Upper Ventura River Valley Basin

Annual Report Water Year 2022

Upper Ventura River
GROUNDWATER AGENCY
SUSTAINABLE MANAGEMENT

April 2023

Upper Ventura River Valley Basin
Annual Report Water Year 2022

Prepared for

Upper Ventura River
GROUNDWATER AGENCY
SUSTAINABLE MANAGEMENT

Upper Ventura River Groundwater Agency

Prepared by

BONDY
Groundwater Consulting, Inc.

Bondy Groundwater Consulting, Inc.

PROFESSIONAL GEOLOGIST
BRYAN TODD BONDY
No. 7676
STATE OF CALIFORNIA

CERTIFIED HYDROGEOLOGIST
BRYAN TODD BONDY
No. 821
STATE OF CALIFORNIA

Bryan Bondy, PG, CHG
UVRGA Executive Director

INTERA

INTERA Incorporated

REGISTERED PROFESSIONAL ENGINEER
ABHISHEK SINGH
C 89384
CIVIL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
STEVEN HUMPHREY
No. 10024
STATE OF CALIFORNIA

Abhishek Singh, PhD, PE
Principal Engineer

Steven Humphrey, PG
Senior Hydrogeologist

Executive Summary

> **§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.***

The Upper Ventura River Groundwater Agency (UVRGA) adopted the Groundwater Sustainability Plan (GSP) for the Upper Ventura River Groundwater Basin (UVRGB, or Basin) on January 6, 2022, and this is the second Annual Report in compliance with the California Code of Regulations §356.2. The GSP included data collected within the Basin through the water year 2019; therefore, the first annual report included data collected during water years 2020 and 2021. This second annual report reports data and findings for water year 2022, extending from October 1, 2021, through September 30, 2022.

Total precipitation for water year 2022 was 12.91 inches, compared to the average of 21.07, making the water year type classification for water year 2022 dry.

Total water use within the Basin meets agricultural, M&I, domestic, and native vegetation demands and is sourced from groundwater and local surface water. Estimated total water use in the Basin for water year 2022 was 3,212 acre-feet per year (AF/yr), similar to the prior water year (3,196 AF/yr). Of the 3,212 AF of total water use, approximately 1,709 AF was supplied from groundwater and 1,503 AF from surface water. In addition, approximately 2,430 AF of groundwater pumped by wells was exported from the Basin. In total, approximately 4,139 AF of groundwater was pumped by wells or transpired by native vegetation during water year 2022 and was less than the prior water year (i.e., 4,982 AF).

The annual change in groundwater storage for the Basin was calculated using the updated numerical groundwater model of the Basin for the period spring 2021 to spring 2022. The groundwater storage increased slightly between water years 2021 and 2022 despite water year 2022 being classified as "dry". The storage increased primarily because water year 2021 was significantly drier and had much lower streamflow compared to water year 2022.

The groundwater quality remained stable for the water year 2022, compared to the historical data.

The GSP implementation is evaluated through comparing monitoring data to the Sustainable Management Criteria (SMC) for each applicable sustainability indicator: chronic lowering of groundwater levels, reduction of groundwater storage, degraded water quality, and depletion of interconnected surface water. The groundwater levels measured in water year 2022 were compared to the SMC established for the chronic lowering of groundwater levels and reduction of groundwater storage sustainability indicators (which has groundwater levels as a proxy), and two representative monitoring wells exceeded the minimum threshold in water year 2022. The downward trend in groundwater levels and the two minimum threshold exceedances correlate with the hydrologic impacts of several years of consecutive below average precipitation and streamflow. The remaining five representative monitoring wells had groundwater levels above their 5-year interim milestones. Undesirable results associated with water level declines is defined as a minimum threshold exceedance at all seven representative monitoring sites, which has yet to be experienced. For the degraded water quality depletion of interconnected surface water sustainability indicators, measurable objectives were met for water year 2022. Although the land subsidence sustainability indicator was determined to be not applicable to UVRGB, the GSP included annual review of InSAR data, subject to continued availability from DWR. InSAR measurements of land surface elevation changes during 2022 were well below the accuracy range indicating there was no measurable land subsidence due to groundwater withdrawal within the UVRGB.

GSP implementation efforts during water year 2022, included the following:

- GSP adoption,
- Continued implementation of the Foster Park Protocols management action[1],
- Continued groundwater level and streamflow monitoring at existing monitoring sites,
- Initiation of visual streamflow terminus monitoring,
- Initiation of riparian Groundwater Dependent Ecosystem (GDE) monitoring,
- Adoption of a well registration, metering, and extraction reporting ordinance and initial ordinance implementation efforts,
- Adoption of monitoring workplans for the Confluence and Foster Park Aquatic GDE and initial workplan implementation efforts, and
- Initial work on a Sustainable Groundwater Management Program Implementation Grant application.

[1] The "Foster Park Protocols to Address Direct Depletion of Interconnected Surface Water" management action was implemented beginning September 2019.

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

AF/yr	acre-feet per year
cfs	cubic feet per second
CMWD	Casitas Municipal Water District
DMS	Data Management System
DWR	Department of Water Resources
ft	foot/feet
GDE	Groundwater Dependent Ecosystem
GSP	Groundwater Sustainability Plan
InSAR	interferometric synthetic aperture radar
M&I	municipal and industrial
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MOWD	Meiners Oaks Water District
RWQCB	Regional Water Quality Control Board
SMC	Sustainable Management Criteria
TDS	total dissolved solids
USGS	United States Geological Survey
UVRGA	Upper Ventura River Groundwater Agency
UVRGB	Upper Ventura Groundwater Basin (Upper Ventura River Valley Basin, Department of Water Resources Basin No. 4-003.01)
VRWD	Ventura River Water District
WQO	Water Quality Objective

1.0 Introduction [§356.2(a)]

§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.

This document is the second Annual Report for the Upper Ventura River Valley Basin (Department of Water Resources [DWR] Basin No. 4-003.01; referred to herein as the Upper Ventura Groundwater Basin [UVRGB] or the Basin), fulfilling the requirements set forth by the Sustainable Groundwater Management Act (SGMA) Groundwater Sustainability Plan (GSP) Regulation Code §356.2. The GSP was adopted on January 6, 2022, by the Upper Ventura River Groundwater Agency (UVRGA) and was uploaded to the DWR GSP online portal on January 24, 2022 (UVRGA, 2022a). The GSP reports data through water year 2019 (ending September 30, 2019) for the UVRGB. The first Annual Report, submitted in April 2022, presented data and information for water years 2020 and 2021 for UVRGB (UVRGA, 2022b).

This second Annual Report presents data and information for water year 2022 for UVRGB (i.e., October 1, 2021, through September 30, 2022). The numerical groundwater model developed for the GSP was updated for this Annual Report to simulate water year 2022 and was used to calculate the groundwater flow directions, groundwater extraction, change in groundwater in storage, and streamflow depletion for the Basin in support of report development.

To track the progress of the GSP implementation, the water year 2022 data and model results are compared against the Sustainable Management Criteria (SMC) established in the adopted GSP (UVRGA, 2022a). This Annual Report also provides updates to the status of GSP implementation, including the projects and management actions described in the adopted GSP.

1.1 Background

The UVRGB is a medium-priority groundwater subbasin in western Ventura County. The Basin is in the central portion of the Ventura River Watershed along the Ventura River near the communities of Casitas Springs, Mira Monte, and Meiners Oaks (Figure 1.1). The Basin is bordered by the Ojai and Lower Ventura River Groundwater basins to the east and south, respectively (DWR Basin Nos. 4-002 and 4-003.02).

The UVRGB is a thin alluvial-fill aquifer which is intimately connected to the Ventura River. The groundwater budget and flow conditions in the alluvial aquifer are dominated by interaction with the Ventura River, which provides most of the recharge (inflows) to the Basin as streamflow percolation in the northern portion of the Basin and receives most of the discharge (outflows) from the Basin as down-valley groundwater flow that feeds springs (i.e., groundwater discharge) in the Ventura River in the southern portion of the Basin. Groundwater extractions are secondary to groundwater discharge to the Ventura River except during dry periods when the spring flows decrease substantially due to low Ventura River streamflow entering the northern end of the Basin.

Groundwater has historically supplied approximately one-third of the water used in the Basin for municipal, agricultural, domestic, and environmental uses, and is sourced from local extractions. Most of the extracted water is used for irrigation and public supply. There are also a number of domestic wells that supply water to homes and limited irrigation. Other sources of water supply for the Basin include private agricultural spring and creek diversions located adjacent to the Basin and local surface water diverted from the Ventura River and stored in Lake Casitas by the Casitas Municipal Water District (CMWD). The non-groundwater supplies provide approximately two-thirds of the water supply in the Basin.

2.0 Groundwater Conditions [§356.2(b)]

This section describes precipitation and water year type for the Basin, groundwater elevations, groundwater quality, groundwater extraction, surface water supplies, total water use, and the change in groundwater in storage for the Basin.

Groundwater data for water year 2022 were collected from a variety of agencies and incorporated into the UVRGA Data Management System (DMS), which is described further in the GSP (UVRGA, 2022a). A copy of the monitoring data is included in Appendix A. Groundwater levels were monitored by the County of Ventura, UVRGA, Meiners Oaks Water District (MOWD), and a private well owner. Groundwater quality data was collected by the County of Ventura and water suppliers reporting to the California Division of Drinking Water. Groundwater extractions were metered by Ventura River Water District (VRWD), MOWD, CMWD, and the City of Ventura and estimated for agricultural and domestic wells pursuant to the assumptions used in the GSP. Surface water supply data were provided by MOWD and VRWD.

2.1 Precipitation and Water Year Types

Precipitation data were provided by the Ventura County Public Works Agency from gages 020B (Ventura River County Water District) and 218 (Meiners Oaks – County Fire Station) and were updated for water year 2022 (Figure 2.1). Total precipitation for water year 2022 was 12.91 inches, compared to the average of 21.07 inches at gages 020B and 218 for 1926-2022 (Figure 2.2).

The water year type for 2022 was classified as dry (Figure 2.2) based on total annual precipitation (from Ventura County Watershed Protection District rainfall gage 20B) for a given water year compared to long-term historical precipitation trends from precipitation gages within the Basin (see Section 3.1.1.1 in the GSP [UVRGA, 2022a]). The bulk of the precipitation for water year 2022 was during the month of December and the remainder of the water year experienced significantly below average precipitation.

2.2 Numerical Groundwater Model Update

The numerical groundwater model constructed for the GSP simulated the historical period (2006-2019) to calculate the historical and current water budget components based on observed and estimated data for extraction rates, natural recharge and return flows, evapotranspiration, and streamflow (Appendix H in the GSP; UVRGA, 2022a). The first Annual Report, submitted April 2022, updated the numerical model to include data for water years 2020 and 2021. For this second Annual Report, the numerical model was updated to include data for water year 2022.

2.3 Groundwater Elevations [§356.2(b)(1)(A),(B)]

§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:*

(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.

(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.

Groundwater elevations were updated through water year 2022 for the monitoring wells in the UVRGB monitoring network (Figure 2.3). Figure 2.3 also shows the hydrogeologic areas for the Basin identified in the GSP, which are used to facilitate explanation of conditions in different areas of the Basin. Generally, groundwater flow is from a northern to southern direction, following the surface drainage and the topographic gradient of the Basin. In the Mira Monte/Meiners Oaks hydrogeologic area, groundwater flow is generally to the southwest and west towards the Upper Ventura River.

2.3.1 Groundwater Elevation Contours [§356.2(b)(1)(A)]

Modeled groundwater levels were used to produce the groundwater level contour maps discussed below. Observed groundwater levels for the seasonal highs (spring) and lows (fall) for water year 2022 are included on the contour maps for reference. Observed data may not agree with the contours due to differences in measurement date compared to modeled date and differences inherent in the model calibration.

Groundwater level contours for the water year 2022 spring-high season (March of 2022) indicate flow directions and gradient were generally from north to south, which is consistent with previous years (Figure 2.4). Groundwater level contours for the water year 2022 fall-low season (September of 2022) indicate flow directions were consistent with the spring-high season for the same water year (Figure 2.5). Groundwater level measurements were on average approximately 12 feet (ft) lower in September compared to March during the 2022 water year, with most of the declines occurring in the central part of the Basin adjacent to the Upper Ventura River channel.

2.3.2 Groundwater Elevation Hydrographs [§356.2(b)(1)(B)]

Groundwater elevation hydrographs for representative monitoring wells in the Basin are shown with water year types on Figure 2.6. The temporal trend during water year 2022 is downward for all monitoring wells except for wells 05N12W33G01S and 03N23W08B07S. The downward trends at most monitoring wells are due to consecutive years of below average streamflow and precipitation compared to previous years.

2.4 Groundwater Quality

Maps of average concentrations of the key indicator constituents for water year 2022 in the UVRGB are shown on Figures 2.7 through 2.11.

The average nitrate concentrations in water year 2022 ranged from 0.6 milligrams per liter [mg/L] to 11.2 mg/L (Figure 2.7) and are consistent with the historical data for the Basin (see GSP section 3.2.4; UVRGA, 2022a). Nitrate concentrations are highest in the Mira Monte/Meiners Oaks area to the east of the Ventura River, with one well having average nitrate concentrations above the Maximum Contaminant Level (MCL) with an average concentration of 11.2 mg/L for water year 2022. The Mira Monte/Meiners Oaks area is known to be a source of nitrate for the Basin (UVRGA, 2022a). All the remaining wells in the Basin have average concentrations below 5 mg/L, which is consistent with the historical record. While nitrate levels of up to 10 mg/L as Nitrogen are acceptable based on drinking water standards, the Water Quality Objective (WQO) for total Nitrogen in the Ventura River within the UVRGB, as defined in the Regional Water Quality Control Board (RWQCB) Basin Plan (RWQCB-LA, 2019), is 5 mg/L (Nitrate-N + Nitrite-N). Nitrate concentrations in groundwater outside of the Mira Monte/Meiners Oaks area are lower than the (RWQCB) Basin Plan WQO of 5 mg/L, except for one well (5.6 mg/L in 04N23W09B04S; see Figure 2.7).

The average total dissolved solids (TDS), sulfate, chloride, and boron concentrations for water year 2022 are all consistent with the historical data for the Basin (Figures 2.8 through 2.11). Some of the sampled wells were not analyzed for these constituents during water year 2022; however, the spatial distribution of available water quality data was adequate for annual reporting purposes. Please see the GSP section 3.2.4 for additional detail on the groundwater quality for the Basin (UVRGA, 2022a).

2.5 Groundwater Extraction [§356.2(b)(2)]

> **§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:*
>
> ***(b)*** *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*
>
> ***(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.***

Monthly groundwater extraction data were provided by the City of Ventura, CMWD, VRWD, and MOWD, which report volumes supplying municipal and industrial (M&I) water uses for the Basin. Agricultural groundwater supplies within the Basin were estimated using the methods described in the GSP (UVRGA, 2022a). Domestic well extractions were estimated by assuming domestic wells in the Basin were providing a de minimis amount (2 acre-feet per year [AF/yr]) of water for domestic use. Groundwater extraction due to native vegetation[2] was calculated using the numerical groundwater model (see Appendix H in GSP; UVRGA, 2022a). The values discussed in this section and presented in Table 2.1 reflect total extracted groundwater from the UVRGB. It is noted that significant volumes of extracted groundwater are exported from the Basin, explaining the differences between the values for extracted groundwater and groundwater use within the Basin (i.e., difference in reported values in Tables 2.1 and 2.2).

The extracted volumes for water year 2022 are summarized by water use sector in Table 2.1. Total extraction via pumping wells (excluding the native vegetation[1] term) for water year 2022 (3,251 AF/yr) was less than the historical average of 5,035 AF/yr (2006-2019). Agricultural groundwater use accounts for 12% of the total extraction via pumping wells for water year 2022, compared to 6% for the historical average, although it is noted that the agricultural extractions are estimated. Domestic extraction rates were consistent with the historical period and M&I extraction rates were slightly lower (81% of the total extraction via pumping for water year 2022, compared to 90% for the historical average), although it is noted that the domestic extractions are estimated. The volumes extracted from each well for water year 2022 are shown on Figure 2.12.

