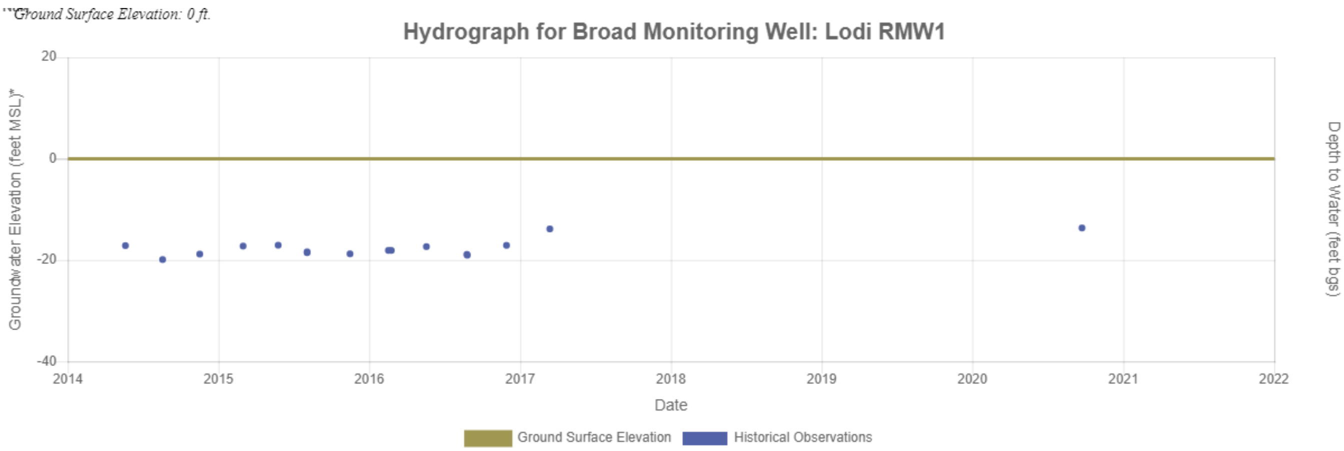


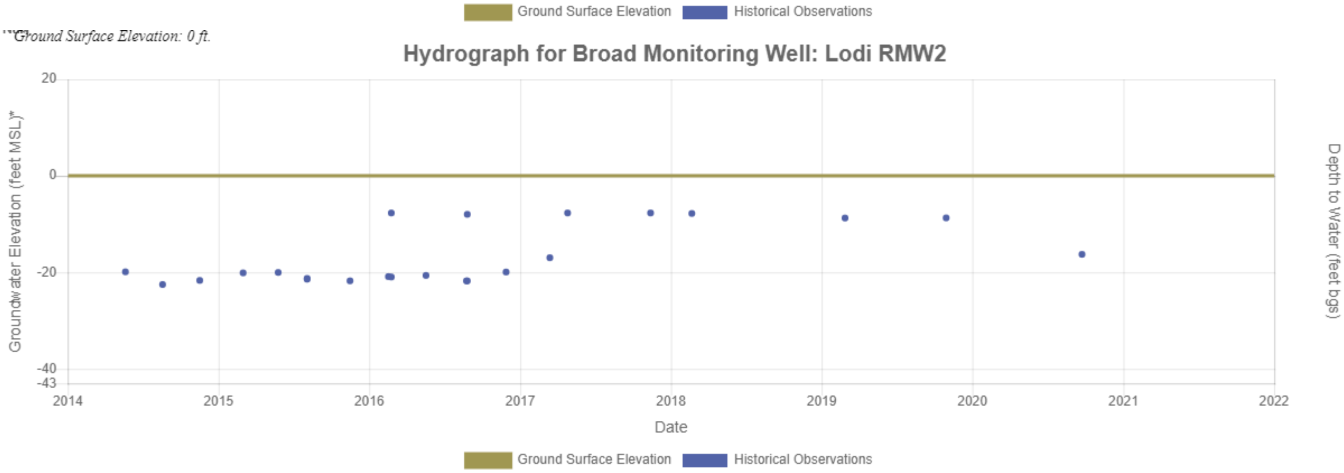
Ground Surface Elevation: 0 ft.

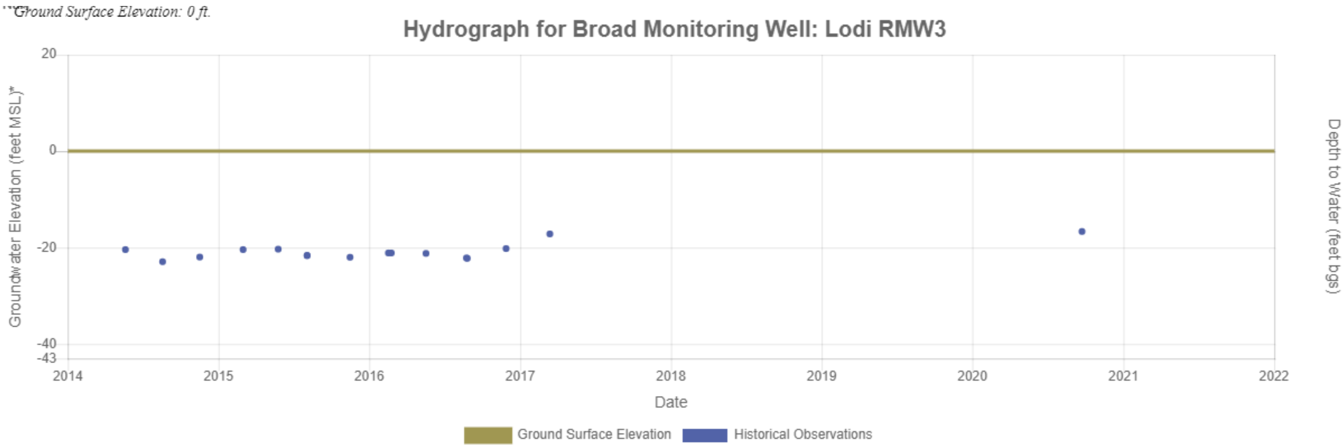


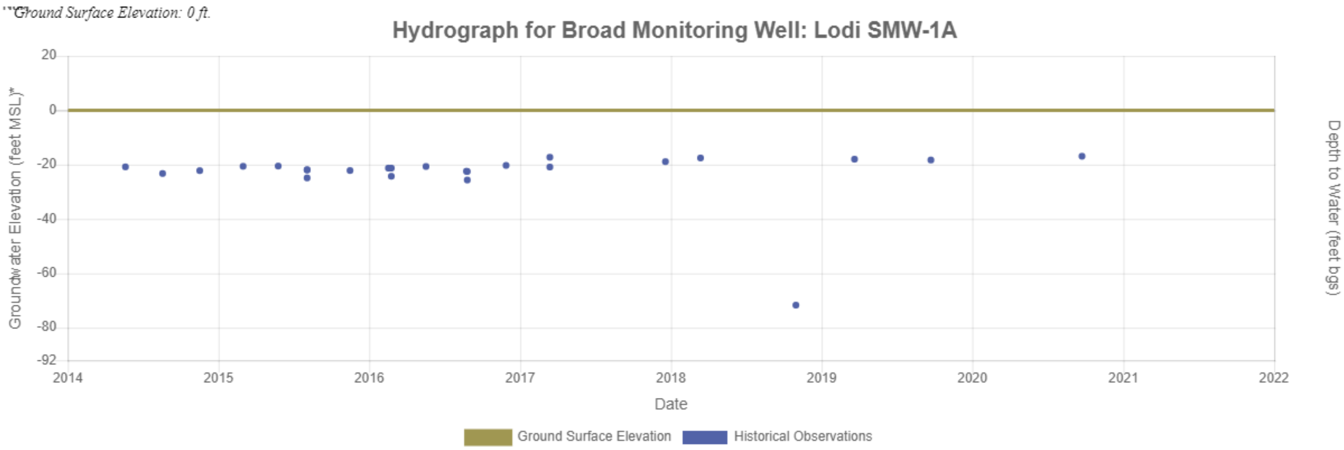

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-26D
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

