ANNUAL REPORT | APRIL 2023

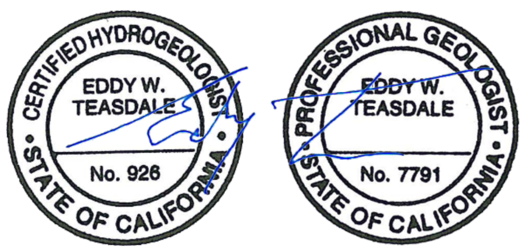
ANTELOPE SUBBASIN GROUNDWATER SUSTAINABILITY PLAN ANNUAL REPORT – 2022

PREPARED FOR

TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

TEHAMA COUNTY GSA

PREPARED BY



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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Meaning
AEM	airborne electromagnetic
af	acre-feet
af/ac	acre-feet per acre
bgs	below ground surface
CASGEM	California Statewide Groundwater Elevation Monitoring Online System
CVP	Central Valley Project
District	Tehama County Flood Control and Water Conservation District
DMS	data management system
DWR	Department of Water Resources
ET	evapotranspiration
eWRIMS	Electronic Water Rights Information Management System
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment Program
GIS	geospatial information system
GPCD	gallons per capita per day
GSP	Groundwater Sustainability Plan
GSA	Groundwater Sustainability Agency
InSAR	Interferometric Synthetic Aperture Radar
km	kilometer
m	meter
MO	measurable objective
MT	minimum threshold
NAVD 88	North American Vertical Datum of 1988
PMA	projects and management action
PRISIM	Parameter-elevation Regressions on Independent Slopes Model
RMS	representative monitoring site
SCADA	supervisory control and data acquisition
SGMA	Sustainable Groundwater Management Act
SMC	sustainable management criteria
Subbasin	Corning Subbasin
SWRCB	State Water Resource Control Board
TDS	total dissolved solids
Tehama IHM	Tehama Integrated Hydrogeological Model
Tehama County FCWCD	Tehama County Flood Control and Water Conservation District
TNC	The Nature Conservancy
TSS	Technical Support Services
USDA	United States Department of Agriculture
USGS	United States Geological Survey