2.6 Surface Water Supply [§356.2(b)(3)]

> **§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:*
>
> ***(b)*** *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*
>
> ***(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.***

Surface water is supplied to the Basin by CMWD as direct deliveries to CMWD retail M&I and agricultural customers and as wholesale deliveries to the retailers VRWD and MOWD for M&I and agricultural use. Historically, surface water is estimated to be ~26% of the total deliveries (UVRGA, 2022a). Monthly purchases from CMWD were provided by VRWD and MOWD. Data for direct retail deliveries by CMWD were not available and were estimated using the methods described in the GSP (UVRGA, 2022a). The total estimated surface water supply volume for water year 2022 was 1,503 AF/yr (see Table 2.2 and Figure 2.13).

[2] Includes the invasive species Arundo.

2.7 Total Water Use [§356.2(b)(4)]

> **§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:*
>
> ***(b)*** *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*
>
> ***(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.***

Water demands in the UVRGB consist of M&I, agricultural, and domestic demands, which are met by a mix of groundwater extractions and surface water deliveries. Additional groundwater use is calculated for the native vegetation[3] using the numerical model (see Appendix H in GSP; UVRGA, 2022a). Water year 2022 data sources are detailed in Table 2.2 and Figure 2.13. The total water use components were measured or estimated using methods described in the GSP (UVRGA, 2022a).

The total water used within UVRGB during water year 2022 was 3,212 AF/yr (see Table 2.2 and Figure 2.13).

2.8 Change in Storage [§356.2(b)(5)(A),(B)]

> **§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:*
>
> ***(b)*** *A detailed description and graphical representation of the following conditions of the basin managed in the Plan:*
>
> ***(5) Change in groundwater in storage shall include the following:***
>
> ***(A) Change in groundwater in storage maps for each principal aquifer in the basin.***
>
> ***(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.***

The updated numerical groundwater model was used to calculate the change in storage for the UVRGB for water year 2022, which is shown in Figure 2.14.

The total change in storage between spring-high groundwater levels in water years 2021 and 2022 was calculated to increase by 848 AF (Figure 2.14). Although groundwater levels for water year 2022 have remained relatively low similar to recent dry water years where groundwater storage coincidently decreased, the increase in storage calculated for water year 2022 despite being classified as dry is due to compounding factors: 1) increases in surface water flow, 2) increases in recharge as infiltration of

[3] Includes the invasive species Arundo.

precipitation, and 3) decreases in groundwater extraction. The change in storage for the Basin was also calculated for each hydrogeologic area and the greatest changes in storage are in the Robles, Santa Ana, and Casitas Springs areas. The Robles area receives most of the water coming into the Basin from the north and the Santa Ana area receives most of the water entering the southern area of the Basin. The Casitas Springs area receives additional water coming in from the San Antonio Creek. Increases in streamflow and precipitation resulted in increases in groundwater in storage, especially adjacent to the Ventura River. Thus, the Robles, Santa Ana, and Casitas Springs areas are the most affected areas, which are a combined 95% of the total increases in storage.

Figure 2.15 shows the water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the Basin, starting in 2006. The cumulative change in storage for the Basin from water years 2006 to 2022 was -12,482 AF.

3.0 Plan Implementation [§356.2(c)]

§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:*

(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.

The plan implementation for the UVRGA GSP was initiated with the submittal of the GSP to DWR in January of 2022. The progress towards implementing the UVRGA GSP is evaluated by comparing monitoring data to the SMC for each applicable sustainability indicator for the past water year (2022). The monitoring data consists of groundwater levels, groundwater quality, and streamflow. The monitoring networks for the Basin are still being built-out, regardless, all currently available data are evaluated for this Annual Report.

3.1 Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage

The SMC are the same for both the chronic lowering of groundwater levels and reduction of groundwater storage sustainability indicators because groundwater levels are used as a proxy for the reduction of groundwater storage indicator. Groundwater levels were evaluated for the seven representative monitoring wells within the Basin and were plotted against their respective minimum thresholds, measurable objectives, and interim measures (Figure 3.1).

The minimum thresholds were exceeded for two wells (05N23W33B03S and 04N23W16C-VRWD-MW2) and the remaining five wells either met their respective 5-year interim milestones or measurable objectives in water year 2022 (Table 3.1). Well 04N23W29F02S has one manual measurement below the minimum threshold during water year 2022 but was considered anomalous due to the lack of correlation with the transducer data. Groundwater levels for water year 2022 are relatively low due to the unusually dry water years 2021 and 2022 and are reflected in the hydrographs' downward trends (see Figure 3.1).

Undesirable results associated with water level declines is defined as a minimum threshold exceedance at all seven representative monitoring sites, which has yet to be experienced.

3.2 Degraded Water Quality

Water year 2022 groundwater quality was data was available for eight monitoring wells or closely spaced groups of wells (Figure 3.2). Well group 4 was not analyzed for the primary constituents (Nitrate, TDS, chloride, sulfate, and boron), and well groups 1 and 3 and well 04N23S16B047S were not analyzed for TDS, chloride, sulfate, and boron during water year 2022. The spatial distribution of available water quality data was adequate for annual reporting purposes.

Nitrate is the only constituent of concern for the degraded water quality sustainability indicator (UVRGA, 2022a). The minimum threshold was defined as any nitrate isocontour exceeding 10 mg/L located outside of the Mira Monte/Meiners Oaks Area, encompassing domestic wells that produce groundwater from the alluvial aquifer that do not have an alternative source of drinking water that is determined by UVRGA to be caused by pumping or GSP projects/management actions. The Mira Monte/Meiners Oaks Area is recognized as a source area for nitrate in groundwater and as such, minimum thresholds do not apply in this area. The public water supply well operators currently manage nitrate by blending with surface water from Lake Casitas. Nitrate measurable objectives were developed for two distinct areas of the Basin: (1) areas with predominantly percolating groundwater (Kennedy, Robles, and Santa Ana areas), and (2) areas with predominantly rising groundwater (in the Casitas Springs Area) (see Table 3.2 for further explanation). An isocontour value of 7.5 mg/L (as nitrogen) is the measurable objective for the percolating groundwater, and an isocontour value of 3 mg/L (as nitrogen) is used for the measurable objective in the Casitas Springs Area.

Figure 3.3 shows the nitrate (as total nitrogen) isocontours for water year 2022, which is based on annual average concentrations observed at the eight wells and well groups. Based on the interpreted contours, water year 2022 results meet the measurable objectives for both areas of predominately percolating groundwater (Kennedy, Robles, and Santa Ana areas) and predominantly rising groundwater levels (Casitas Springs Area). Table 3.2 summarizes the SMC and nitrate results for water year 2022.

3.3 Depletion of Interconnected Surface Water

The Ventura River is considered an interconnected stream system with complex groundwater-surface water interactions that vary significantly with time and location in the Basin. The GSP concluded that significant and unreasonable effects on the Foster Park Habitat Area (see Figure 2.3) could potentially occur under certain low-flow conditions (UVRGA, 2022a). SMC established for this area are shown on Table 3.3. The minimum threshold and measurable objective are the same for this sustainability indicator, and the 5-year interim milestone is equal to the maximum simulated depletion in excess of the measurable objective during the historical period (2006-2019), which is equal to 10.7 cubic feet per second (cfs) (UVRGA, 2022a).

Numerical modeling output was analyzed to assess the frequency, duration, and volume of depletions that are simulated to cause undepleted[4] Ventura River flows at the Foster Park USGS stream gage to be depleted below 2 cfs during water year 2022 (Table 3.3 and Figure 3.4). The top chart in Figure 3.4 shows undepleted flows (blue) and depleted flows (red). The difference between the blue and red lines at any point in time is the total depletion, which is shown as the black line on the bottom chart. The bottom chart on Figure 3.4 also shows the direct depletion in blue. Indirect depletion is not plotted explicitly; it is the distance between blue direct depletion line and the black total depletion line. The minimum threshold is plotted in orange. Undepleted flow is not simulated to be below 2 cfs during water year 2022. The modeled depletion results for water year 2022 did not exceed the minimum threshold and met the 5-year interim milestone.

For this annual report, the numerical model was updated with streamflow data previously unavailable for 2021 and a reassessment of streamflow depletion estimates for water year 2021 indicated that there were no minimum threshold exceedances as was previously reported in last year's annual report (the modeled streamflow for water year 2021 in Figure 3.4 of this report can be compared to Figure 3.5 from last year's annual report; UVRGA, 2022b). The differences in model results due to the updated streamflow inputs were not substantial so the model does not require any recalibration.

3.4 Land Subsidence

The GSP concluded that the land subsidence sustainability indicator is not applicable to UVRGB because of the small aquifer thickness, coarse-grained nature of the aquifer, lack of significant clay units within the aquifer, and extremely rapid recovery of groundwater levels during recharge events. Nonetheless, the GSP included annual review of interferometric synthetic aperture radar (InSAR) data (subject to continued availability from DWR) to confirm the absence of land subsidence related to groundwater conditions.

DWR provides land surface displacement data for the UVRGB on their SGMA Data Viewer Web-based geographic information system viewer (DWR, 2022), which includes InSAR measurements for water year 2022 (TRE Altamira, Inc., 2020). This land surface displacement dataset was downloaded and reviewed. DWR has stated that on a statewide level for the total vertical displacement measurements between June 2015 and June 2018, the errors due to measurement are as follows (Paso Robles GSA, 2020):

- The error between InSAR data and continuous global positioning system (GPS) data is 16 mm (0.052 ft) with a 95% confidence level, and
- The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 ft with 95% confidence level.

Therefore, a land surface change of less than 0.1 ft (the cumulative error) is within the noise of the data collection and processing and is considered equivalent to no measurable subsidence in this GSP.

The reported cumulative vertical displacement from the InSAR measurements during the 2021-2022 study period were consistently well below the accuracy range and areas falling below the accuracy range are

[4] Streamflow that would exist if no groundwater pumping had occurred.

shown in gray on Figure 3.5. This indicates that there is no measurable land subsidence due to groundwater withdrawal within the UVRGB.

3.5 Seawater Intrusion

The GSP concluded that the seawater intrusion sustainability indicator is not applicable to UVRGB because it is an inland basin with no connection to the ocean. UVRGB is located 6 miles inland from the Pacific Ocean and the base of the Basin (bedrock elevation) along the southern boundary (also the lowest point in the Basin) is ~160 ft above mean sea level.

3.6 Projects and Management Actions

3.6.1 Domestic Well Survey

The UVRGA Board of Directors adopted the Ordinance Establishing Well Registration, Metering, and Reporting Requirements in July 2022. The ordinance requires the well owners to register existing and new wells with UVRGA, flowmeters on all non-*de minimis* wells, period flowmeter calibration verification, and quarterly reporting of groundwater extractions. The well registration form developed for ordinance implementation serves as the primary tool for performing the domestic well survey. The registration form collects information about domestic wells including whether the well is used for drinking water supply and whether a backup potable water supply is available. The form also offers nitrate testing (to be paid for by UVRGA) for interested domestic well owners.

3.6.2 Foster Park Protocols to Address Direct Depletion of Interconnected Surface Water

The Foster Park Protocols management action consists of operational protocols for the City of Ventura extraction facilities in the Foster Park Aquatic Habitat Area, which will address direct depletion of ISW. The Foster Park Protocols involve monitoring river gages and shutting down the City's extraction facilities when certain surface water flow thresholds are reached.

The implementation trigger for implementing the Foster Park Protocols was the settlement agreement between the City of Ventura and Santa Barbara Channelkeeper regarding the action titled Santa Barbara Channelkeeper v. State Water Resources Control Board and the City of San Buenaventura (Los Angeles County Superior Court, Case No. 19STCP01176) (Appendix D of the GSP). The settlement agreement was executed in September 2019 and amended in August 2020 (Appendix D of the GSP). The Foster Park Protocols have been operative since September 2019 and expected to be operative in perpetuity (Personal communication, e-mail from Jenny Tribo of City of Ventura to Bryan Bondy, dated May 19, 2021).

3.6.3 Actions to Address Indirect Depletion of Interconnected Surface Water

3.6.4 Action No. 1-1 of GSP Table 6.1-01 (Develop Foster Park Aquatic Habitat Area Monitoring Plan) was completed and approved by the UVRGA Board

of Directors in August 2022.Groundwater Level Monitoring Well Data Gaps Project

There was no activity on this task during the reporting period as the reporting period was prior to GSP adoption.

3.6.5 Stream Gage Data Gaps Project

There was no activity on this task during the reporting period as the reporting period was prior to GSP adoption.

3.6.6 Confluence Aquatic Habitat Area Biological Monitoring Study

The Confluence Aquatic Habitat Area Aquatic GDE Monitoring Workplan was completed and approved by the UVRGA Board of Directors in August 2022.

3.6.7 Additional Projects and Management Actions for the GSP

This section describes any new projects or management actions that have been identified since adoption of the initial GSP. Projects or management actions described in this subsection are being described in the annual report to ensure they are eligible for funding under the Sustainable Groundwater Management Implementation Grant Program and/or other funding opportunities.

3.6.7.1 Optional Monitoring Wells to Improve Groundwater Levels and Quality Monitoring Networks

Upon additional evaluation, UVRGA determined that sustainable management of the Basin may require additional groundwater level and/or quality data in areas that were not identified in the initial GSP but have been identified since the GSP was prepared. Through the first annual report, UVRGA added optional monitoring well locations to the GSP for potential consideration during the GSP implementation period (Figures 3.6 and 3.7) to reflect UVRGA's current thinking about areas where additional monitoring wells may be required and/or improve the monitoring networks. UVRGA reserves the right to consider other areas for optional monitoring wells based on the status and availability of existing monitoring wells going forward, site access negotiations, ongoing monitoring data, GSP implementation progress, and other factors.

During water year 2022, UVRGA began working on a Sustainable Groundwater Management Implementation Grant application that includes a funding request for the optional monitoring wells.

4.0 References

Department of Water Resources (DWR). 2022. SGMA Data Viewer Web-based geographic information system viewer. Accessed March 2022. Available at https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer.

Paso Robles Groundwater Sustainability Agency (Paso Robles GSA). 2020. Paso Robles Subbasin Groundwater Sustainability Plan. Prepared for Paso Robles Subbasin Cooperative Committee and the Groundwater Sustainability Agencies. January 31.Regional Water Quality Control Board –Los Angeles District (RWQCB –LA). 2019. Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties.

TRE Altamira, Inc. 2021. InSAR Land Surveying and Mapping Services in Support of the DWR SGMA Program Technical Report. October 2021 Update.

Upper Ventura River Groundwater Agency (UVRGA). 2022a. Upper Ventura River Valley Basin Groundwater Sustainability Plan. January 2022.

Upper Ventura River Groundwater Agency (UVRGA). 2022b. Upper Ventura River Valley Basin Annual Report Water Years 2020 and 2021. April 2022.

Figures

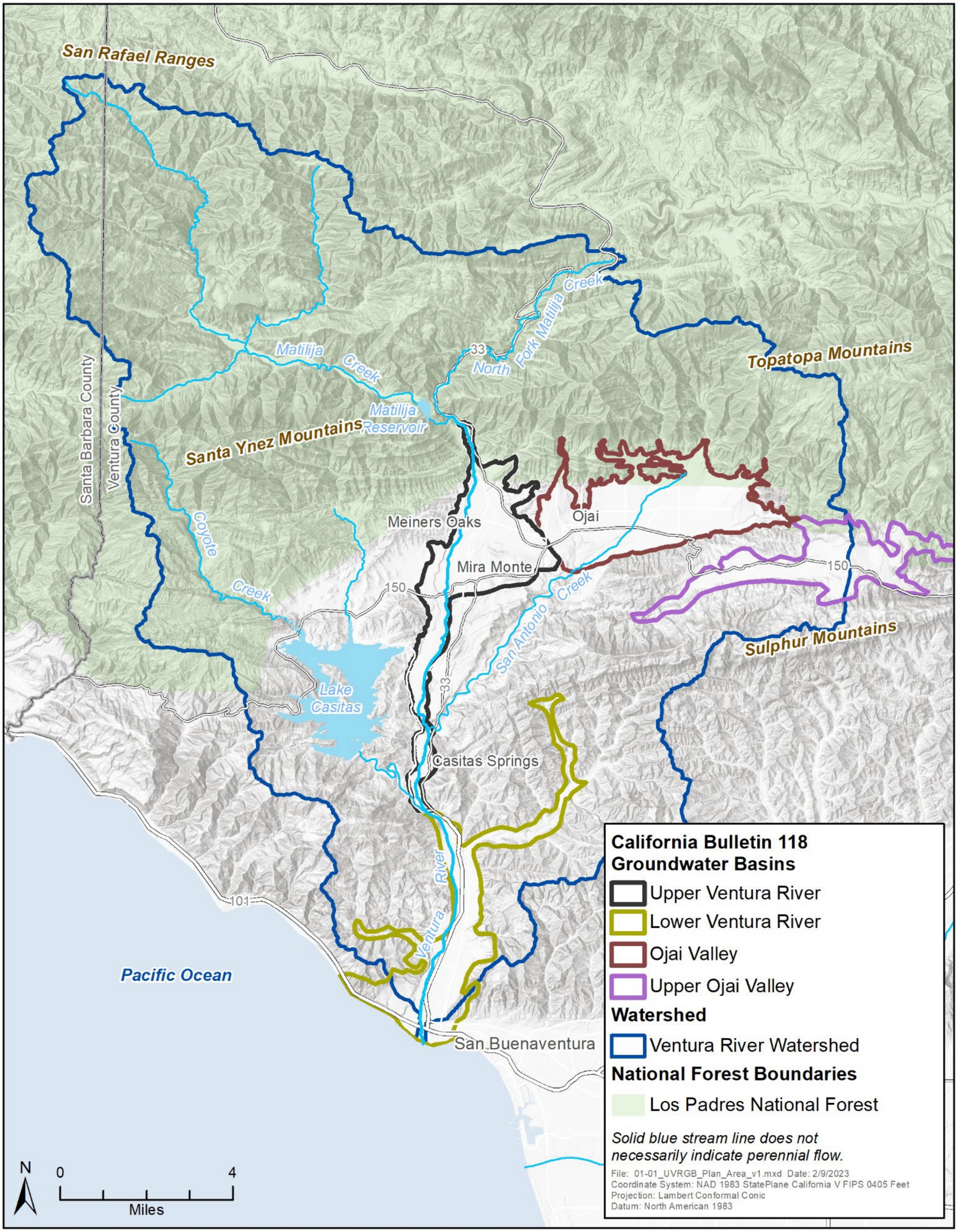


Figure 1.1 Upper Ventura River Groundwater Agency Basin Boundary Map.