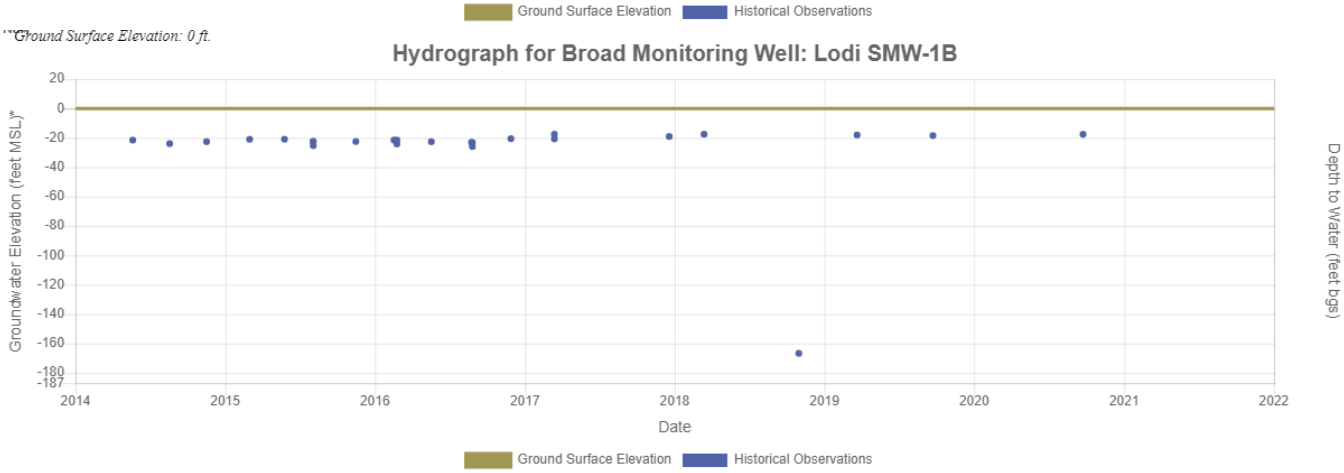

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi MW-27D
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

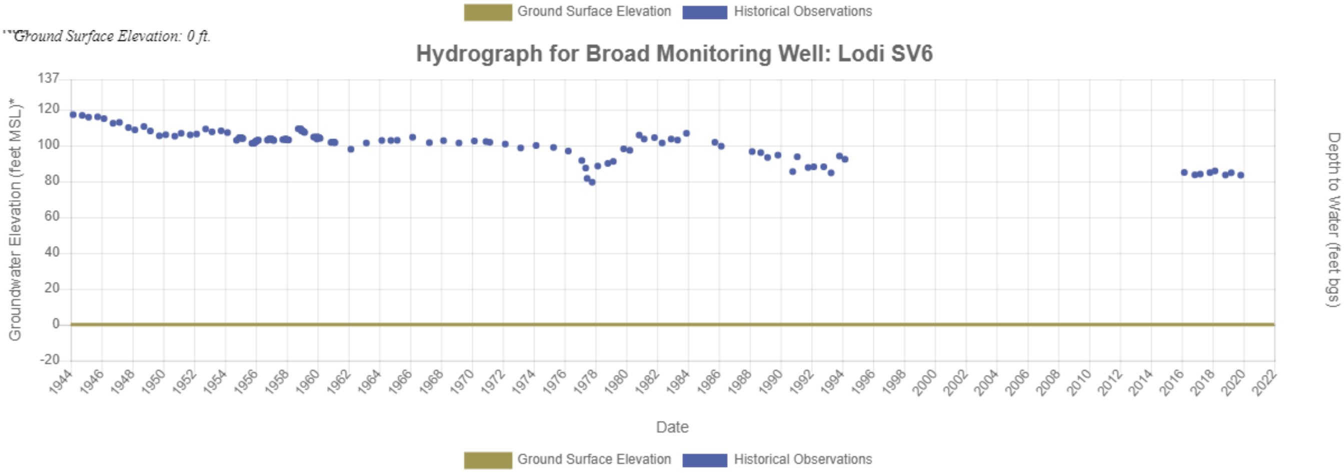

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi RMW1
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

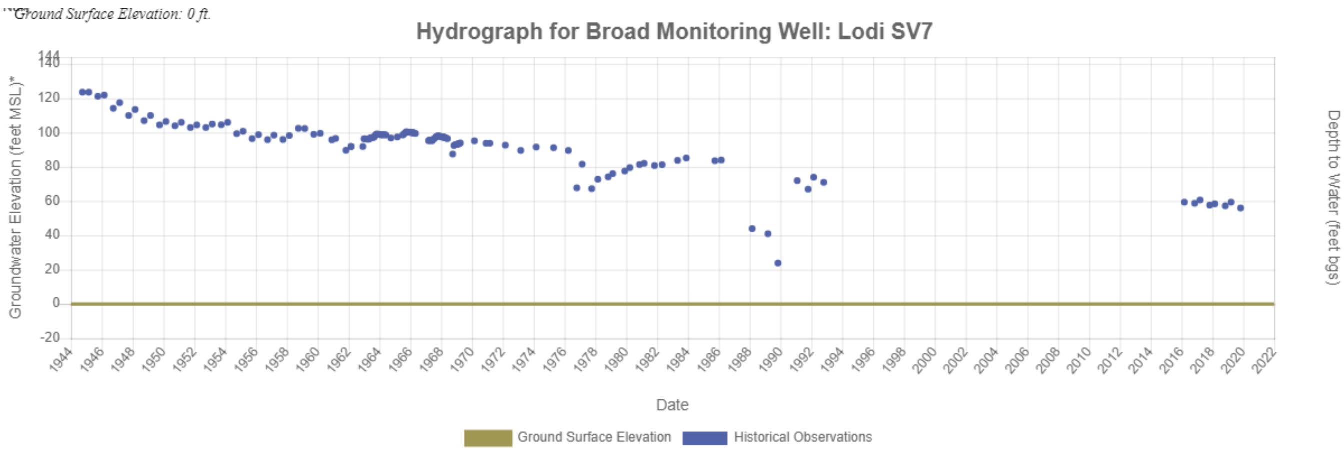

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi RMW2
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
-43
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

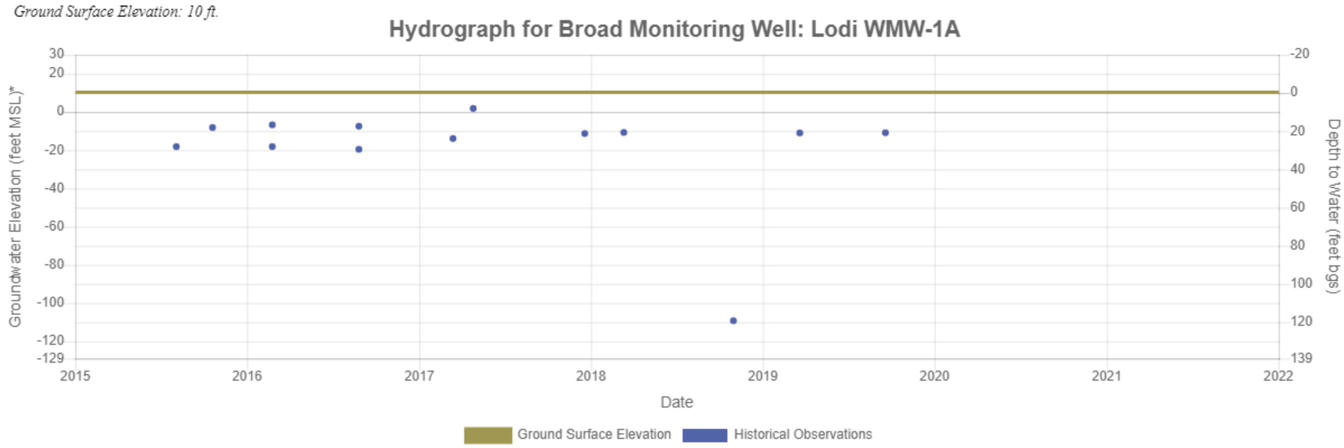

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi RMW3
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
-43
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

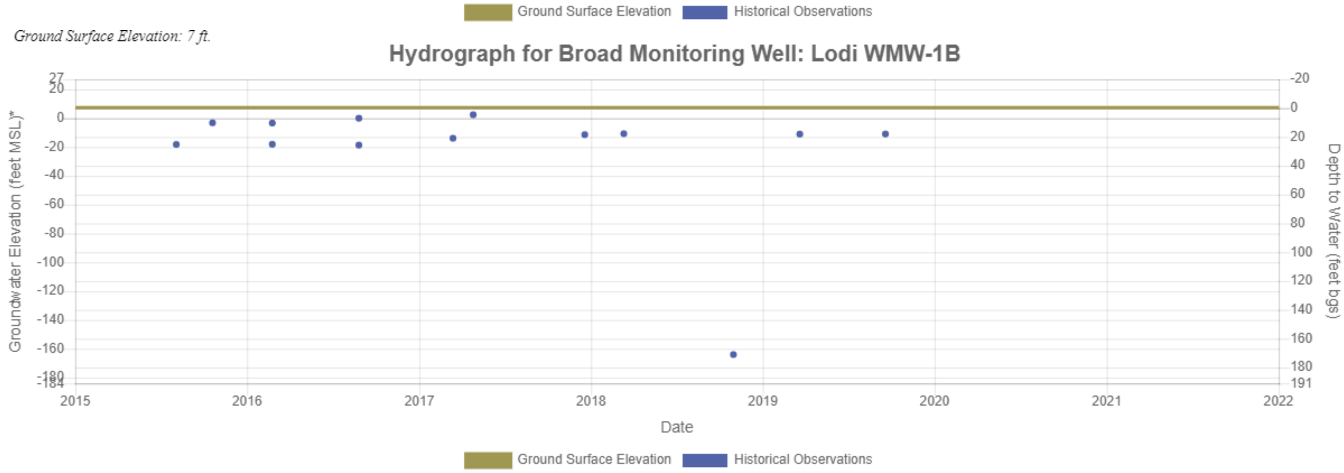

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi SMW-1A
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
-60
-80
-92
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