UWMP	Urban Water Management Plan
WY	water year

EXECUTIVE SUMMARY

ES 1. Introduction

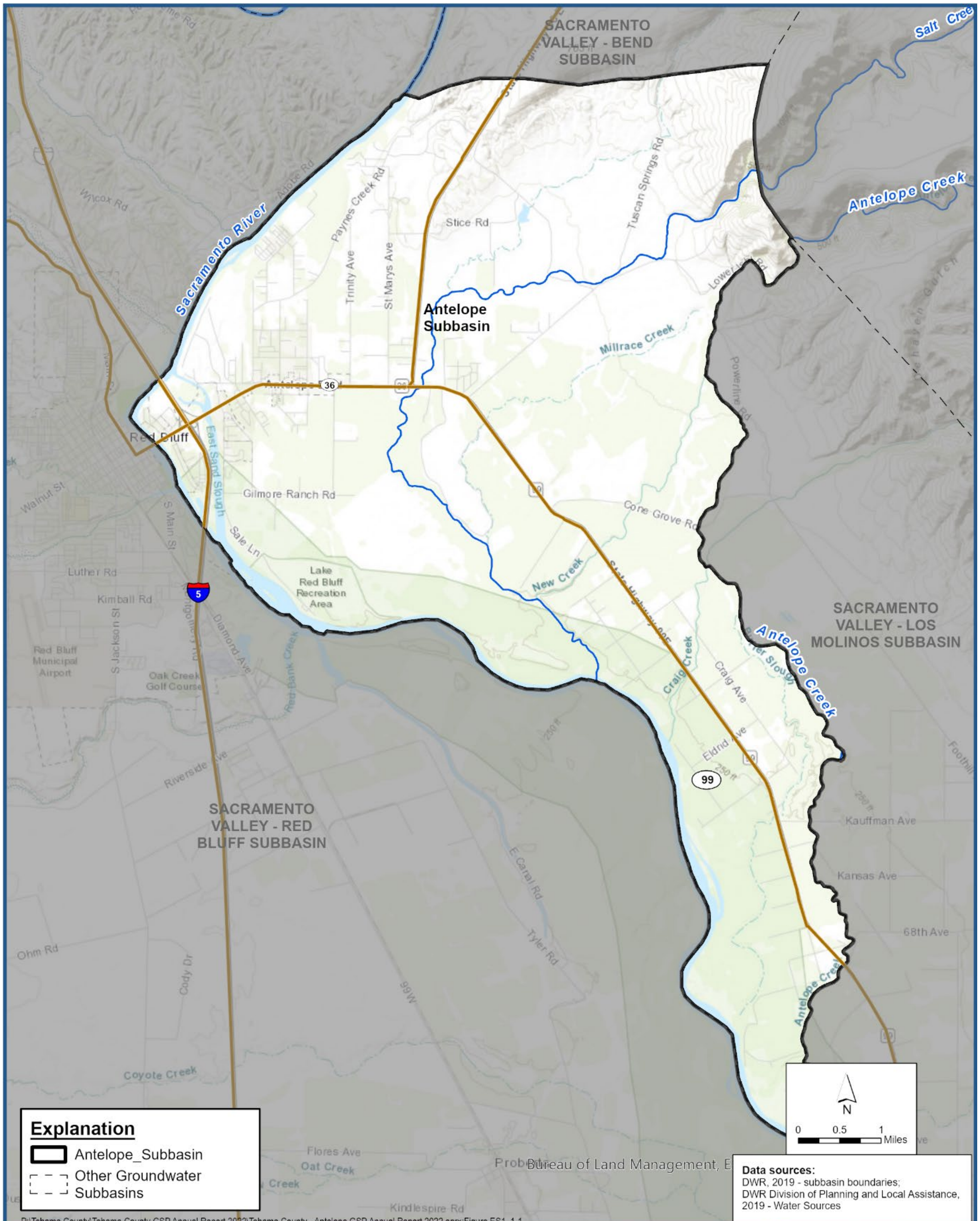
The annual report for the Antelope Subbasin (Subbasin) (5-021.54) was prepared on behalf of the Tehama County Groundwater Sustainability Agency (GSA) to fulfill the statutory requirements of the Sustainable Groundwater Management Act (SGMA) legislation (Section 10728) and regulatory requirements developed by the California Department of Water Resources (DWR) included in the Groundwater Sustainability Plan (GSP) Regulations (Section 354.40 and Section 356.2). The Regulations require the GSA to submit an Annual Report to DWR by April 1, 2023 following the reporting year (October through September).

The Antelope Subbasin covers approximately 19,100 acres and is in the Northern Sacramento Valley Groundwater Basin (**Figure ES-1**). Antelope is one of seven (7) groundwater subbasins within Tehama County. The Tehama County FCWCD is the exclusive GSA for six (6) of those subbasins: Antelope, Bend, Bowman, Los Molinos, Red Bluff, and South Battle Creek. The Corning Subbasin extends into Glenn County, that subbasin is managed in a coordinated effort between the Tehama County FCWCD and the Corning Sub-basin GSAs.

This report is the second Annual Report prepared to support the adopted Antelope Subbasin GSP submitted in January 2022. This Annual Report includes data elements for the current reporting Water Year (WY), 2022. Pursuant to GSP Regulations, the Annual Report includes:

1. Groundwater Elevation Data
2. Water Supply and Use
3. Change in Groundwater Storage
4. GSP Implementation Progress

This Annual Report coincides with one of the most severe and extensive droughts in the western United States' recorded history. In WY 2022, drought conditions in this subbasin were classified as ranging from "extreme" to "exceptional," the most extreme classification defined by the U.S. Drought Monitor. Historically, observed impacts during exceptional drought generally include: widespread water supply shortages, depleted surface water supplies, extremely low federal and state surface water deliveries, curtailment of water rights, extremely high surface water prices, increased groundwater pumping to satisfy water demands, dry groundwater wells, increased well drilling and deepening, increased pumping costs, wildfire, decreased recreational opportunities, and poor water quality, among other potential impacts reported by the U.S. Drought Monitor. All of these conditions were experienced to a degree across California in 2022 and, at least in part, within the Subbasin.