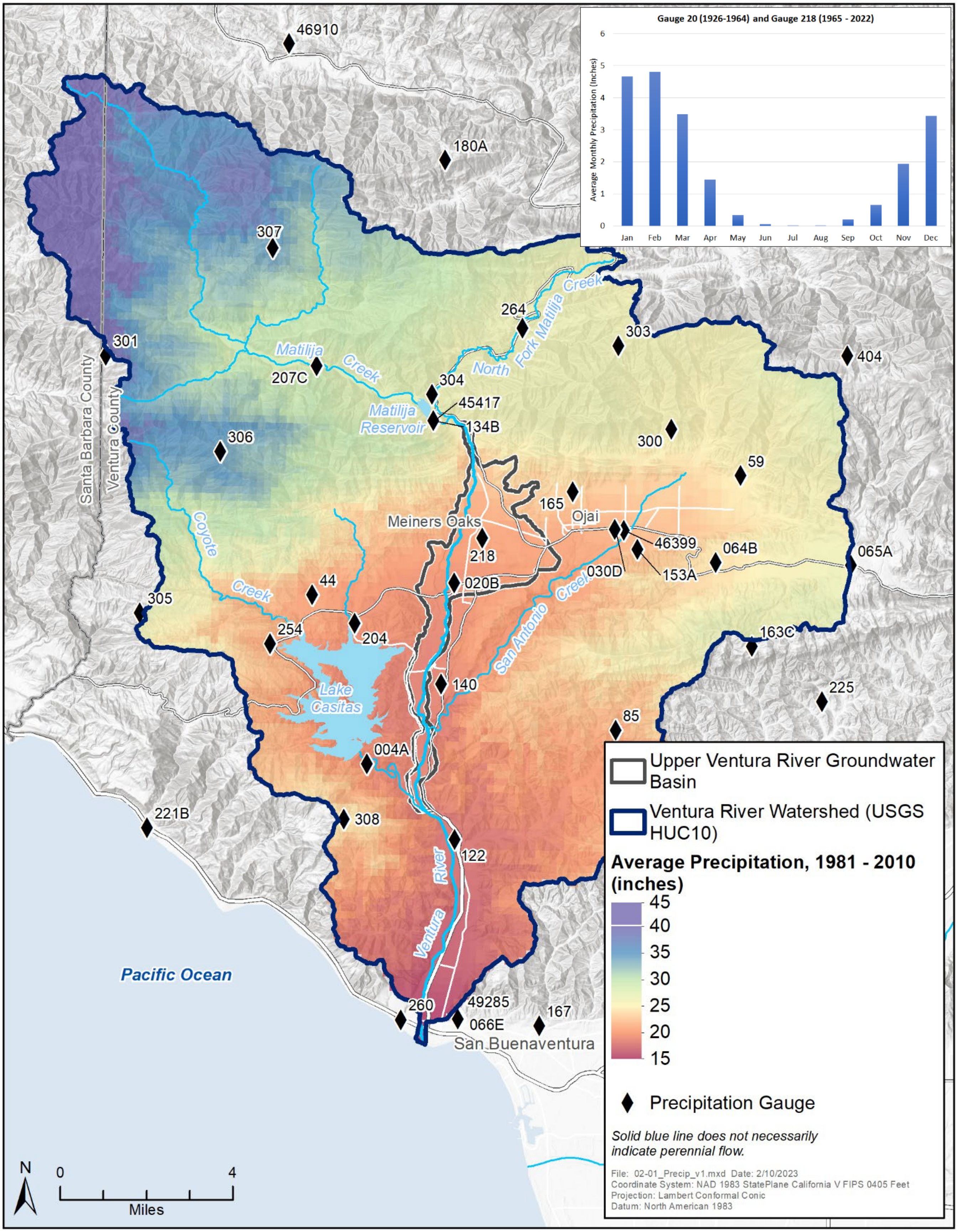
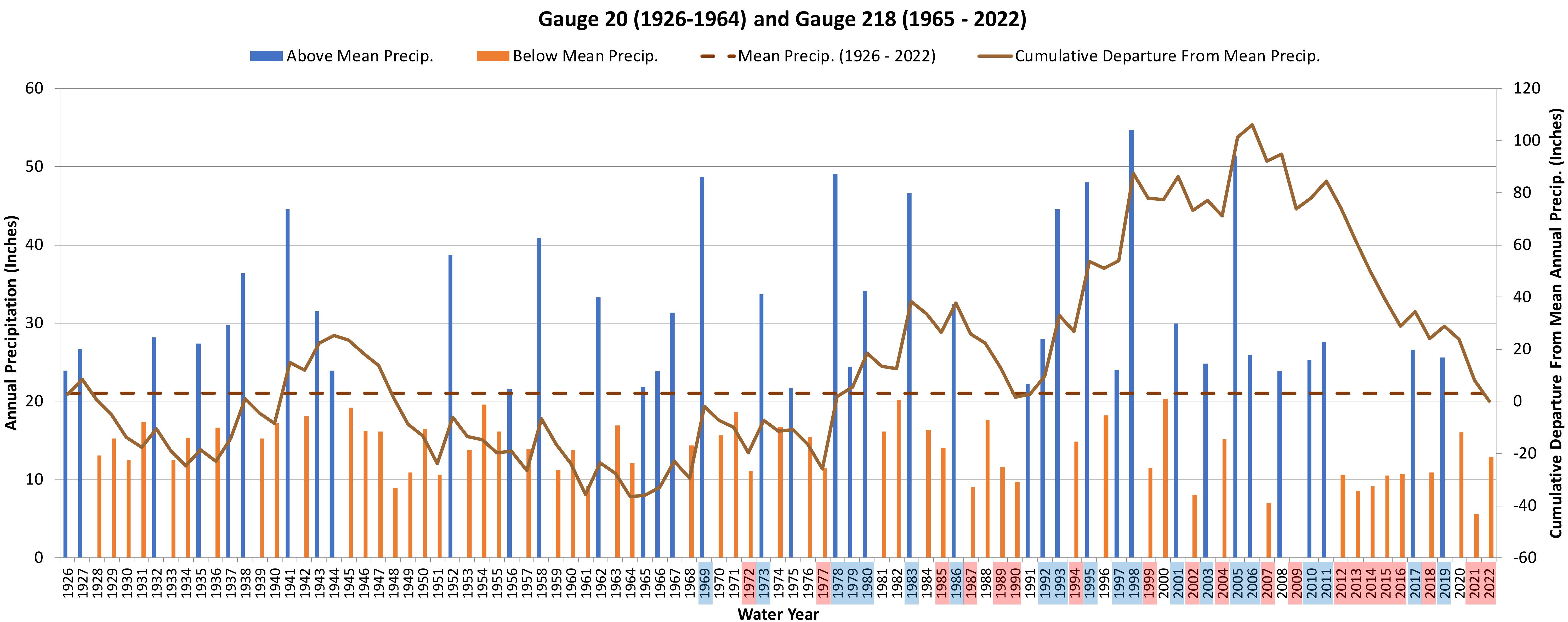


Figure 2.1 Precipitation Map in the Ventura River Watershed.



Water year types:
- dry
- wet
- normal

***Cumulative Departure is the sum of the current difference from the mean annual precipitation and all the past differences.*

Data Source: VCWPD, 2021.

Figure 2.2 Annual and Cumulative Departure from Mean Precipitation.

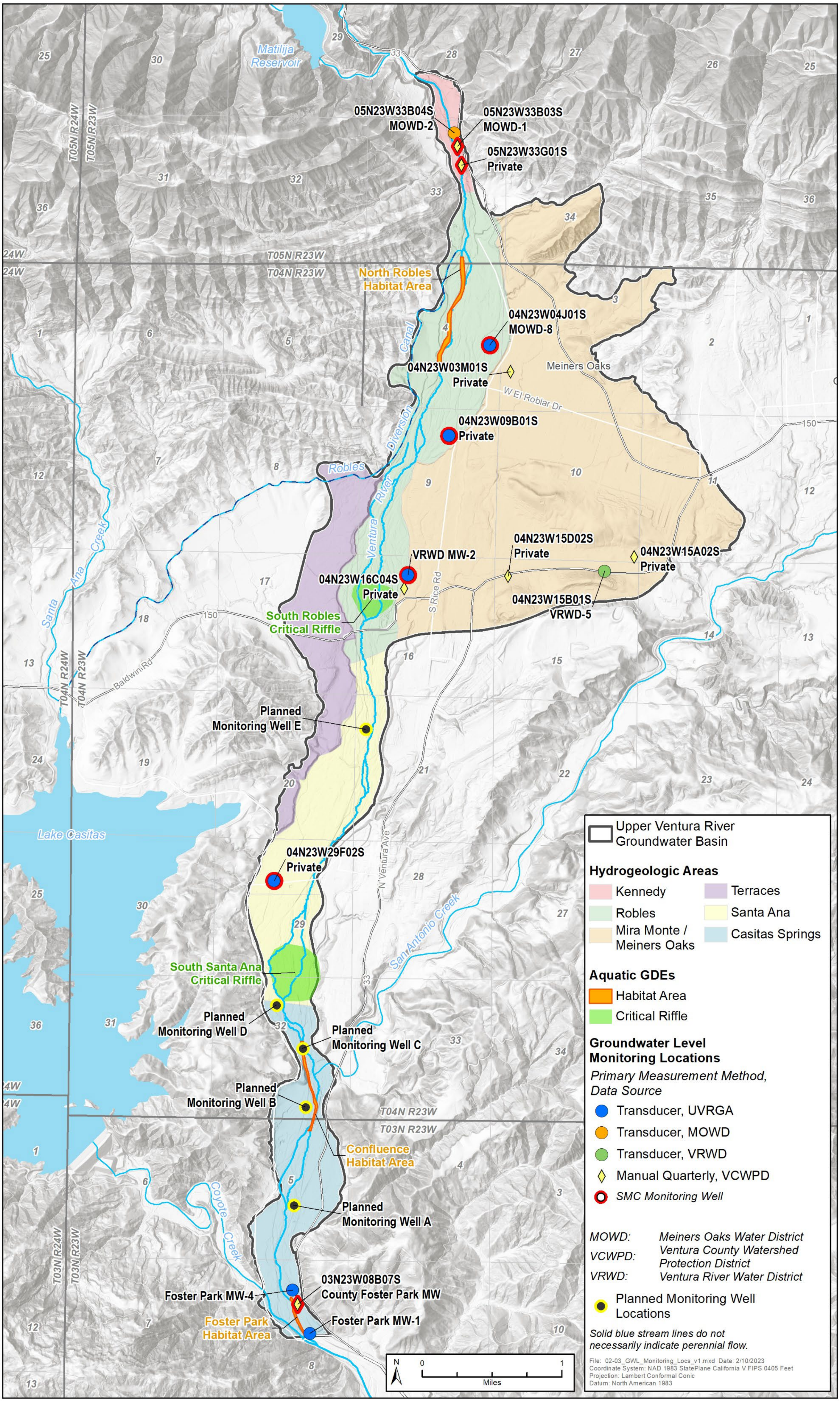


Figure 2.3 Existing and Planned Groundwater Level Monitoring Wells.

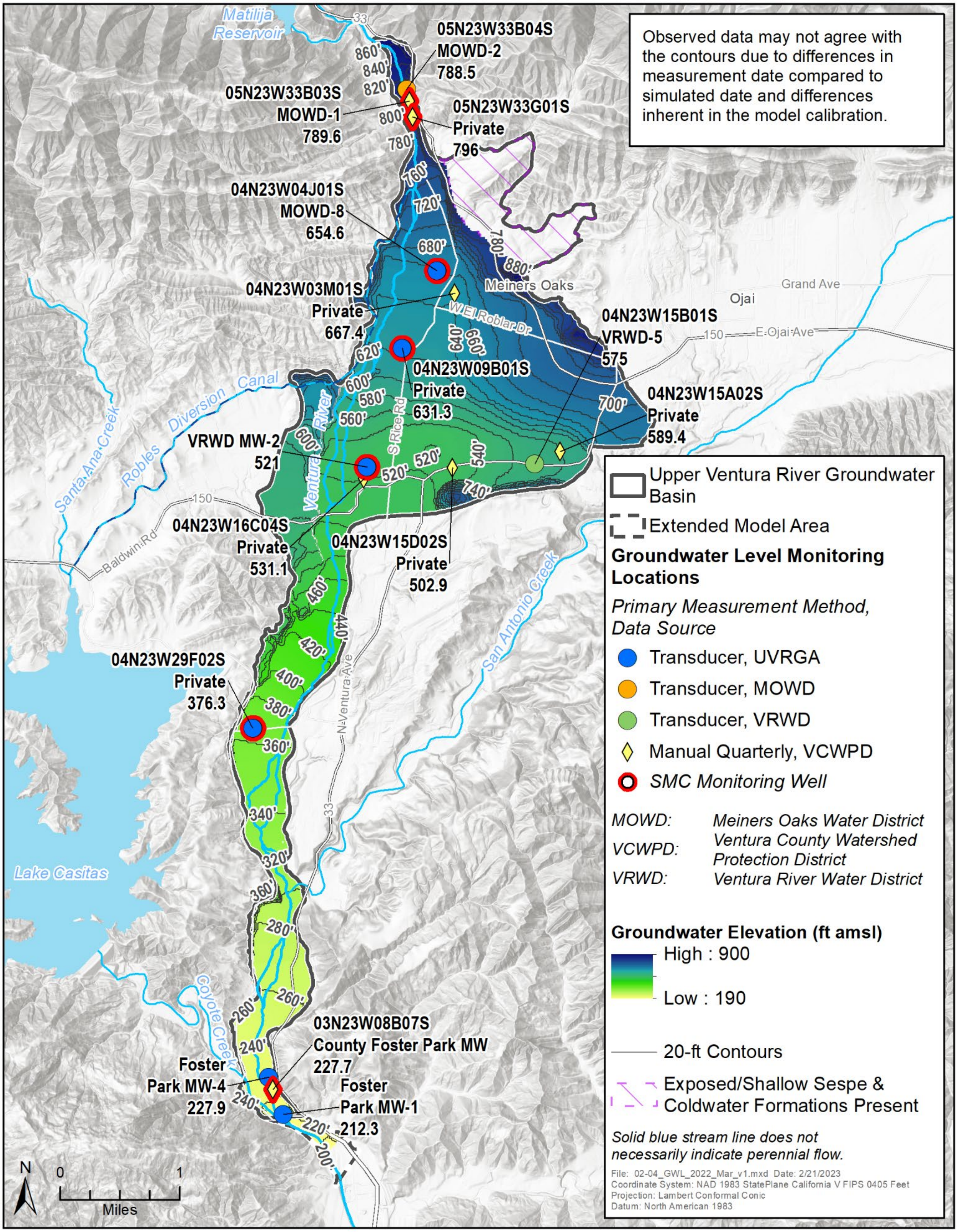


Figure 2.4 Contour Map for High Modeled and Observed Groundwater Levels (Wet Season) – March 2022.