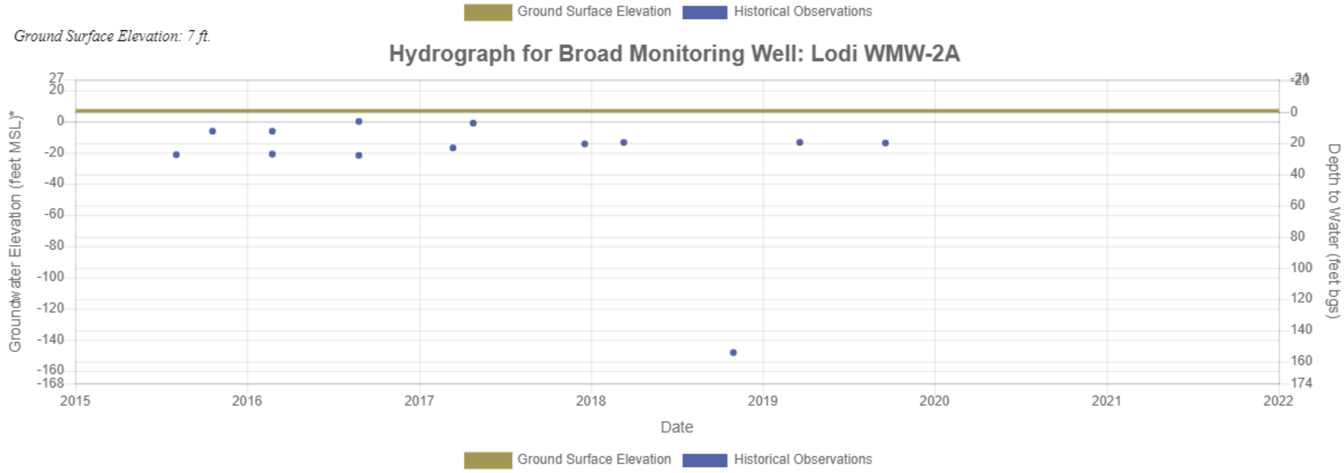

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi SMW-1B
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-187
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

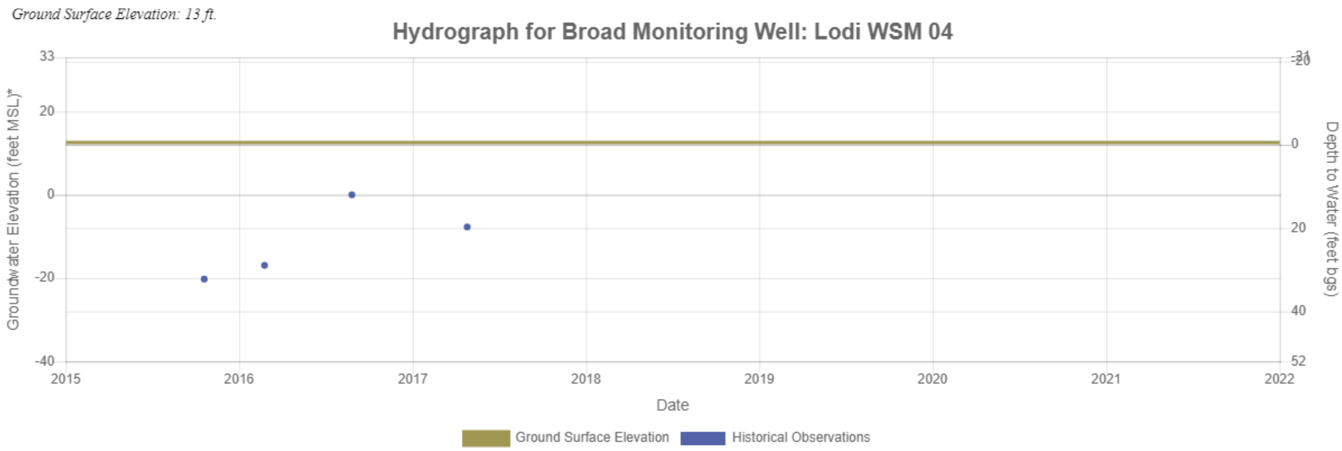

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi SV6
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
137
120
100
80
60
40
20
0
-20
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
Date
Ground Surface Elevation
Historical Observations

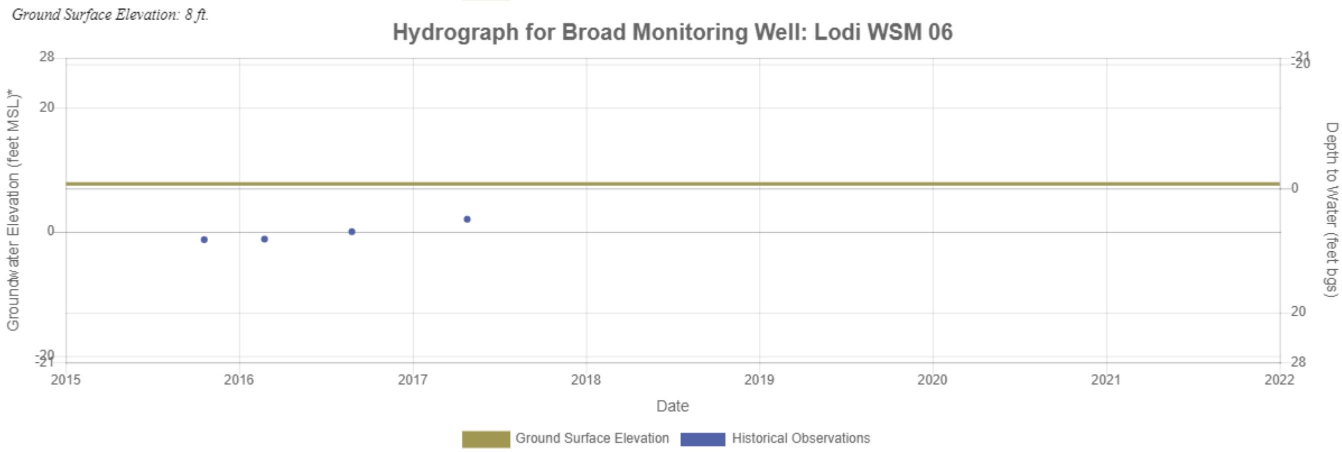

Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Lodi SV7
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

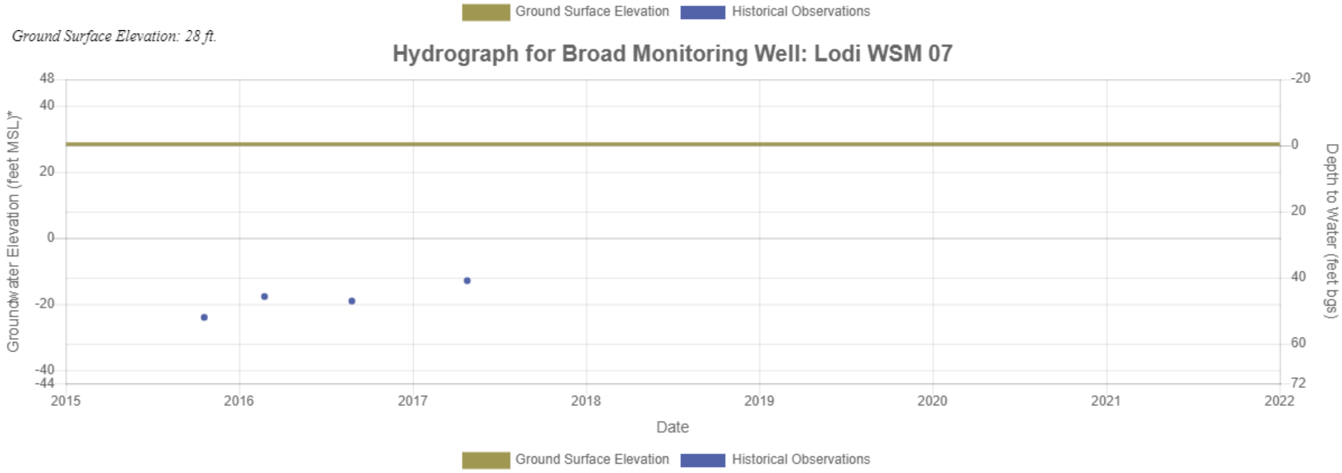

Ground Surface Elevation: 10 ft.
Hydrograph for Broad Monitoring Well: Lodi WMW-1A
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

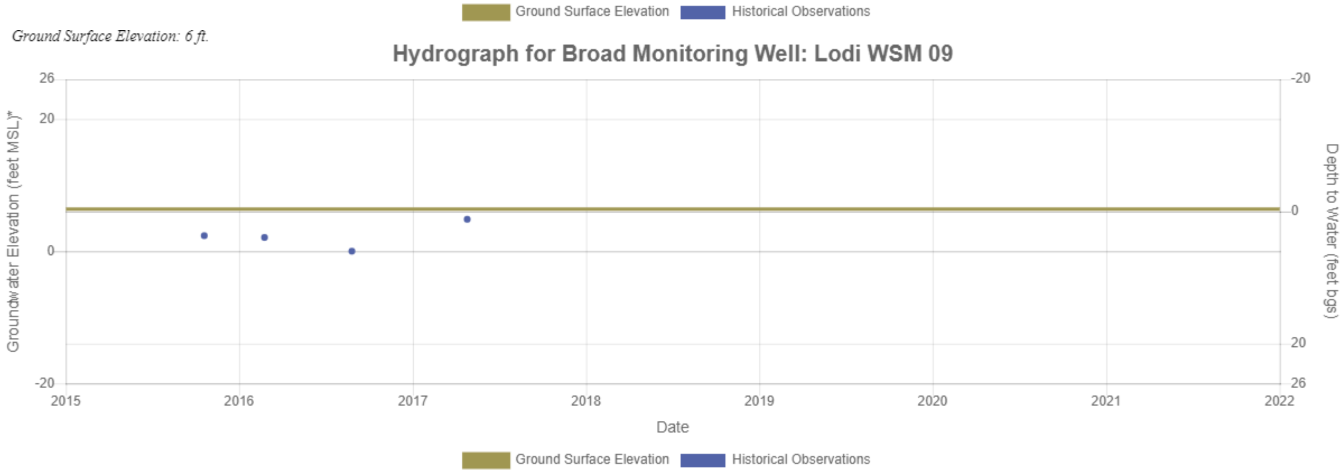

Ground Surface Elevation: 7 ft.
Hydrograph for Broad Monitoring Well: Lodi WMW-1B
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

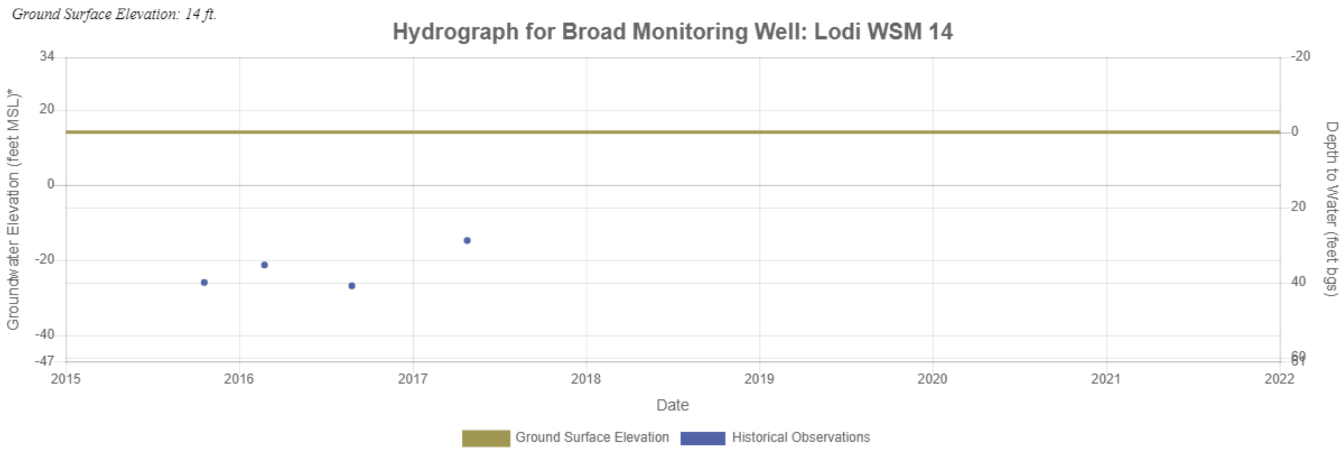

Ground Surface Elevation: 7 ft.
Hydrograph for Broad Monitoring Well: Lodi WMW-2A
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

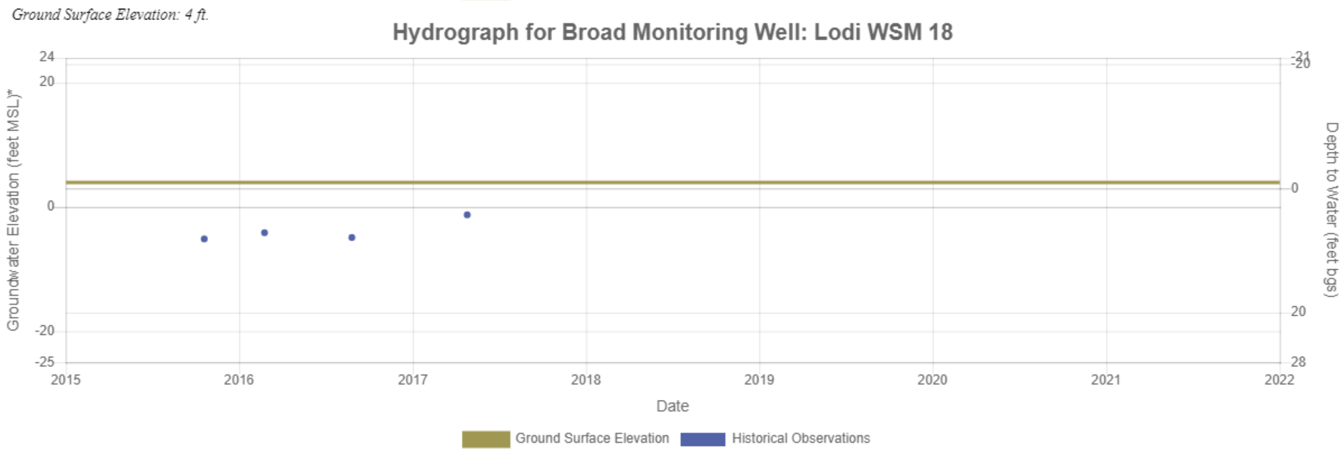

Ground Surface Elevation: 13 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 04
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

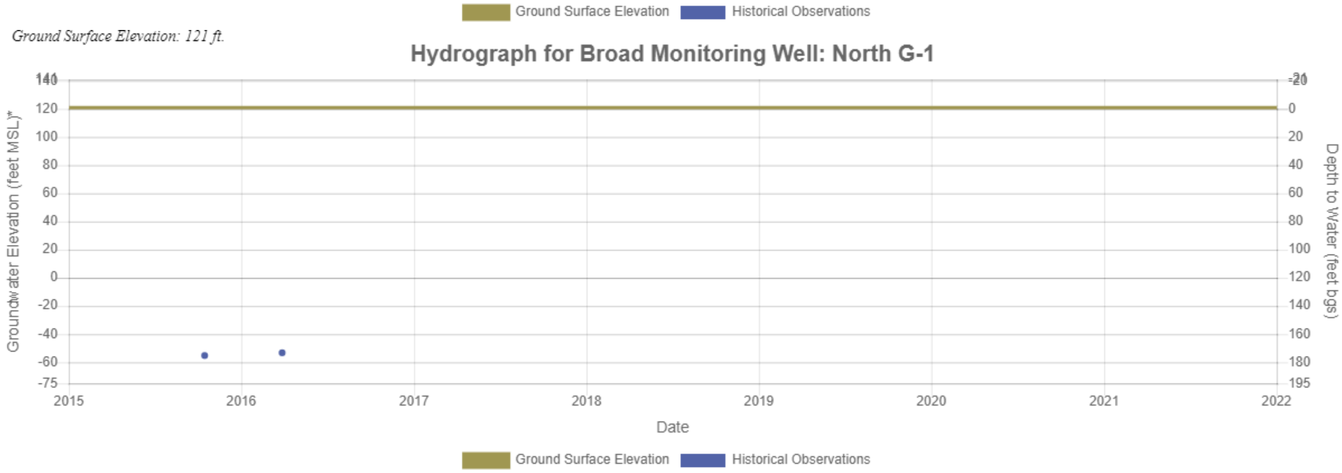

Ground Surface Elevation: 8 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 06
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