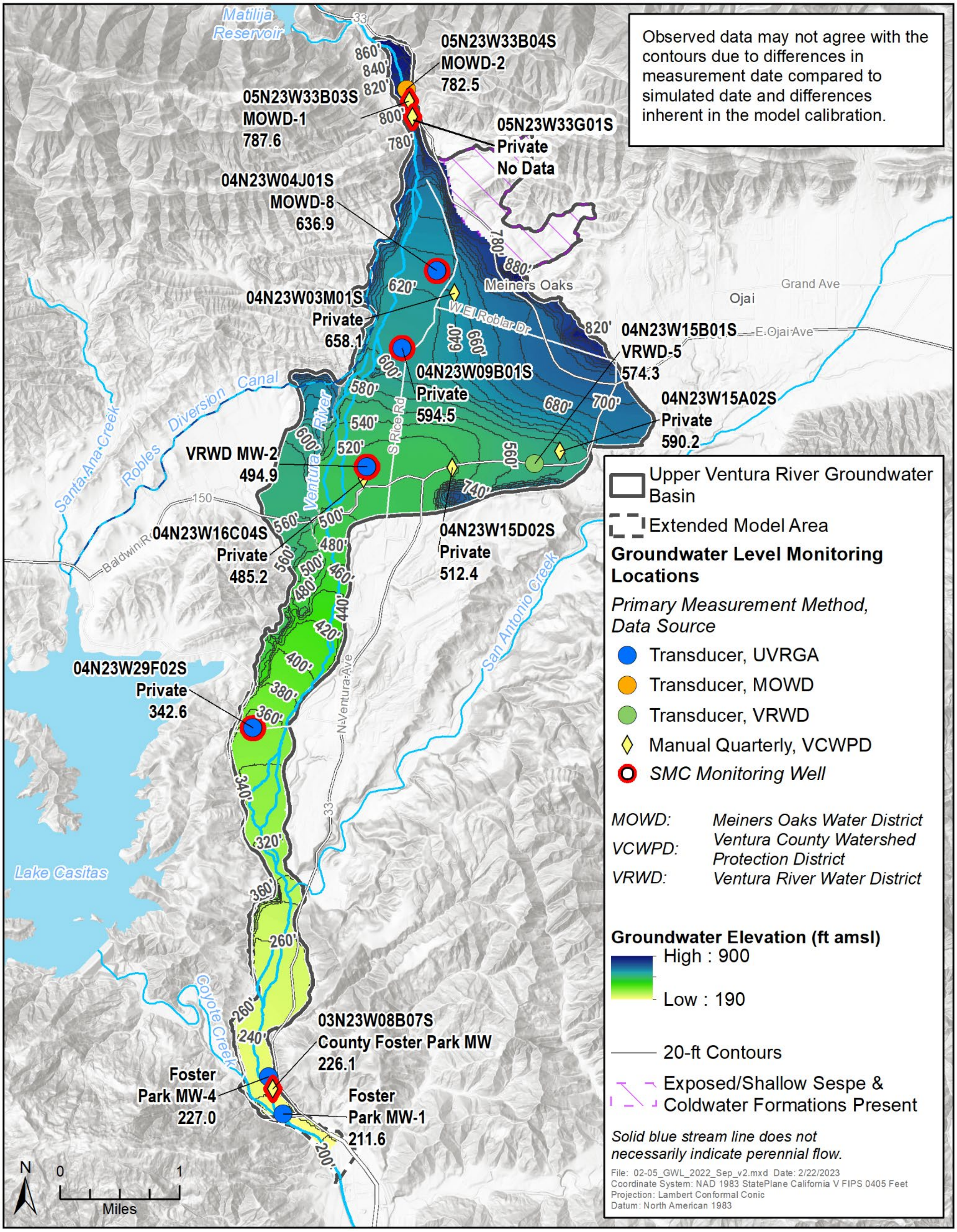


Figure 2.5 Contour Map for Low Modeled and Observed Groundwater Levels (Dry Season) – September 2021.

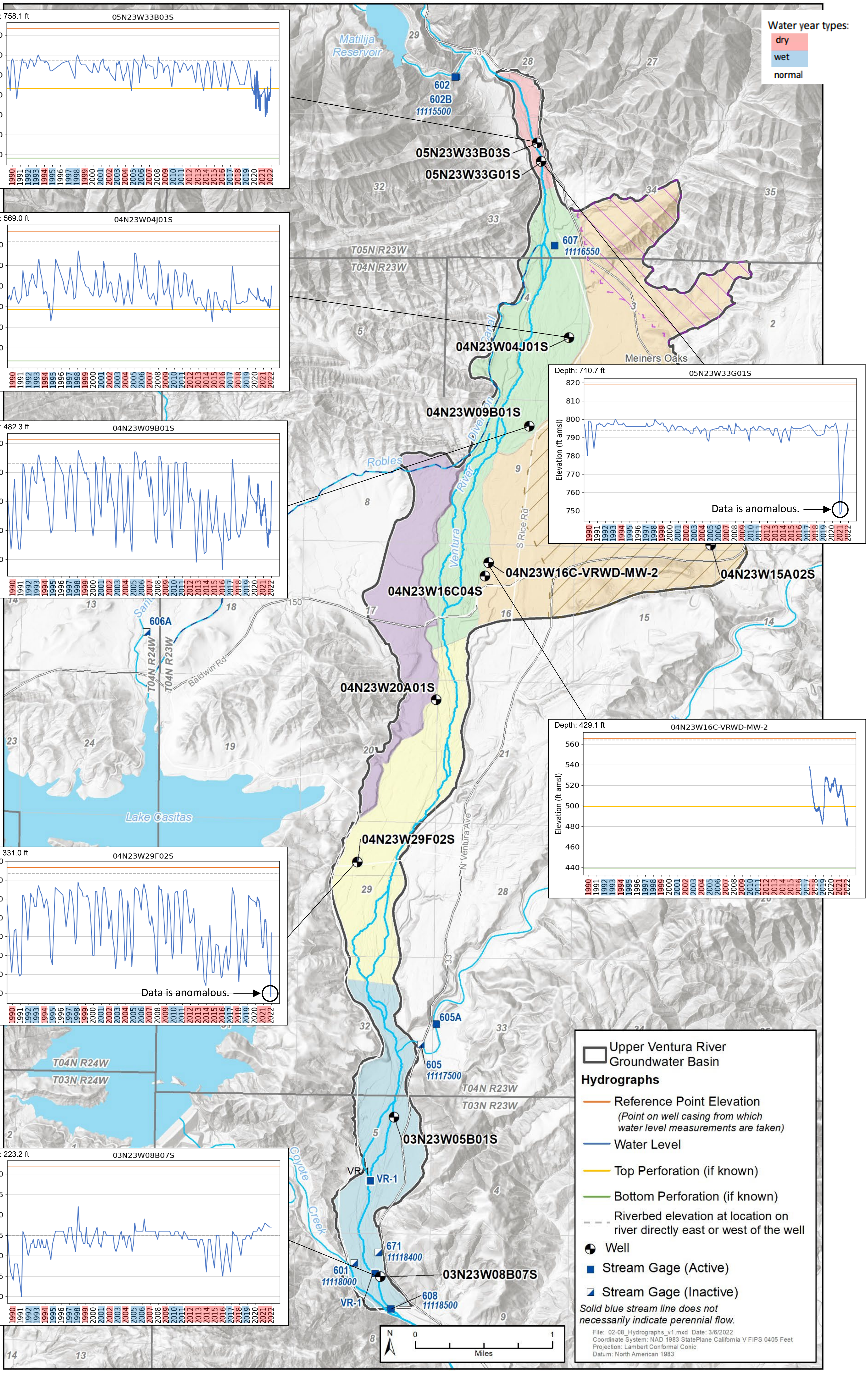


Figure 2.6 Groundwater Level Hydrographs for Key Wells in the UVRGB.

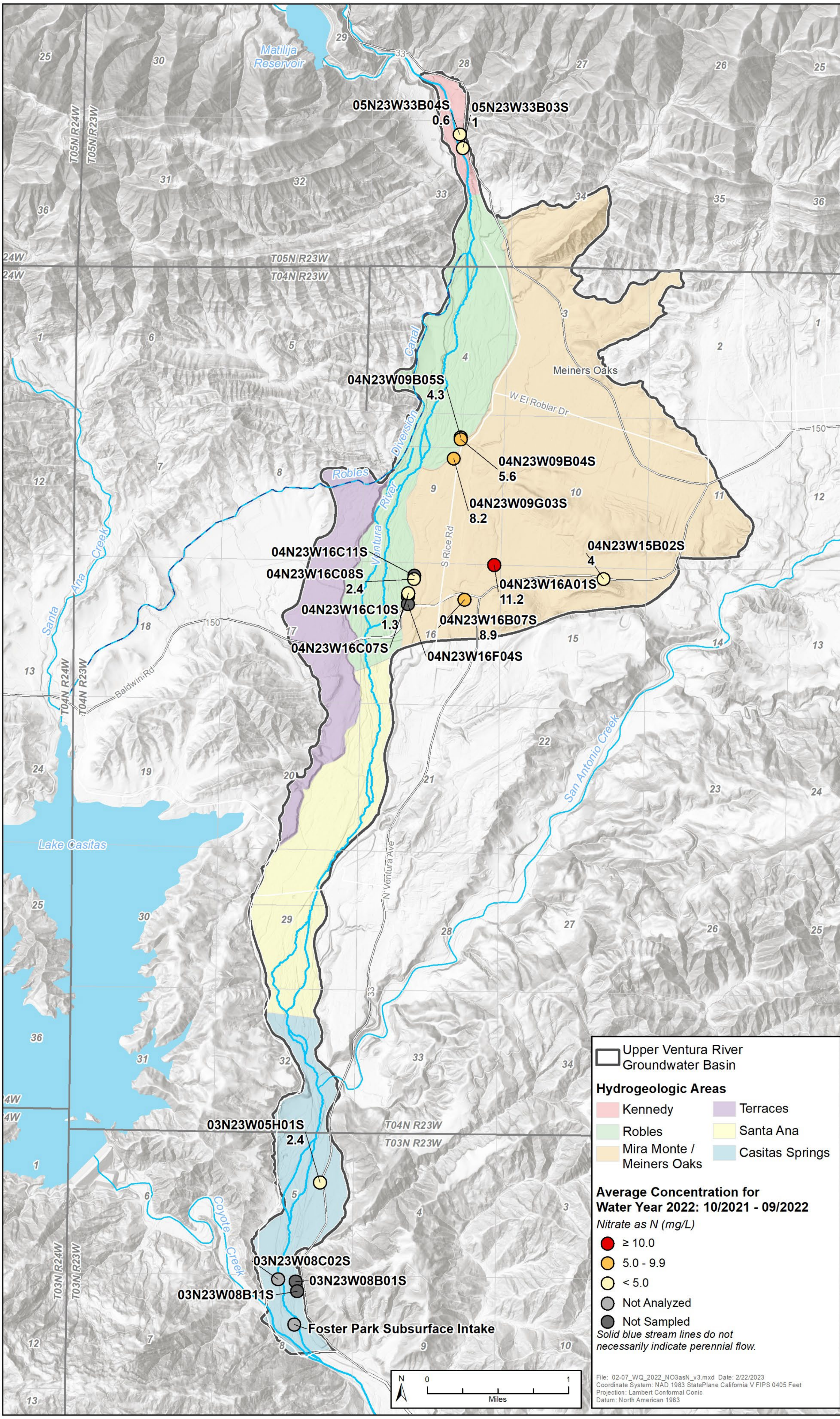


Figure 2.7 Average Nitrate as Nitrogen (N) Concentration in UVRGB, Water Year 2022.

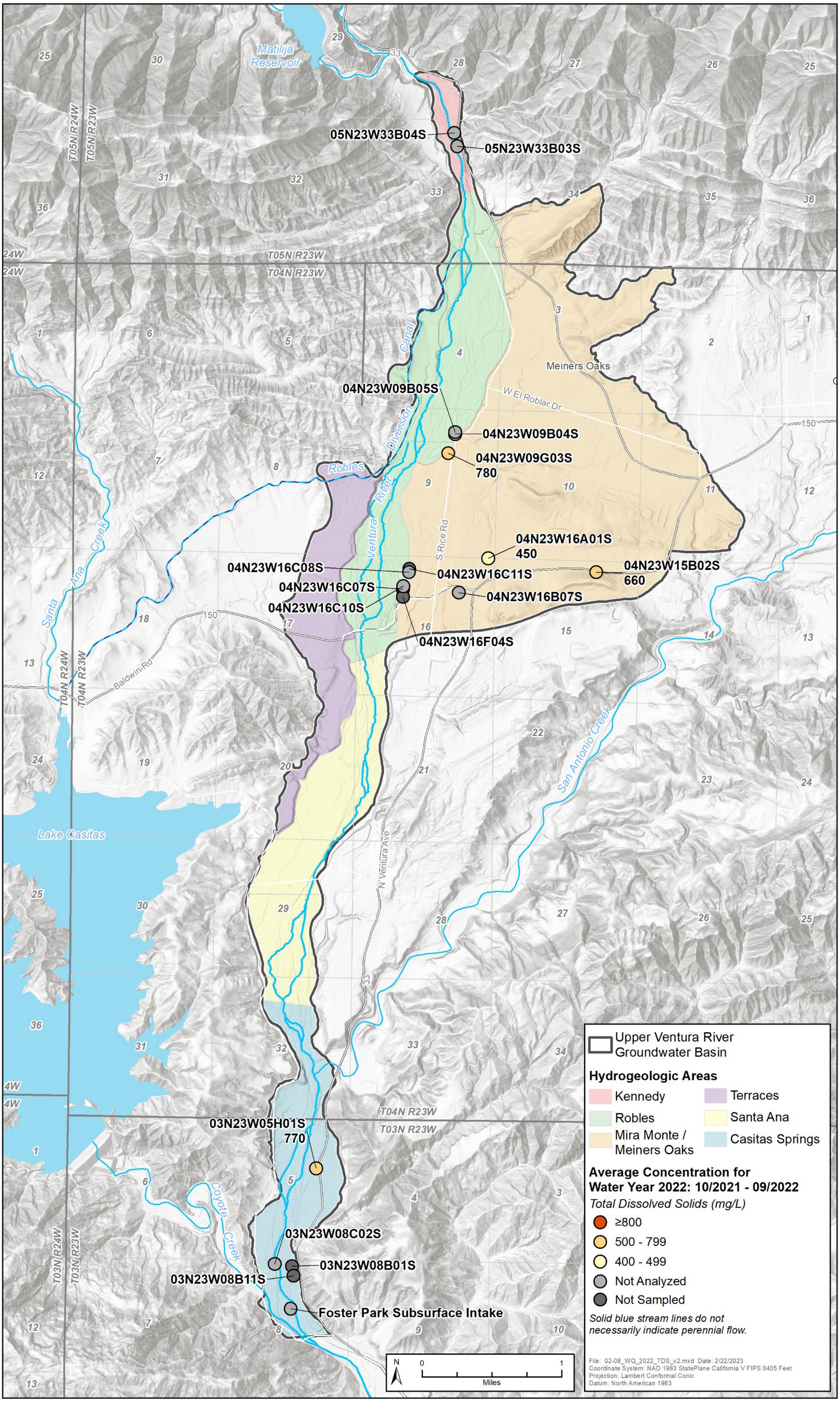


Figure 2.8 Average Total Dissolved Solids Concentration in UVRGB, Water Year 2022.

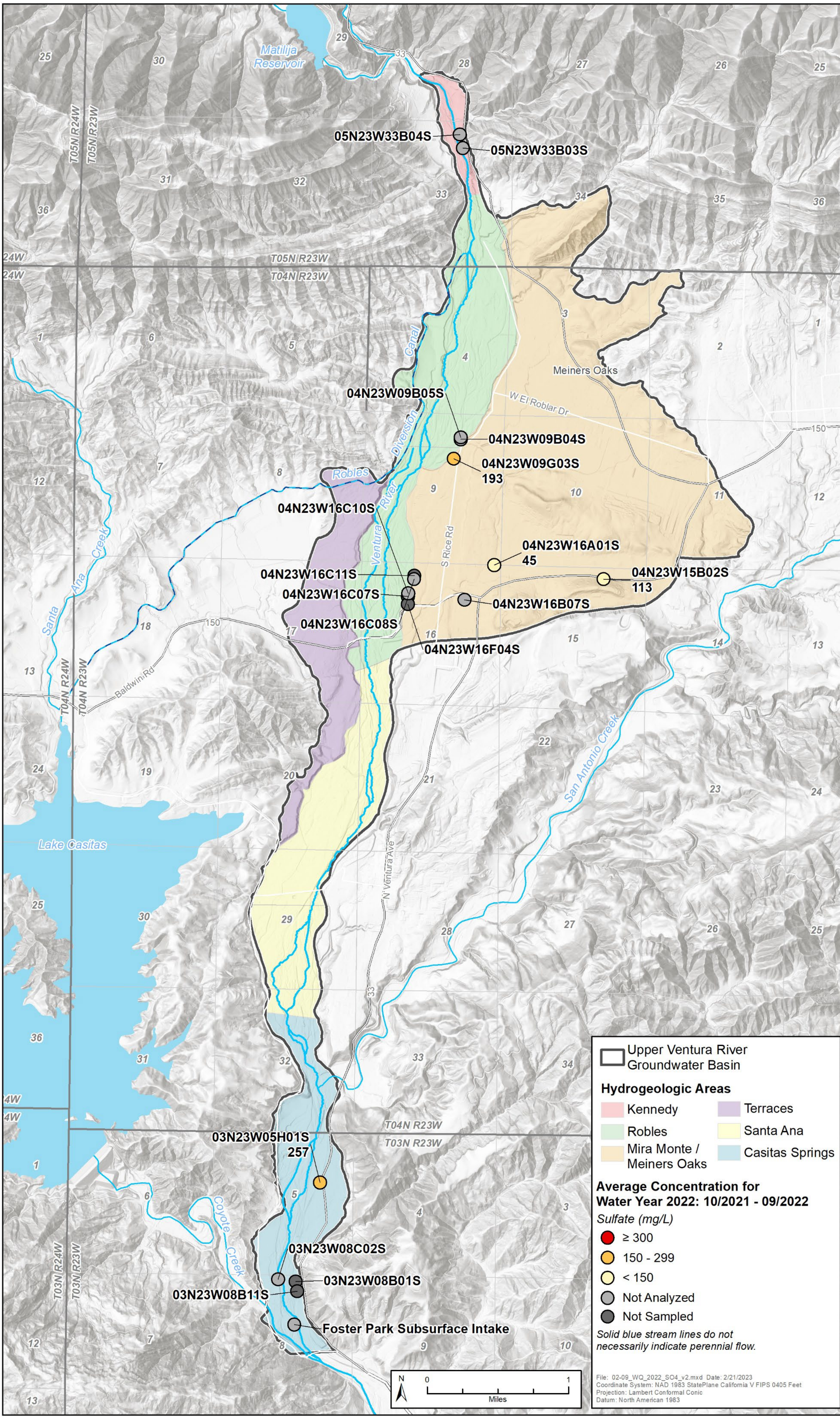


Figure 2.9 Average Sulfate Concentration in UVRGB, Water Year 2022.

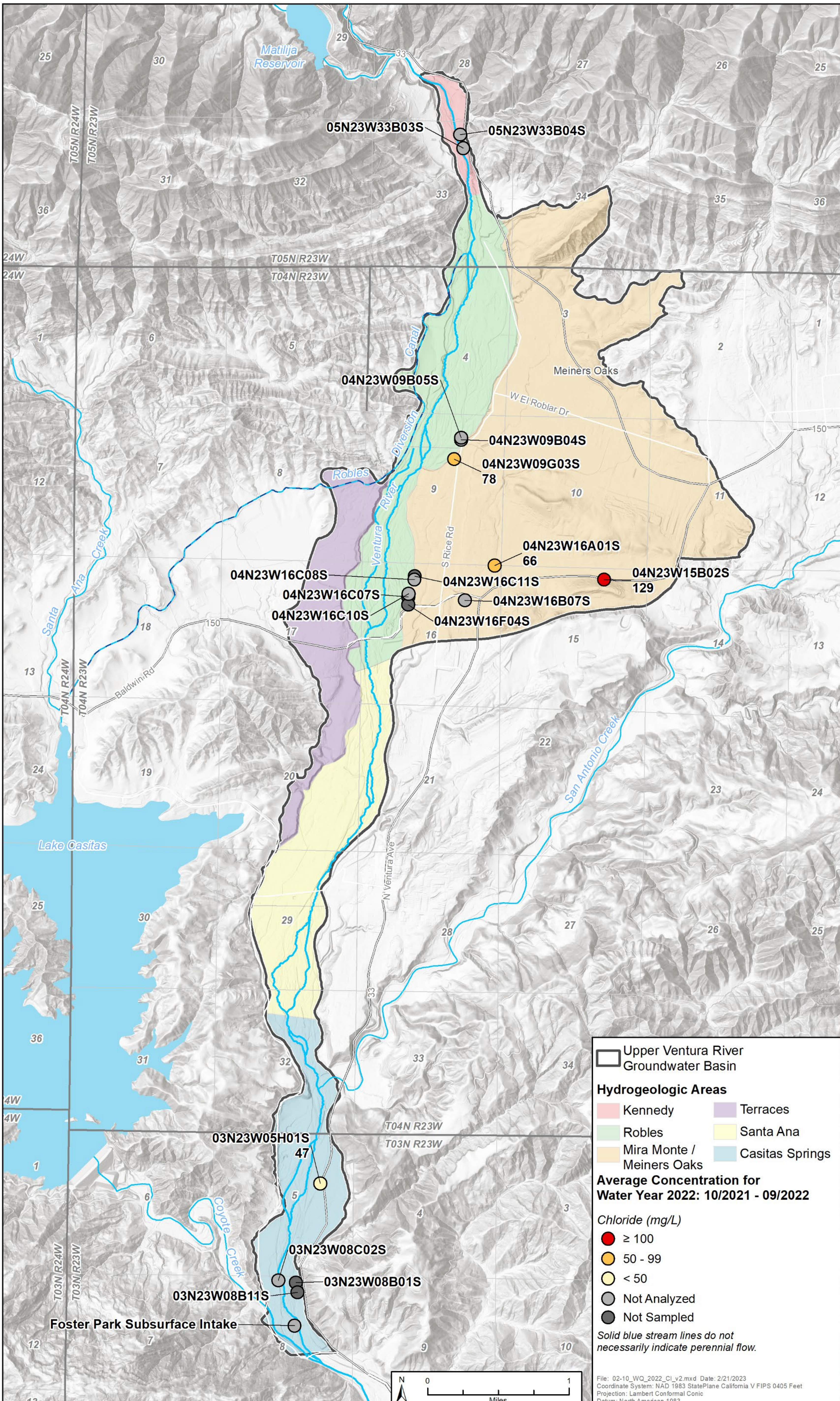


Figure 2.10 Average Chloride Concentration in UVRGB, Water Year 2022.

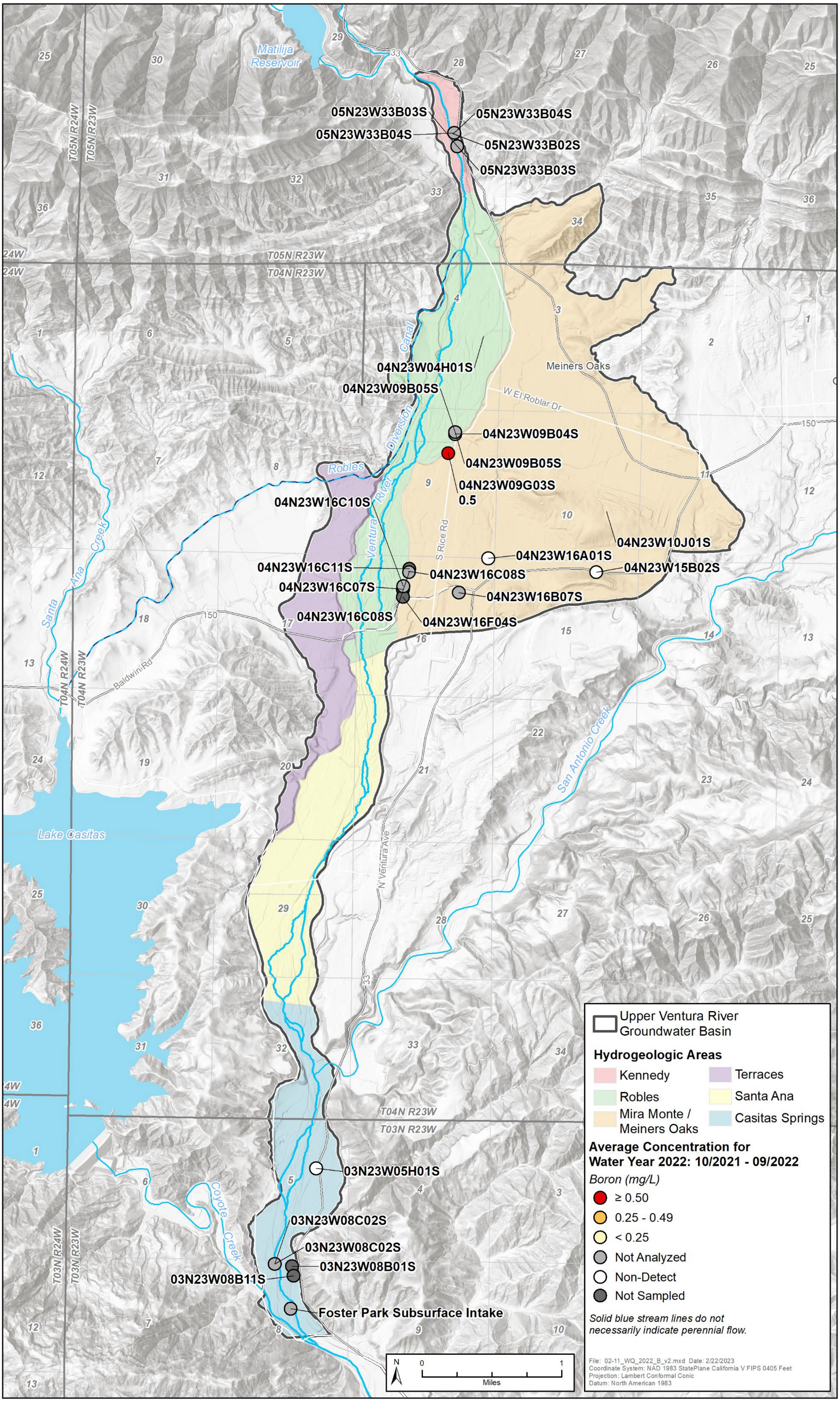


Figure 2.11 Average Boron Concentration in UVRGB, Water Year 2022.

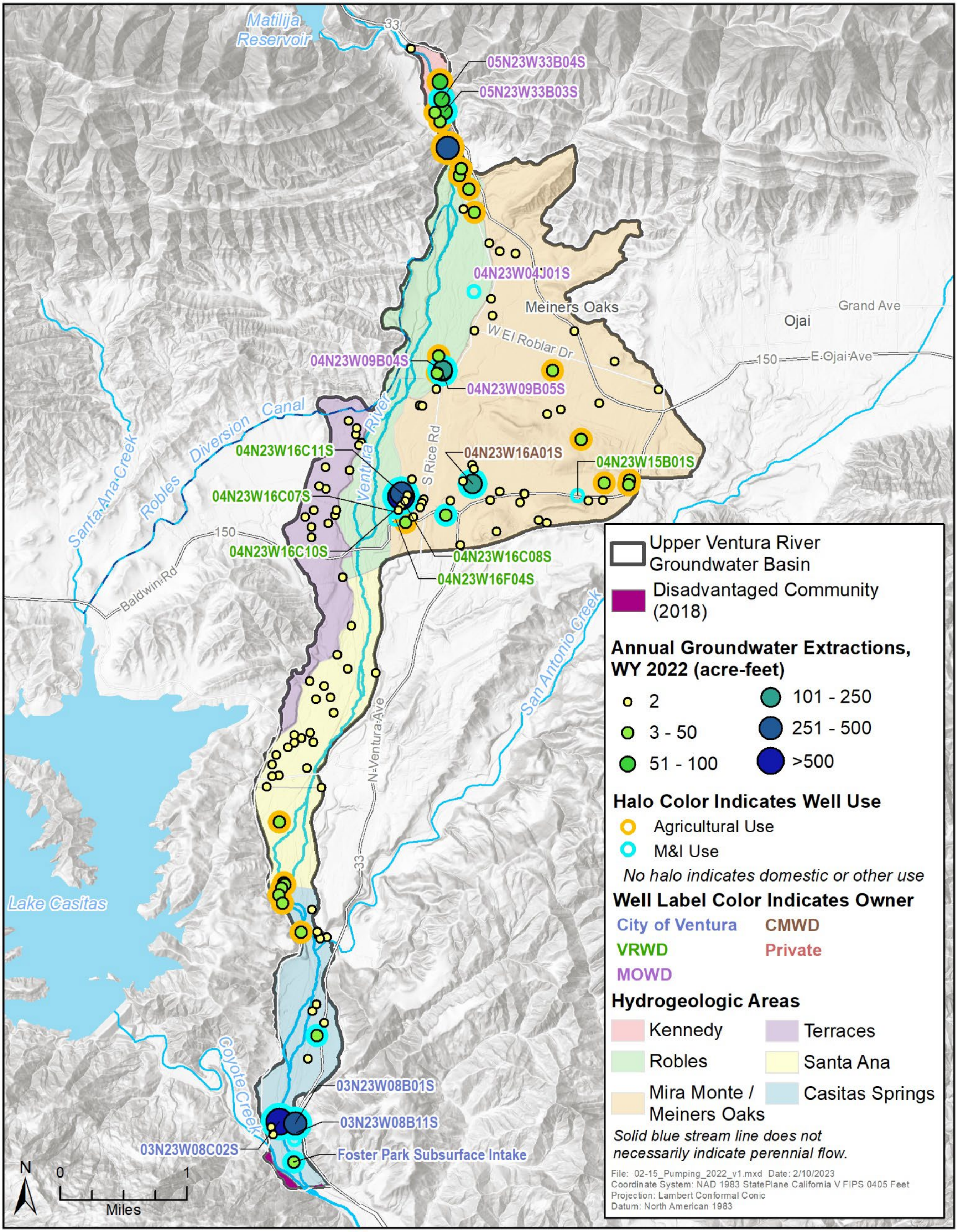


Figure 2.12 Extraction Well Rates, Water Year 2022.