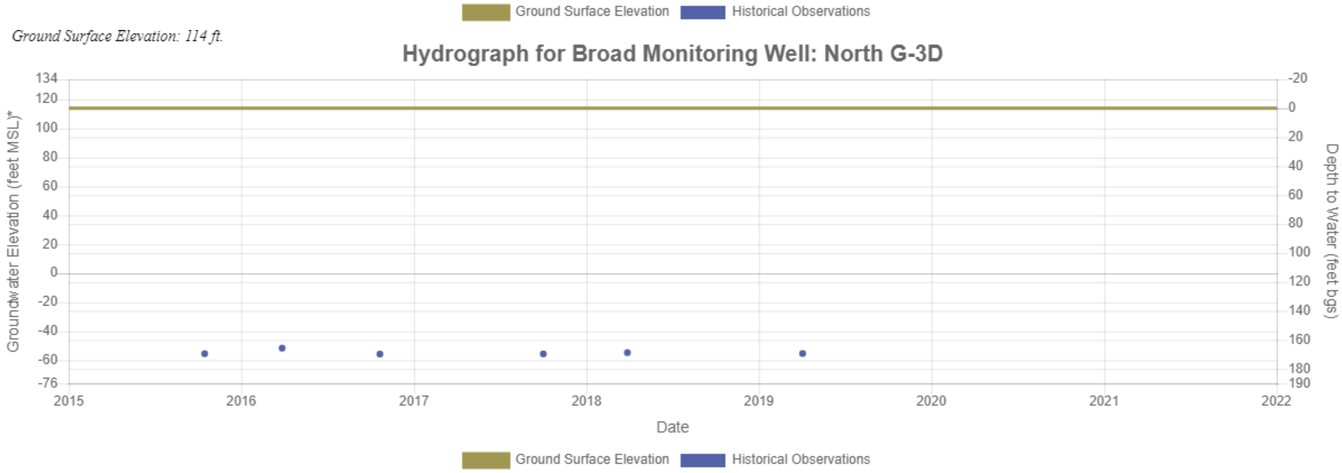

Ground Surface Elevation: 28 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 07
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

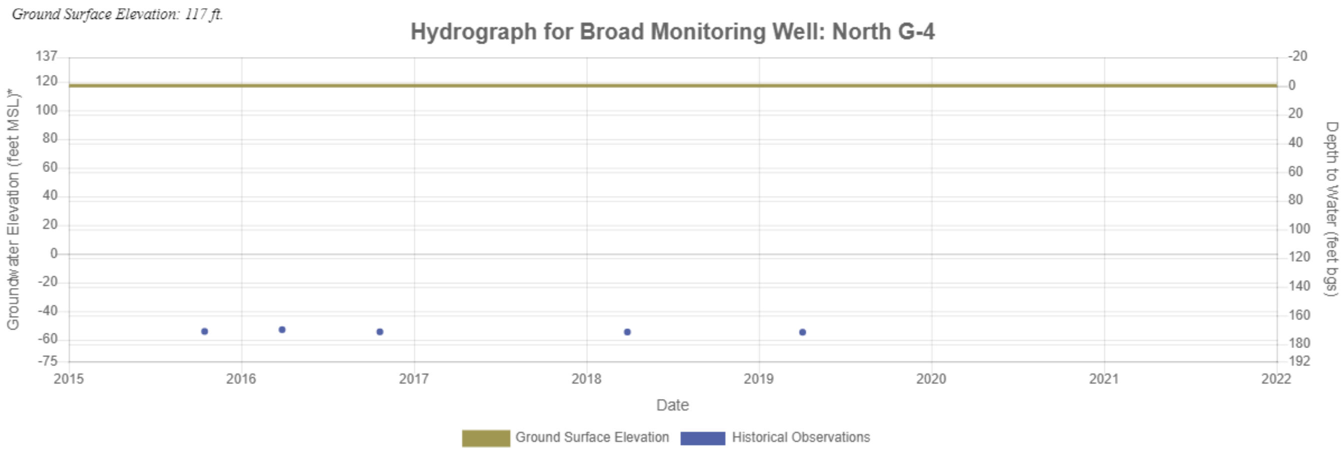

Ground Surface Elevation: 6 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 09
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

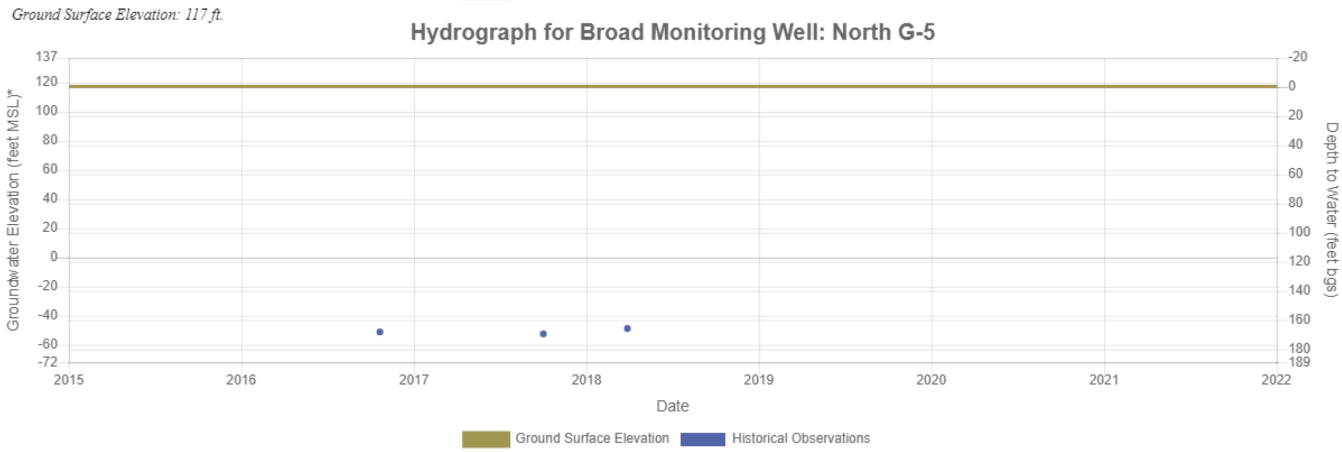

Ground Surface Elevation: 14 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 14
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

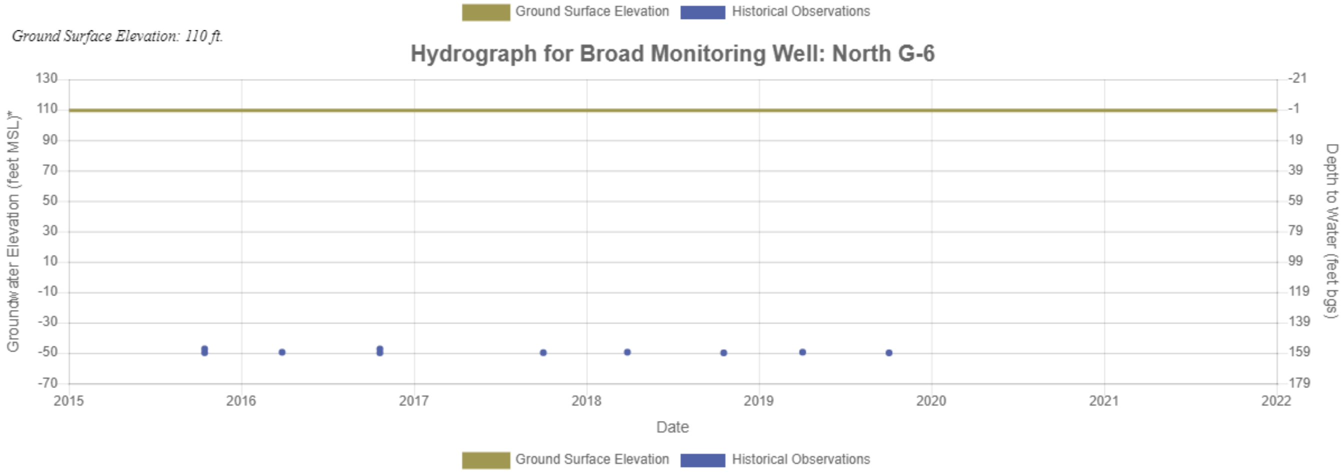

Ground Surface Elevation: 4 ft.
Hydrograph for Broad Monitoring Well: Lodi WSM 18
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

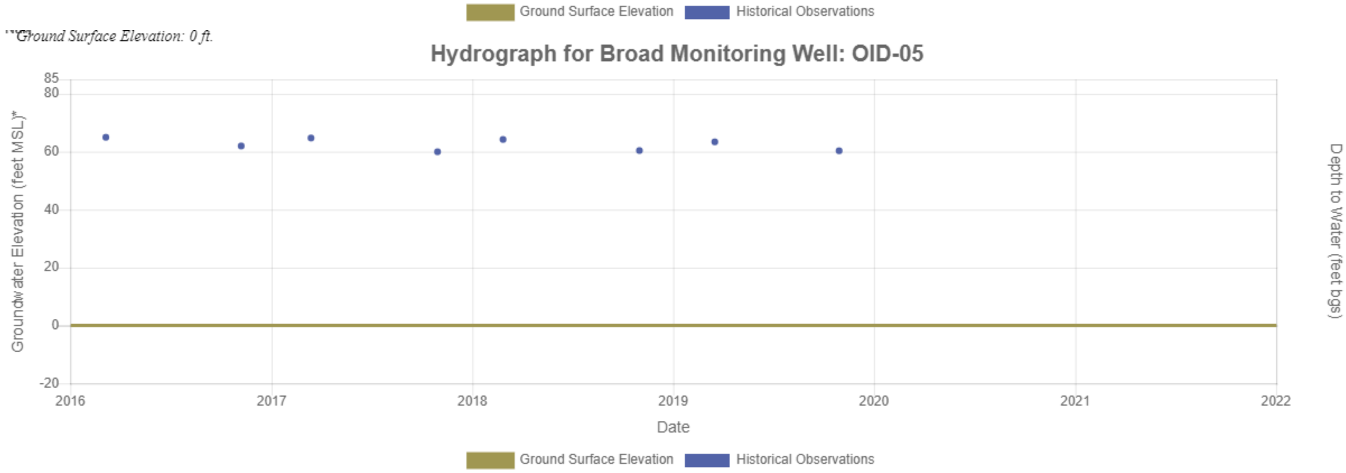

Ground Surface Elevation: 121 ft.
Hydrograph for Broad Monitoring Well: North G-1
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

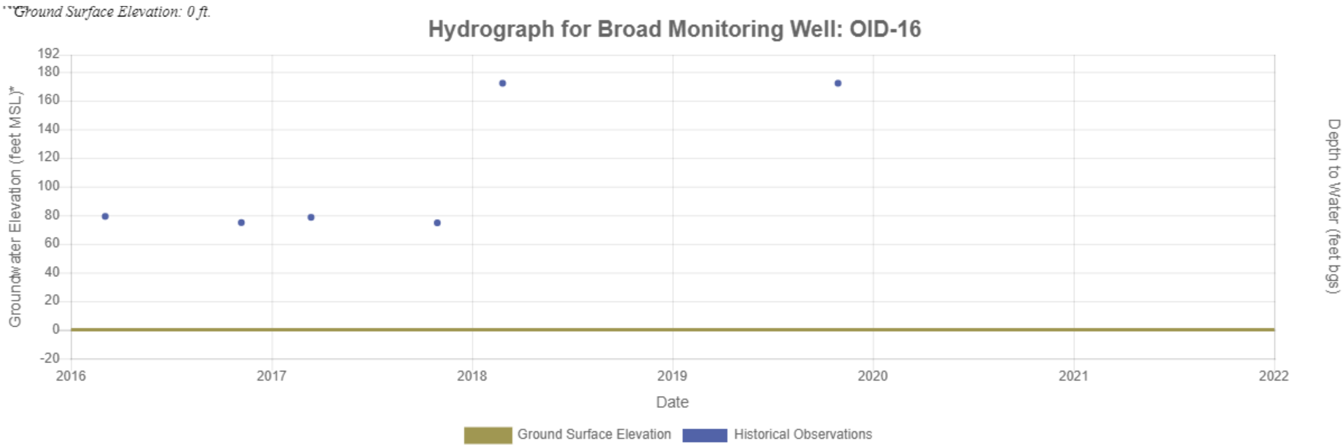

Ground Surface Elevation: 114 ft.
Hydrograph for Broad Monitoring Well: North G-3D
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

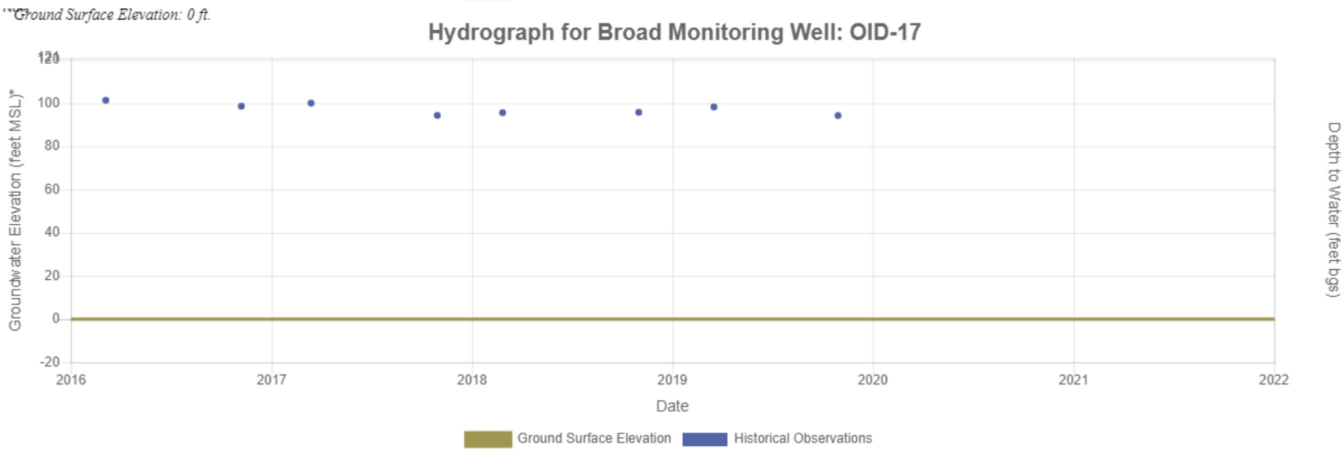

Ground Surface Elevation: 117 ft.
Hydrograph for Broad Monitoring Well: North G-4
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

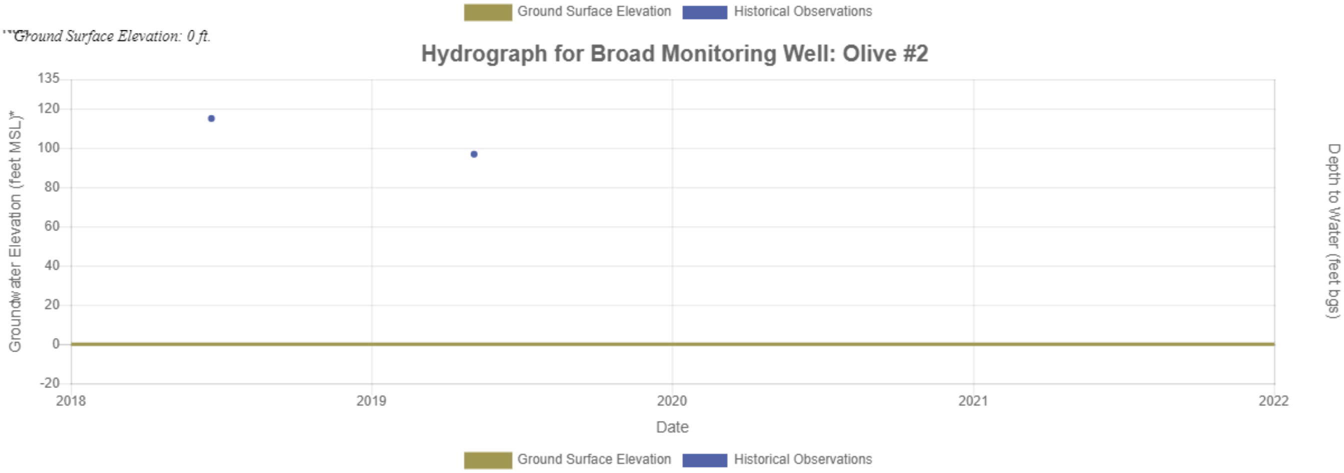

Ground Surface Elevation: 117 ft.
Hydrograph for Broad Monitoring Well: North G-5
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

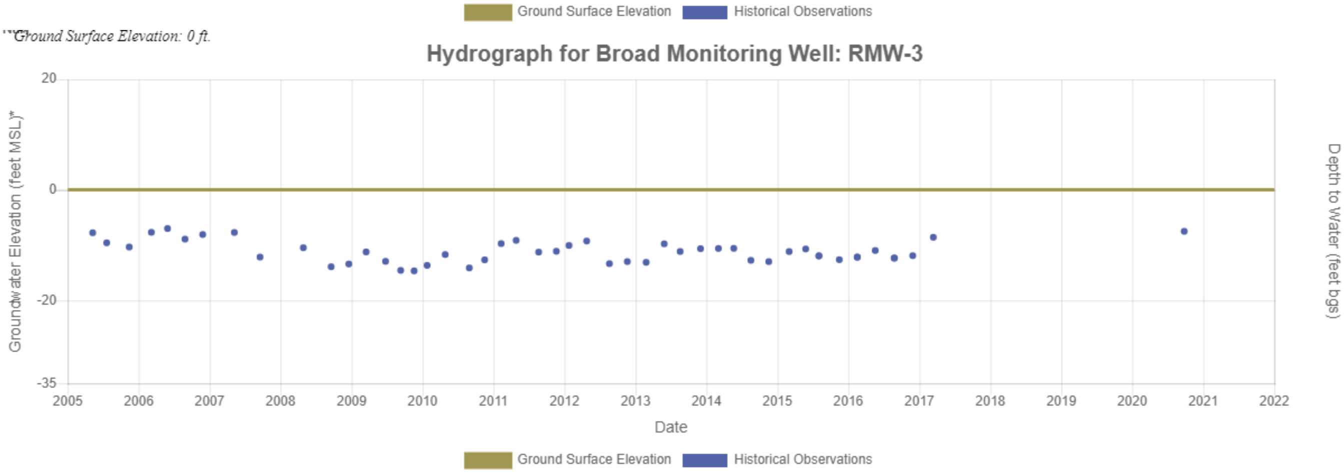

Ground Surface Elevation: 110 ft.
Hydrograph for Broad Monitoring Well: North G-6
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