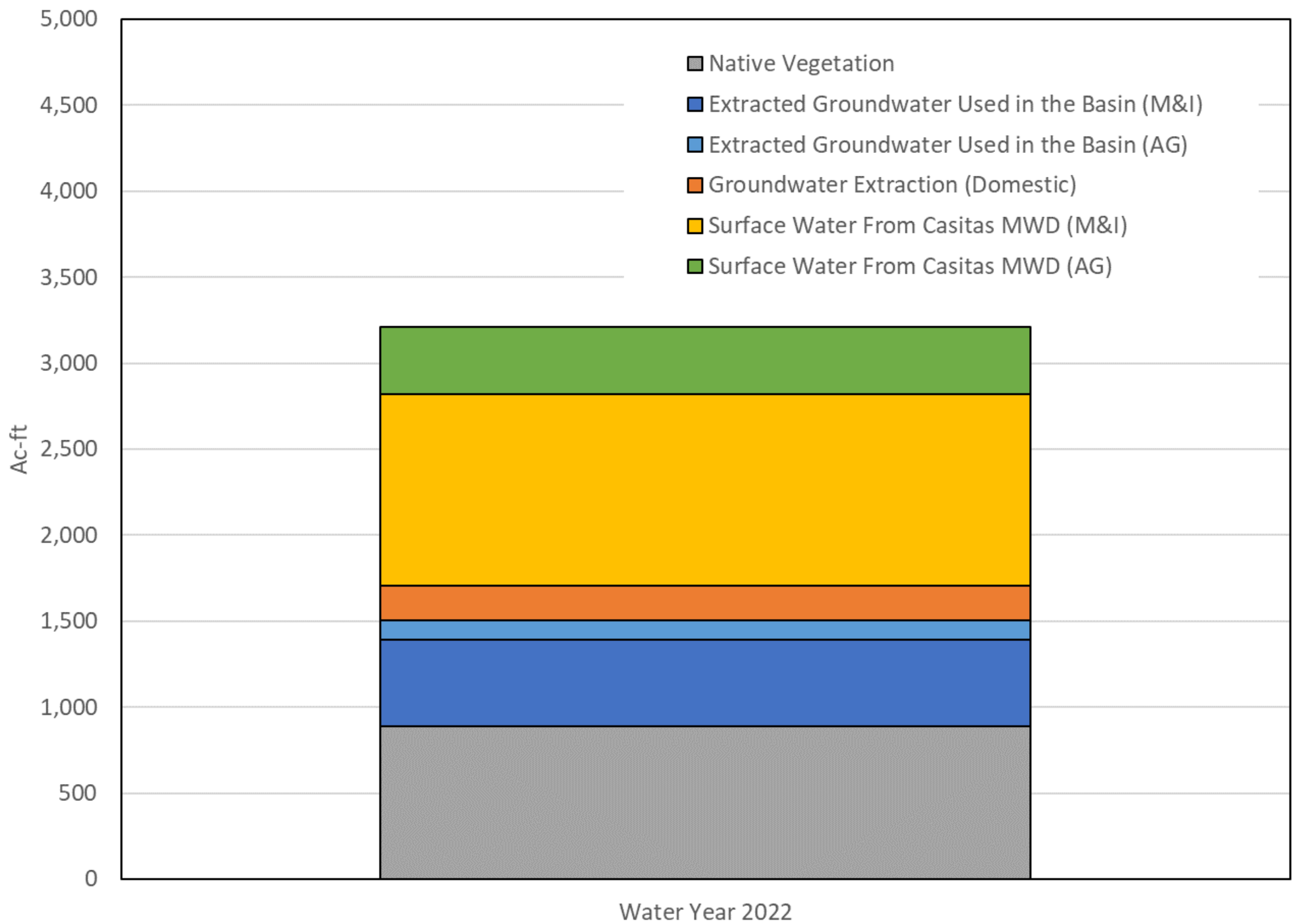


Figure 2.13 Total Water Use Within UVRGB During Water Year 2022.

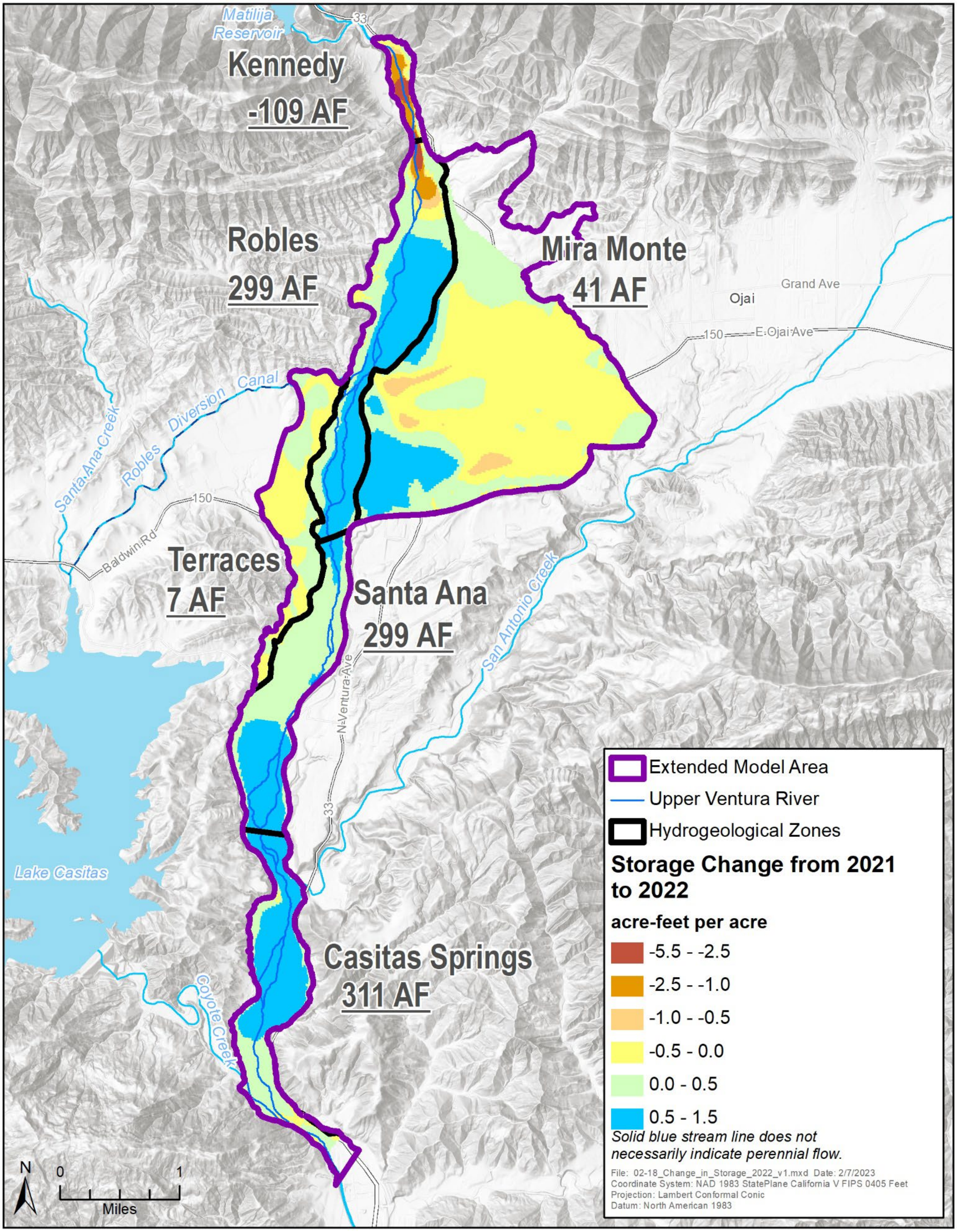


Figure 2.14 Change in Groundwater in Storage Map from Water Years 2021 to 2022.

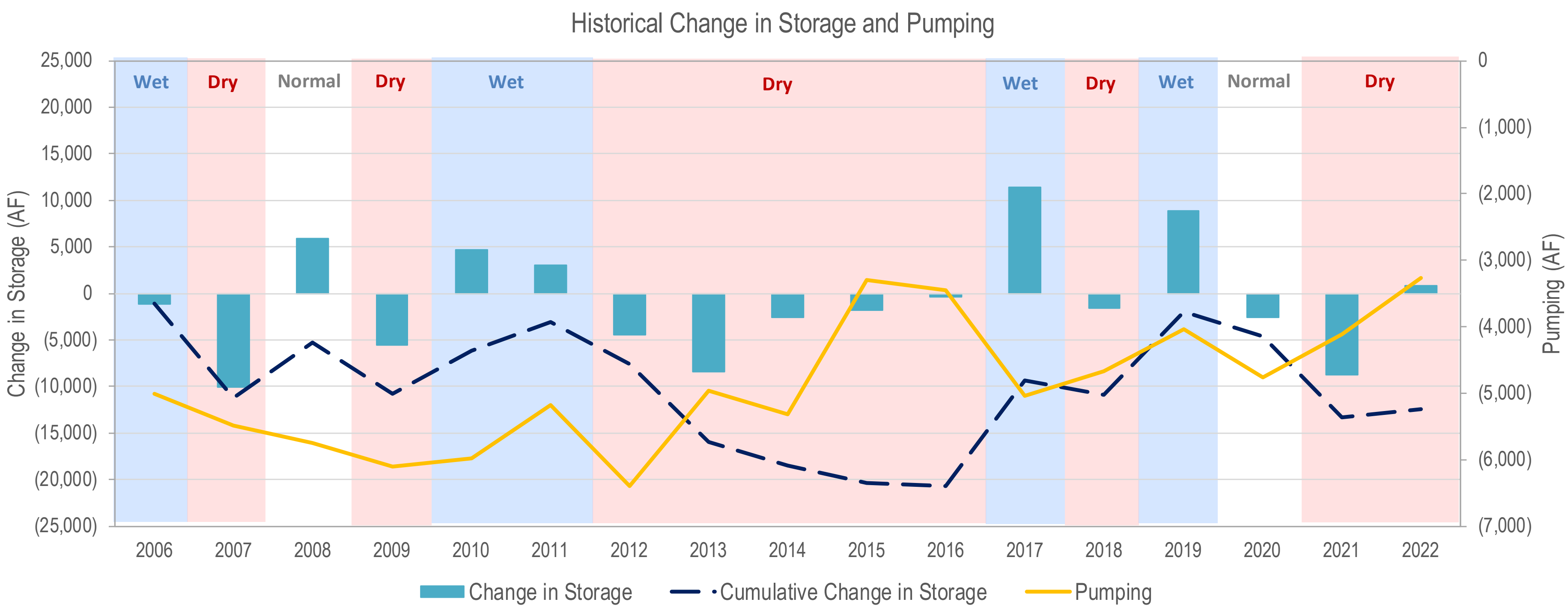


Figure 2.15 Change in Groundwater Storage with Annual Groundwater Extraction and Water Year Type.

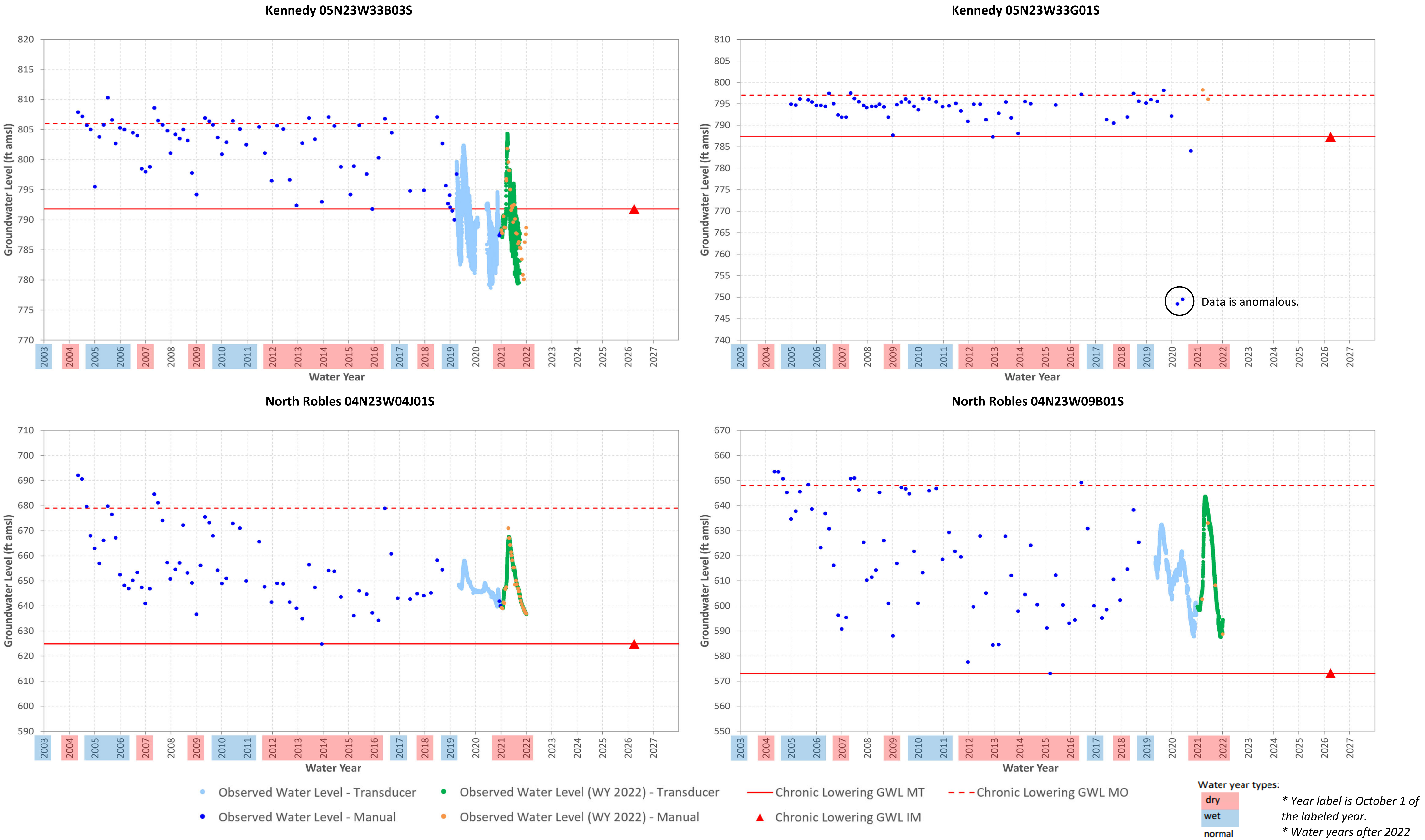


Figure 3.1 Groundwater Level Hydrographs with Minimum Thresholds, Measurable Objectives, and Interim Milestones, Water Year 2022.

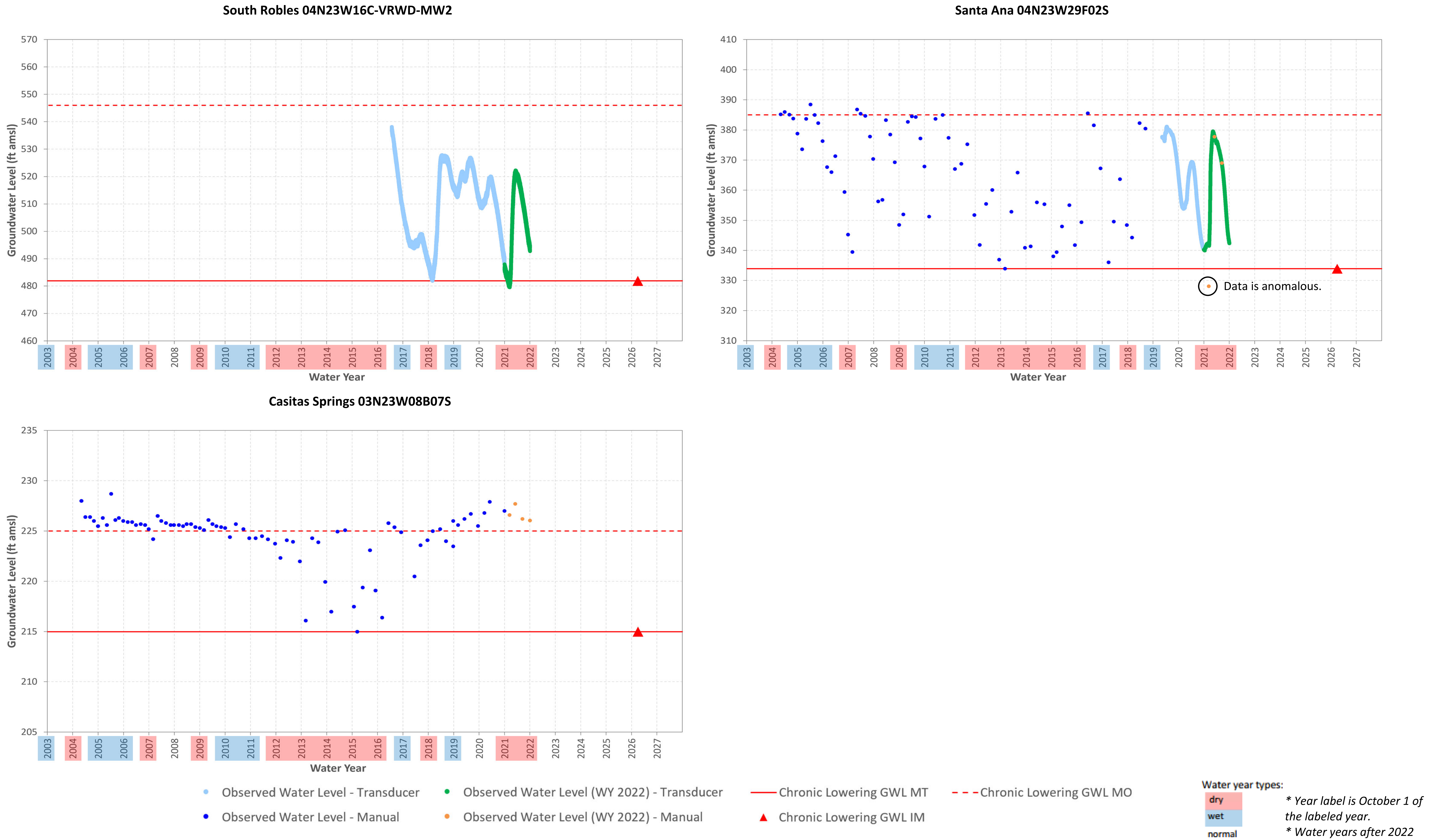


Figure 3.1 Groundwater Level Hydrographs with Minimum Thresholds, Measurable Objectives, and Interim Milestones, Water Year 2022.