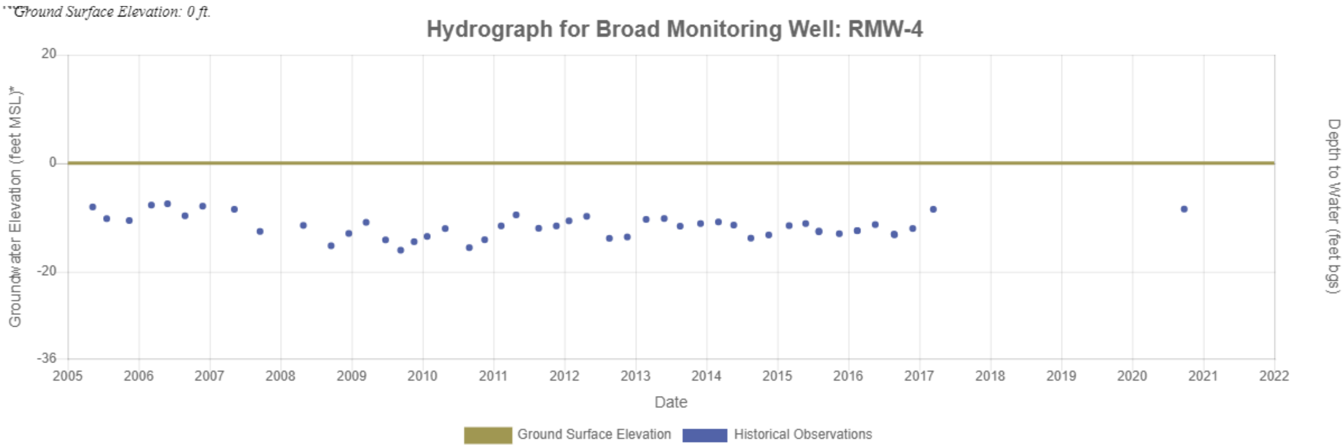

Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: OID-05
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

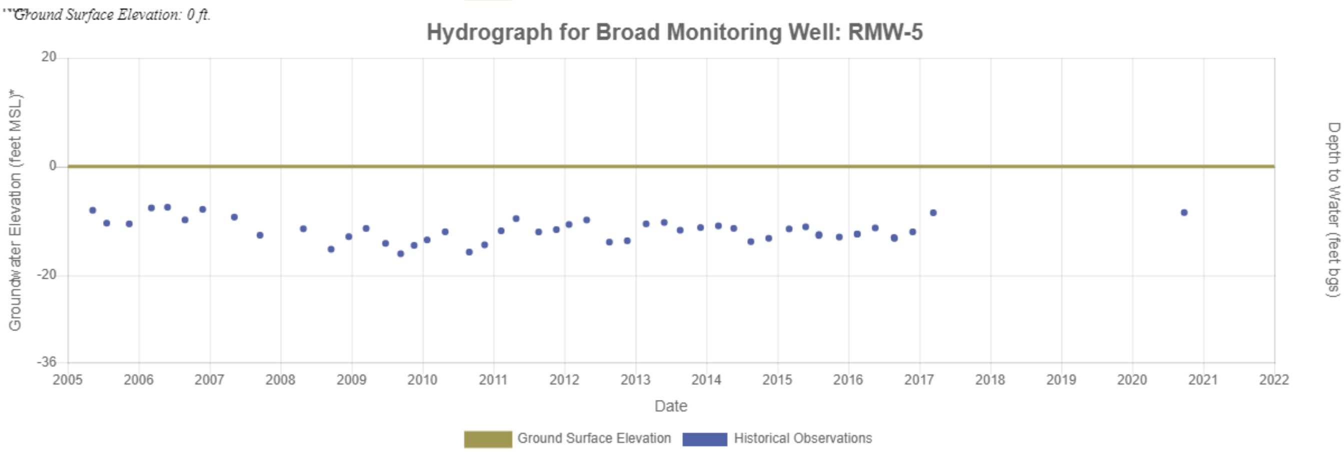

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: OID-16
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

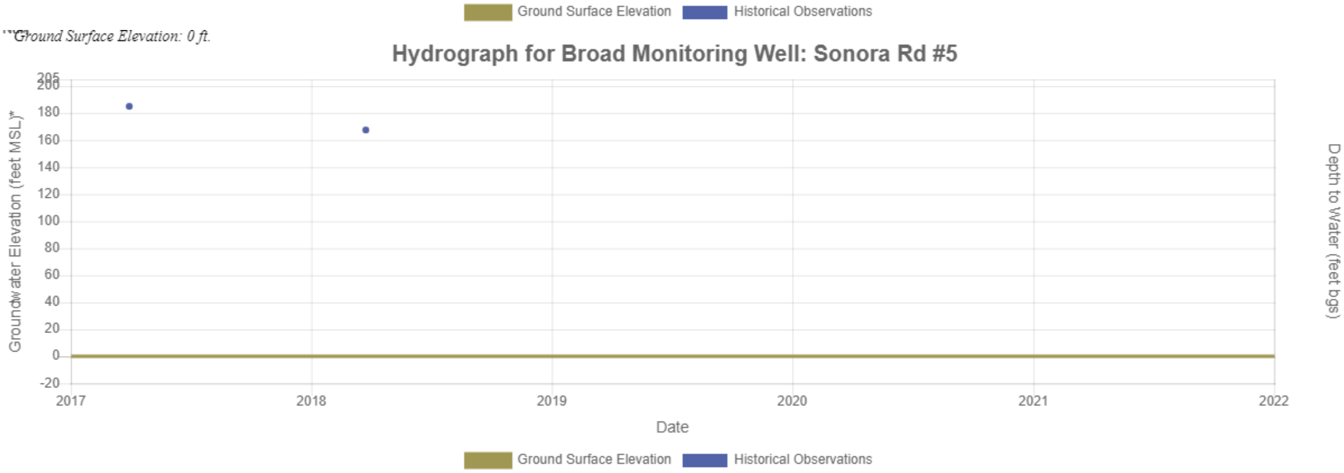

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: OID-17
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

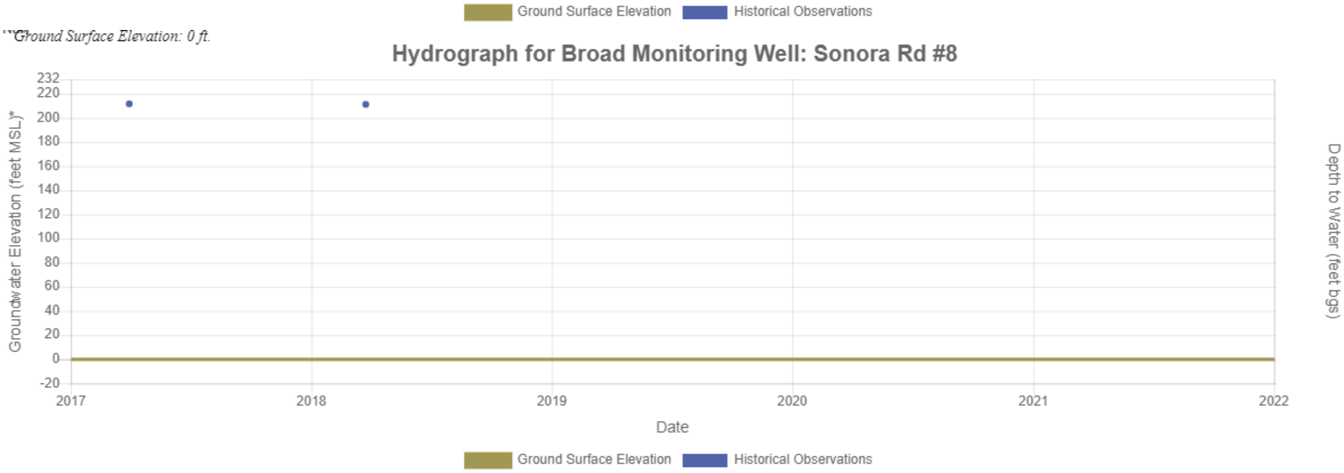

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Olive #2
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

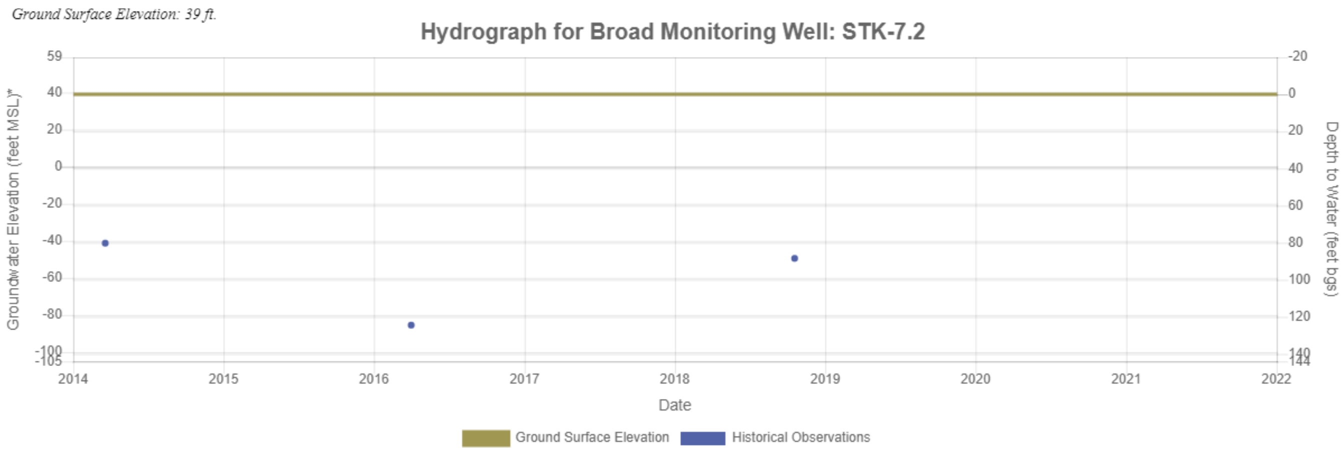

*Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: RMW-3
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Date
Ground Surface Elevation
Historical Observations

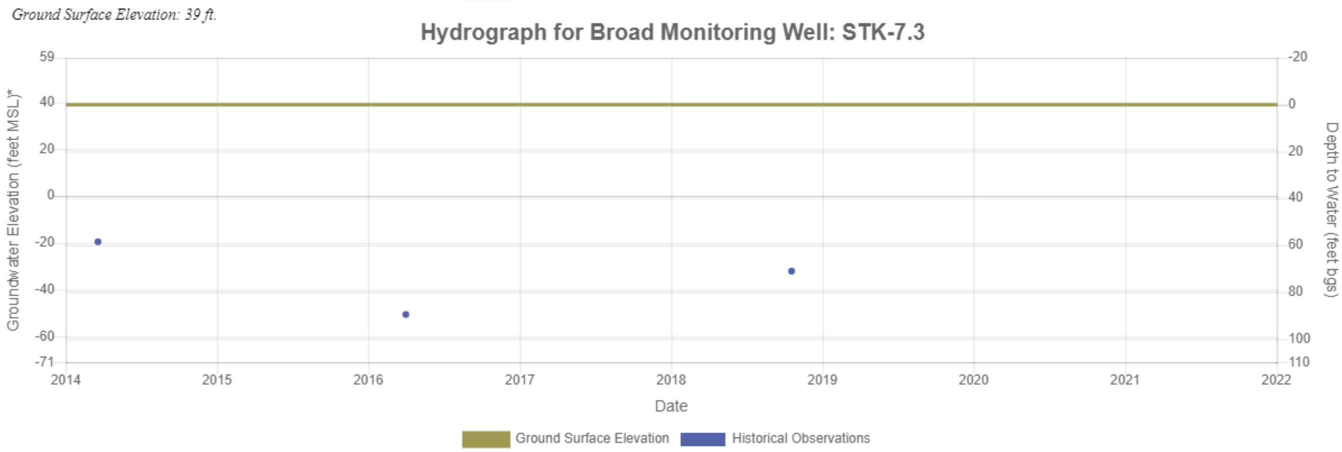

**Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: RMW-4
20
0
-20
-36
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

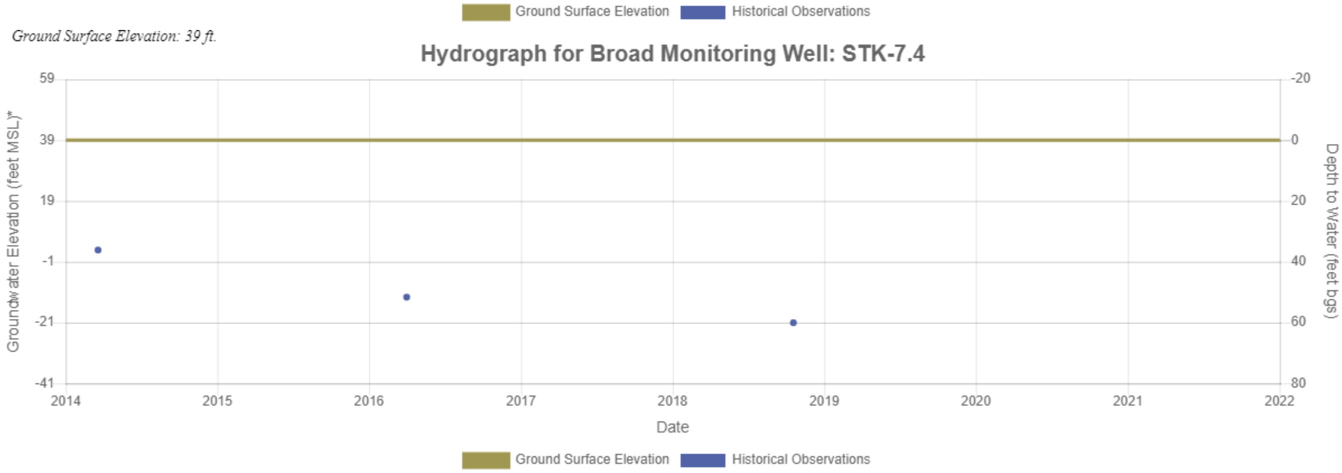

**Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: RMW-5
20
0
-20
-36
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations

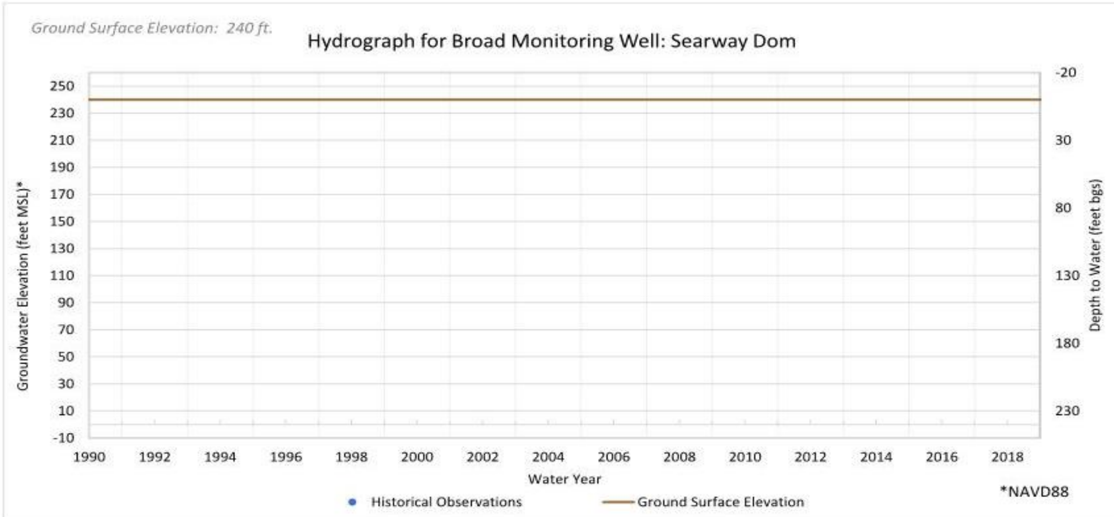

**Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Sonora Rd #5
205
200
180
160
140
120
100
80
60
40
20
0
-20
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


**Ground Surface Elevation: 0 ft.
Hydrograph for Broad Monitoring Well: Sonora Rd #8
232
220
200
180
160
140
120
100
80
60
40
20
0
-20
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 39 ft.
Hydrograph for Broad Monitoring Well: STK-7.2
Groundwater Elevation (feet MSL)*
59
40
20
0
-20
-40
-60
-80
-100
-105
Depth to Water (feet bgs)
-20
0
20
40
60
80
100
120
140
144
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 39 ft.
Hydrograph for Broad Monitoring Well: STK-7.3
Groundwater Elevation (feet MSL)*
59
40
20
0
-20
-40
-60
-71
Depth to Water (feet bgs)
-20
0
20
40
60
80
100
110
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 39 ft.
Hydrograph for Broad Monitoring Well: STK-7.4
Groundwater Elevation (feet MSL)*
59
39
19
-1
-21
-41
Depth to Water (feet bgs)
-20
0
20
40
60
80
2014
2015
2016
2017
2018
2019
2020
2021
2022
Date
Ground Surface Elevation
Historical Observations


Ground Surface Elevation: 240 ft.
Hydrograph for Broad Monitoring Well: Searway Dom
Groundwater Elevation (feet MSL)*
Depth to Water (feet bgs)
Water Year
Historical Observations
Ground Surface Elevation
*NAVD88