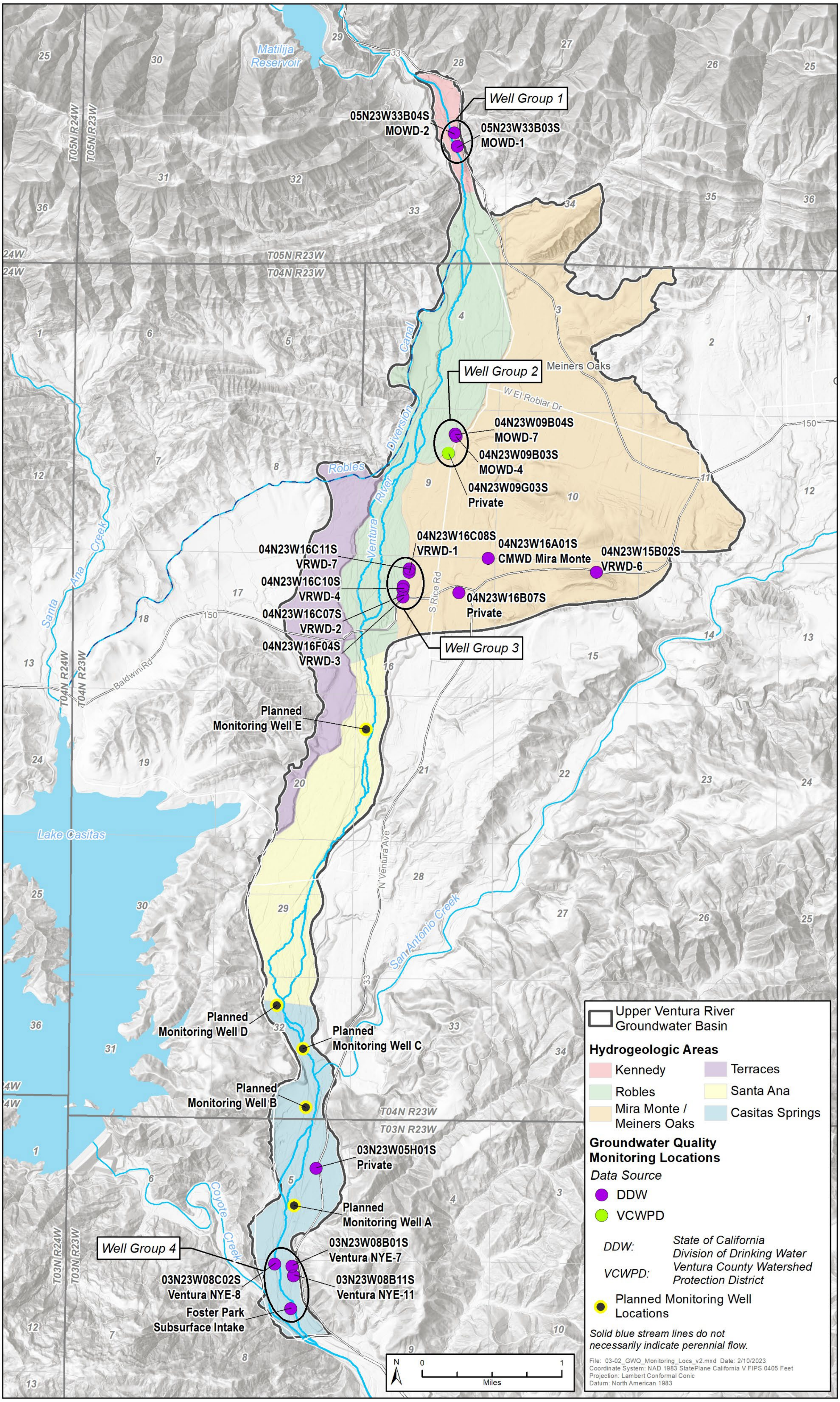


Figure 3.2 Existing and Planned Water Quality Monitoring Network.

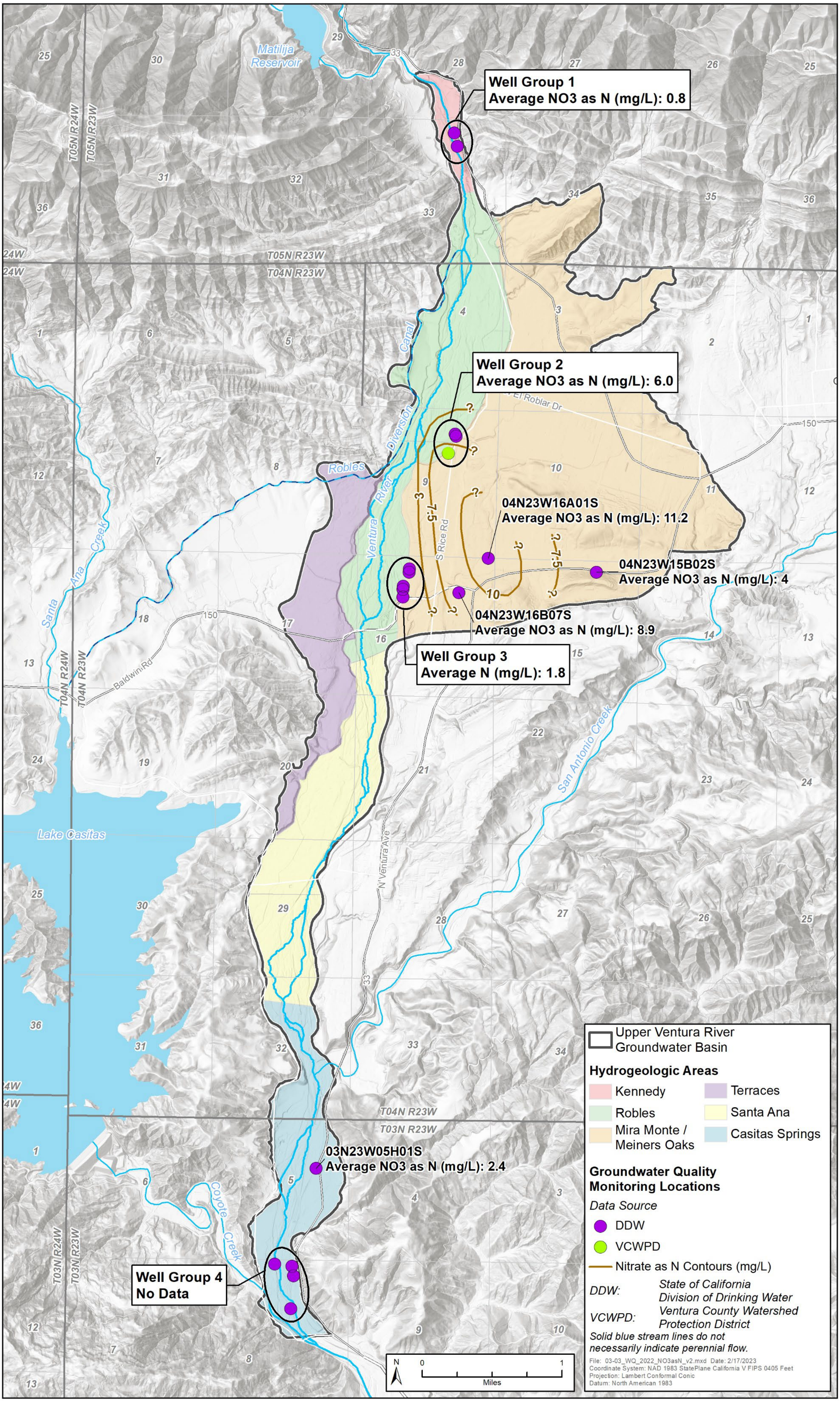
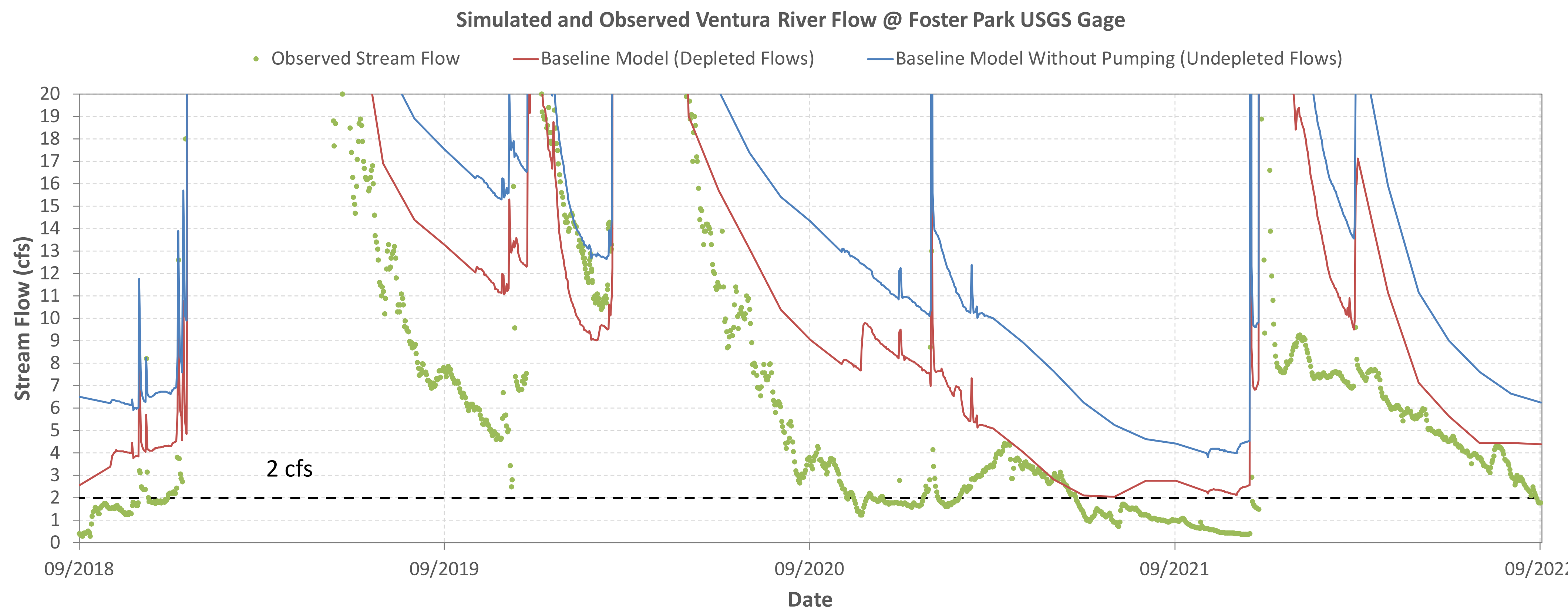


Figure 3.3 Nitrate Concentration Contours for the Degraded Water Quality Sustainability Indicator, Water Year 2022.



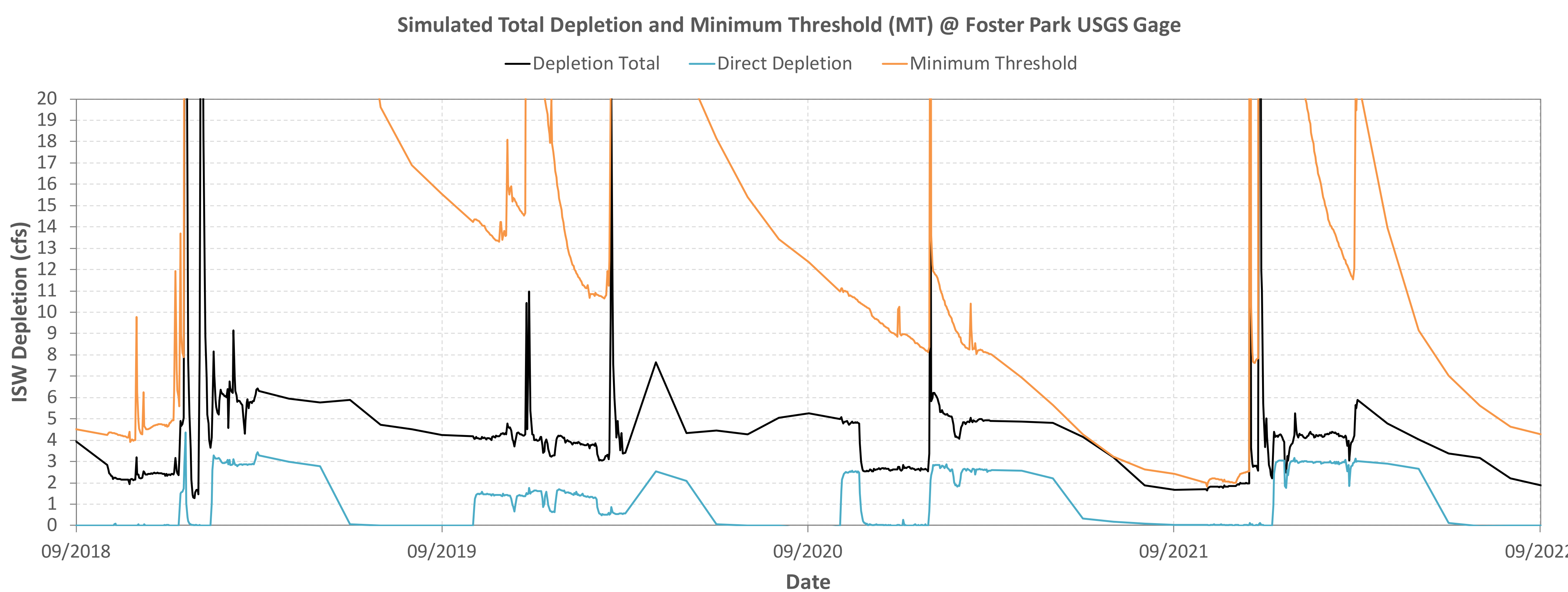


Figure 3.4 Foster Park Aquatic Habitat Area Simulated Streamflow and Depletion.

The term "depletion" refers to the direct or indirect reduction of stream flow resulting from groundwater extraction. Please see GSP Section 3.2.6 for further description of direct versus indirect reductions (depletions) of surface water.

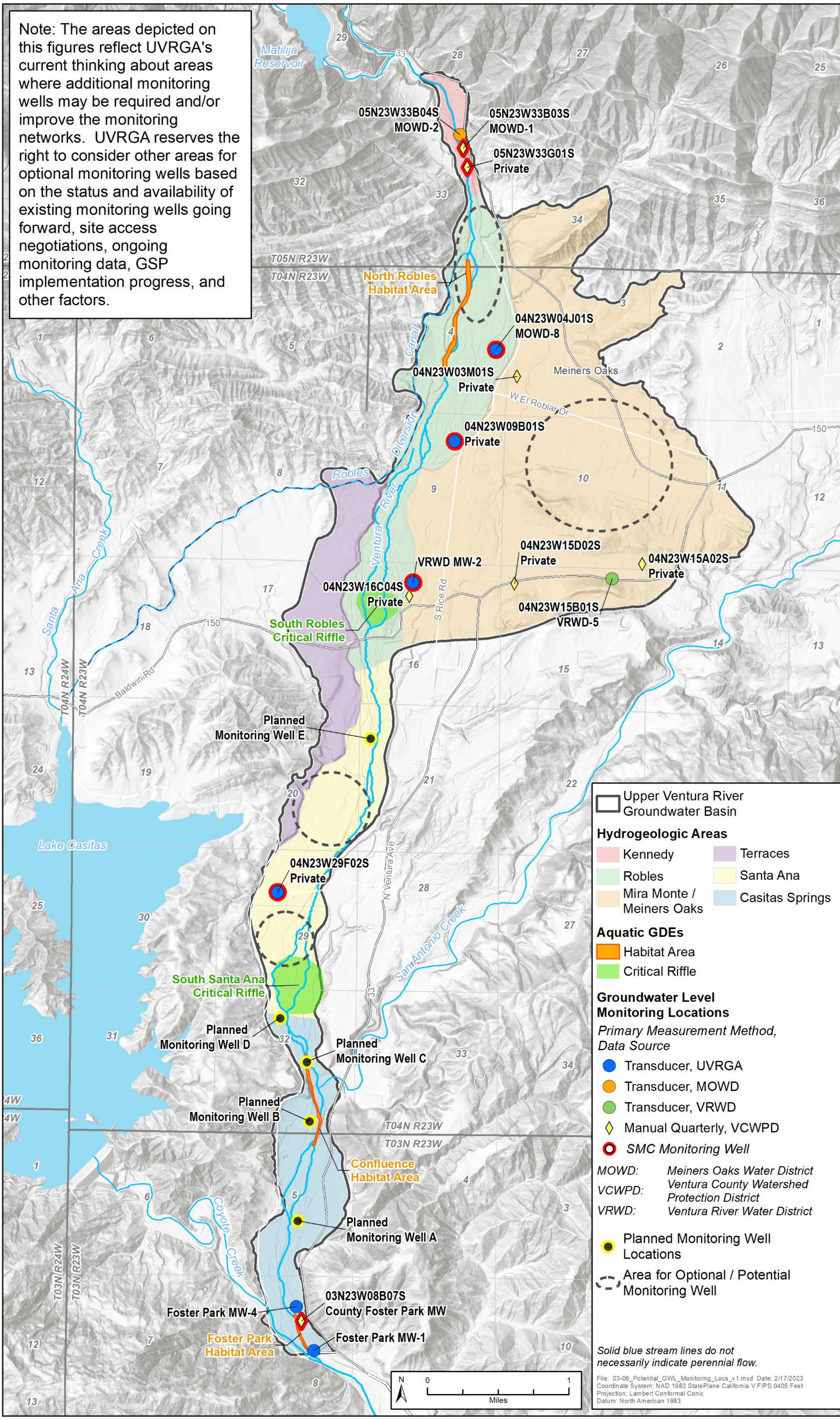


Figure 3.5 Areas for Optional / Potential Monitoring Wells to Improve Groundwater Level Monitoring Network.

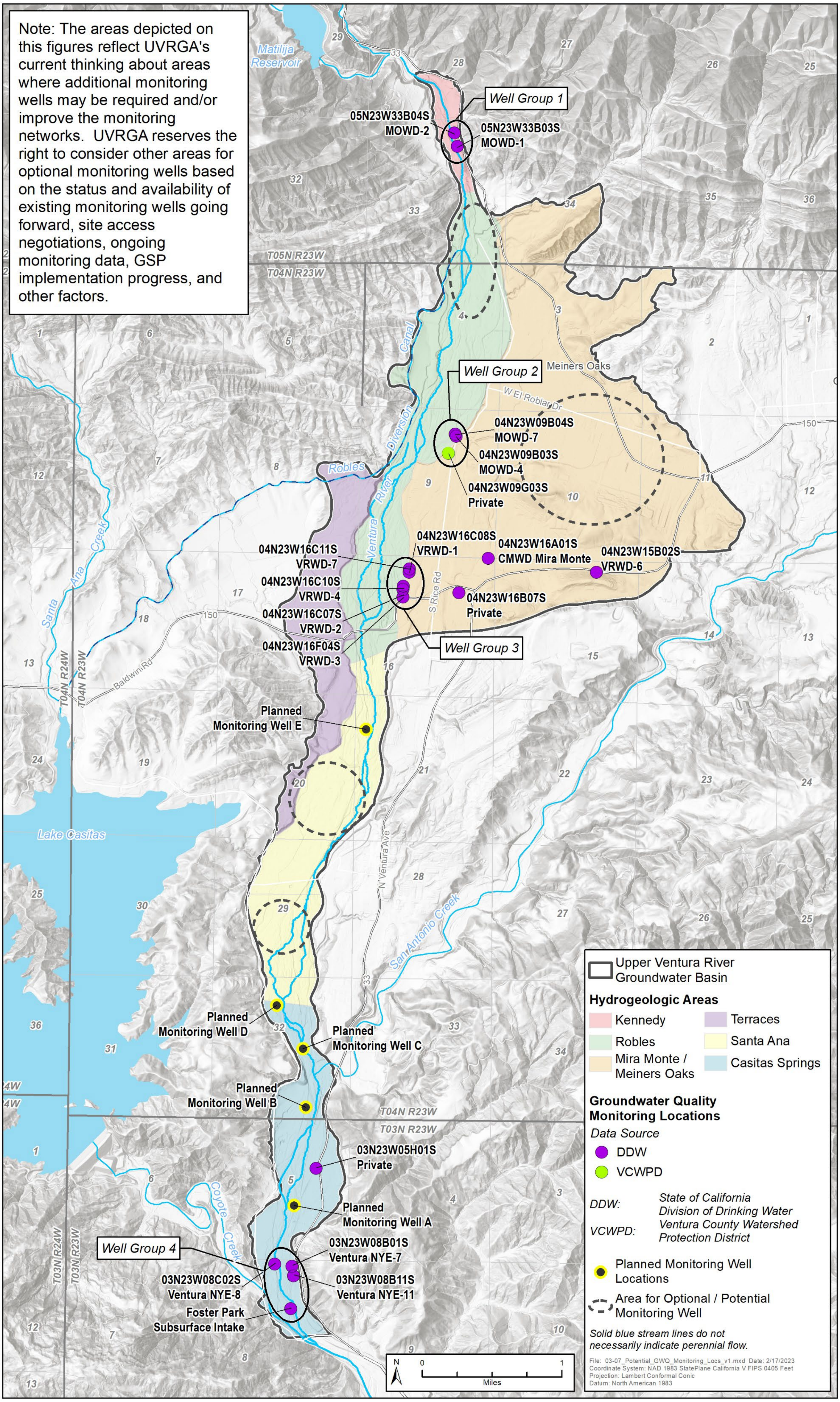


Figure 3.6 Areas for Optional / Potential Monitoring Wells to Improve Groundwater Quality Monitoring Network.

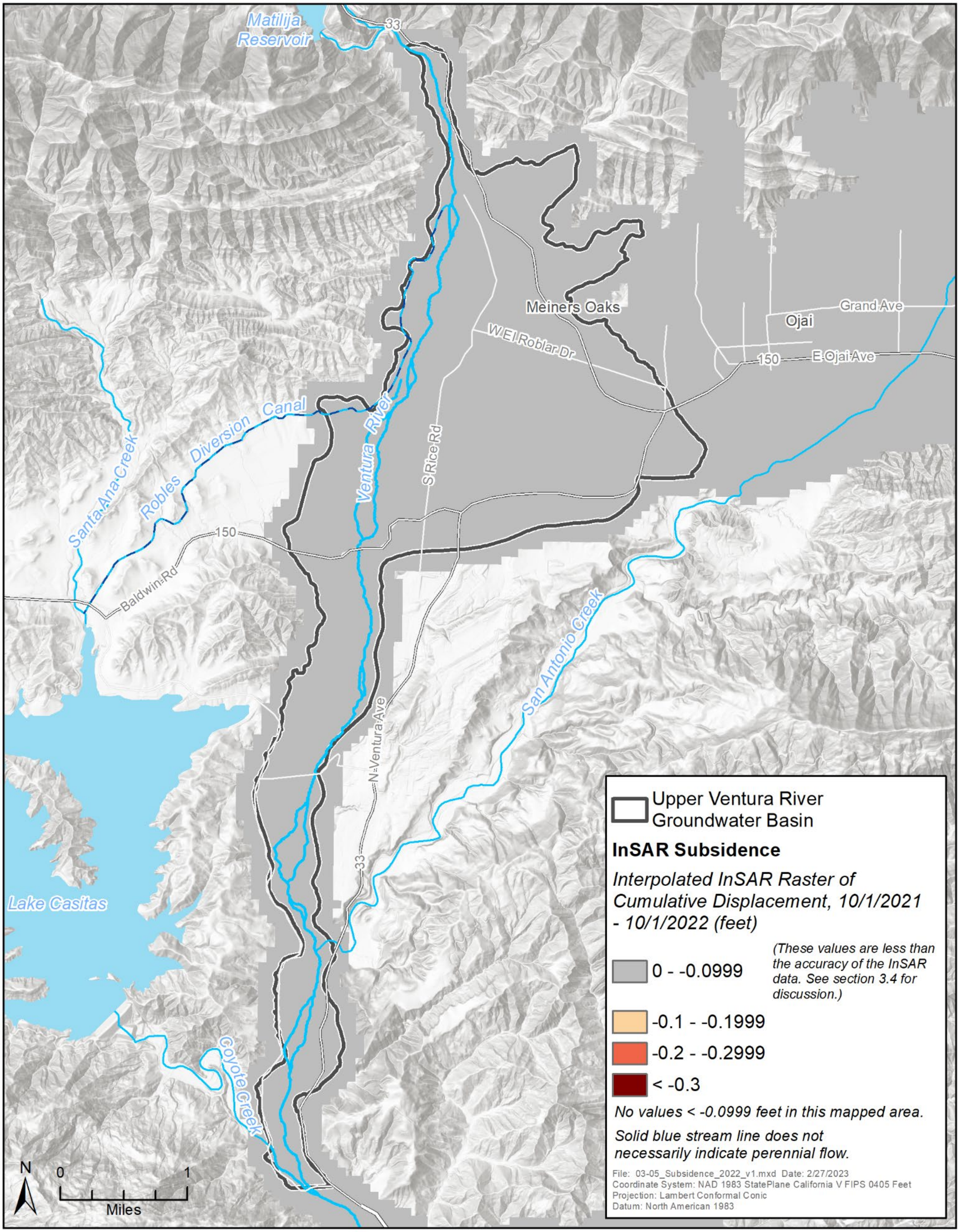


Figure 3.7 Subsidence for Upper Ventura River Groundwater Basin Between Water Year 2022.

Tables

Table 2.1 Groundwater Extraction From UVRGB by Water Use Sector During Water Year 2022.[a]

Water Use Sector		Water Year 2022 AF/yr	Method of Measurement	Accuracy of Measurement
Agricultural		405	Estimated[b]	Medium
Municpal and Industrial[b]	VRWD	868	Direct[c]	High
	MOWD	458		
	CMWD	179		
	City of Ventura	1,137		
Domestic		204	Estimated[b]	Medium
Subtotal (extraction via pumping wells)		3,251		
Native Vegetation[d]		888	Estimated[e]	Medium
TOTAL		**4,139**		

Notes:

- Totals may not match sum of values due to rounding.

a Significant volumes of agricultural and municipal and industrial extracted groundwater is exported from the Basin. Values in this table reflect total extracted groundwater from the UVRGB.

b See Table 2.2 for volumes of extracted groundwater used within UVRGB. See text Section 2.5 and GSP Appendix H (UVRGA, 2022) for details on estimation methods.

c Based on reported values from each district and the City of Ventura.

d Note the extraction due to native vegetation includes the invasive species Arundo.

e Calculated using the numerical groundwater model – see GSP Appendix H (UVRGA, 2022) for details on estimation methods.

Table 2.2 Total Water Use Within UVRGB During Water Year 2022.

Water Year 2022					
Water Use Sector	Water Source Type		Total (AF)	Method of Measurement	Accuracy of Measurement
	Groundwater Extraction (AF)	Surface Water (direct and retail deliveries from CMWD) (AF)			
Agricultural[a]	113	392	505	Direct and estimated[b,c]	Medium
Municpal and Industrial	504[d]	1,111	1,615	Direct and Estimated[b,e]	High
Domestic[a]	204	0	204	Estimated[c]	Medium
Native Vegetation[f]	888	Unknown[g]	888	Estimated[a]	Medium
TOTALS (AF)	1,709	1,503	3,212		

Notes:
- Totals may not match sum of values due to rounding.
a Estimated from numerical model inputs, procedures detailed in the GSP (see Appendix H; UVRGA, 2022).
b CMWD wholesale purchased surface water is metered, direct surface water purchases are estimated; see GSP Section 3.3.1.1 (UVRGA, 2022) for more information.
c See Section 2.5 in the text and UVRGA GSP (2022) for groundwater estimation methods.
d Significant volumes of agricultural and municipal and industrial extracted groundwater are exported from the Basin. Values in this table reflect extracted groundwater that is used within the UVRGB, see GSP Appendix H (UVRGA, 2022) for more information and Table 2.1 for total extraction volumes.
e Groundwater is based on reported values from each district and the City of Ventura, see Table 2.1 for total extraction volumes.
f Note the extraction due to native vegetation includes the invasive species Arundo.
g The modeled streamflow does not account for the surface water ET losses, see GSP Appendix H (UVRGA, 2022) for more information.

Table 3.1 Sustainable Management Criteria[a] for the Chronic Lowering of Groundwater Levels and Reduction of Groundwater Storage Sustainability Indicators.

State Well Identification Number	Well Name	Chronic Lowering of GW Levels and Reduction of GW Storage MT (ft amsl)	Chronic Lowering of GW Levels and Reduction of GW Storage MO (ft amsl)	IM 5-year (ft amsl)	IM 10-year (ft amsl)	IM 15-year (ft amsl)	IM 15-year (ft amsl)	2022 Minimum GW Level (ft amsl)
05N23W33B03S	Kennedy 05N23W33B03S	792	806	792	806	806	806	779.4
05N23W33G01S	Kennedy 05N23W33G01S	787	797	787	797	797	797	796.1
04N23W04J01S	North Robles 04N23W04J01S	625	679	625	679	679	679	636.9
04N23W09B01S	North Robles 04N23W09B01S	573	648	573	648	648	648	587.5
04N23W16C-VRWD MW-2[b]	South Robles VRWD-MW-2	482	546	482	546	546	546	479.5
04N23W29F02S	Santa Ana 04N23W29F02S	334	385	334	385	385	385	340.3
03N23W08B07S	Casitas Springs 03N23W08B07S	215	225	215	225	225	225	226.1

Notes:
MT = minimum threshold; MO = measurable objective; IM = interim milestone

[a] The combination of minimum threshold exceedances that is deemed to cause significant and unreasonable effects in the basin for chronic lowering of groundwater levels is minimum threshold exceedances in the seven representative monitoring sites.

[b] Values for MT and 5-year IM have been updated since what was presented in the GSP (UVRGA, 2022).

Color Key:

MO met
5-year IM met
MT exceeded

Table 3.2 Water Quality Minimum Thresholds and Measurable Objectives.

Constituent	MCL (mg/L)	RWQCB WQO (mg/L)	Range of Average Historical Concentrations for Wells or Well Groups (mg/L)	MT isocontour (mg/L)[1]	MO isocontour (mg/L)[2]	Status of Sustainable Management Criteria for Water Year 2022
Percolating Groundwater Areas (Kennedy, Robles, Mira Monte/Meiners Oaks, and Santa Ana Hydrogeologic Areas)						
Nitrate (as N)	10	10	1.1 – 12.6	10	7.5	MO met
Areas with Rising Groundwater (Casitas Springs Hydrogeologic Areas)						
Nitrate (as N)	10	5 (Surface Water WQO)	1.1 – 1.4	10	3	MO met

Color Key:

MO met

MT exceeded

[1] SGMA undesirable results are considered to occur when any isocontour exceeds 10 mg/L outside of the Mira Monte / Meiners Oaks Area and encompasses an area with active domestic wells producing groundwater from the alluvial aquifer that lack an alternative drinking water source. If the minimum threshold is exceeded, UVRGA will investigate to determine if caused by pumping by a GSP project or management action.

[2] The measurable objectives are not intended to be applicable in the Meiners Oaks / Mira Monte Area because this area is known to be a source area for nitrate and is an existing area of nitrate impacts. If the measurable objective is not met, UVRGA will investigate to determine if caused by pumping by a GSP project or management action.

Table 3.3 Summary of ISW Depletion and SMC in the Foster Park Habitat Area for Water Years 2022.

Undepleted Flow (without groundwater pumping – derived from groundwater model)	Depletion Minimum Threshold and Measurable Objective	Goal	5-year Interim Milestone: Depletion in Excess of Measurable Objective	Water Year 2022 Simulated Depletion
> 2 cfs	Undepleted flow minus 2 cfs	The minimum threshold and measurable objective seek to prevent depletions of surface water flow caused by groundwater pumping that would cause surface water flow to be less than 2 cfs when surface water flow would not be less than 2 cfs without pumping.	Maximum modeled depletion rate of 10.7 cfs	Measurable Objective met
≤ 2 cfs	0 cfs	The minimum threshold and measurable objective seek to prevent depletions of surface water flow caused by groundwater pumping when surface water would already be 2 cfs or less without groundwater pumping.		Not applicable (undepleted flows are not ≤ 2 cfs)

Notes:
See Figure 3.5 for a graph depicting the minimum threshold vs. depletion.
cfs = cubic feet per second

Color Key:

MO met
5-year IM met
MT exceeded