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Antelope Subbasin Area Map

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure ES-1

ES 2. Groundwater Elevations

Groundwater elevation data in the Upper and Lower Aquifers for WY 2022 was analyzed. The Water Year is defined as October through September. Groundwater elevation contour maps for seasonal low and seasonal high-water levels were prepared for WY 2022. Three Representative Monitoring Site (RMS) wells exist that monitor groundwater levels in the Upper Aquifer while no RMS wells are screened in the Lower Aquifer. Through the Technical Support Services (TSS) program, an additional monitoring well was planned to be installed in fall 2022. The TSS well was delayed and is now projected to be installed in March 2023. This nested monitoring well will provide an added well to both the Upper and Lower Aquifers. Seasonal high groundwater elevations were all above measurable objectives in WY 2022.

ES 3. Water Supply and Use

Table ES-1 includes groundwater use data by sector for WY 2022, numbers are rounded to two significant digits, except totals which are unrounded. The agricultural sector had the greatest decrease in use from 26,000 af in WY 2021 to 23,000 af in WY 2022. Native vegetation experienced an increase from 460 af in WY 2021 to 1,300 af in WY 2022, while urban groundwater use saw an increase from 1,000 af in WY 2021 to 1,800 af in WY 2022. In 2021 Urban use included estimated Rural Residential use, in 2022 they are reported separately. WY 2022 has been preliminarily classified as Critical by DWR (DWR, 2022).

Table ES-1. Groundwater Use by Water Use Sector

Sector	2022 (af)
Agricultural	23,000
Urban	1,700
Rural Residential	130
Native Vegetation (Plant groundwater uptake)	1,300
Total	**26,130**
Total (excluding Native Vegetation[1])	**24,830**

[1] *Excludes native vegetation which involves only natural plant uptake of shallow groundwater, not direct pumping, and extraction.*

Total surface water deliveries have been estimated from total surface water diversions by accounting for conveyance losses, reuse, and boundary outflows for WY 2022 and are presented in **Table ES-2**, numbers are rounded to two significant digits, except totals which are unrounded. Total surface water deliveries for the Antelope Subbasin were estimated to be about 12,000 af for WY 2022.

Table ES-2. Surface Water Deliveries by Water Use Sector and Source		
Sector	2022 (af) Supply Source	
	CVP	Local
Agricultural	0	12,000
Urban	0	0
Native Vegetation	0	0
Total	**12,000**	

ES 4. Groundwater Storage

Changes in groundwater storage from Spring 2021 to Spring 2022 were calculated using measured groundwater levels and a storage coefficient for the aquifer. Changes in groundwater levels from Spring 2021 to Spring 2022 at selected wells were interpolated to estimate the groundwater elevation change in areas where sufficient data was available. Estimated elevation change was multiplied by a storage coefficient (0.066) available from the Tehama Integrated Hydrogeological Model (Tehama County FCWCD, 2022) to estimate the groundwater storage change volume in the Upper and Lower aquifers. Changes in storage calculations are described further in **Section 2.1**. **Table ES-3** presents the annual storage change values for the Upper and Lower Aquifers.

Table ES-3. Change in Groundwater Storage Based on Seasonal High Groundwater Levels	
Aquifer	2022 (af)
Upper Aquifer	-3,000
Lower Aquifer	-2,000
Total	**-5,000**

ES 5. GSP Implementation Progress

ES 5.1 Progress Towards Achieving Sustainability

Groundwater conditions were above the established Minimum Thresholds (MTs) for the chronic lowering of groundwater levels sustainable management criteria (SMC) in Spring 2022. Overall, water levels in Spring 2022 were lower than Spring 2021 due to extended drought conditions.

The GSA is on track to stay above the Measurable Objective (MO) for the land subsidence SMC. The land subsidence MT is 0.5 feet (ft) per five years.

The depletion of interconnected surface water SMC uses spring groundwater elevations in wells within the monitoring network, and all interconnected surface water RMS wells' water levels were above MT levels.

ES 5.2 Progress Towards PMA Implementation

The Subbasin GSA has applied for grants through DWR's SGM Grant Program to implement Projects and Management Actions (PMAs), with a draft awards list expected in June 2023. The grant application has three components, including GSP implementation and outreach, ongoing monitoring and data enhancements, and project implementation focused on recharge. These projects aim to achieve sustainability goals in the GSP. Additionally, the GSA coordinated with DWR who conducted an AEM survey in 2022 to address data gaps in the subbasin. The collected data is available online and will be used to refine the hydrogeologic conceptual model.

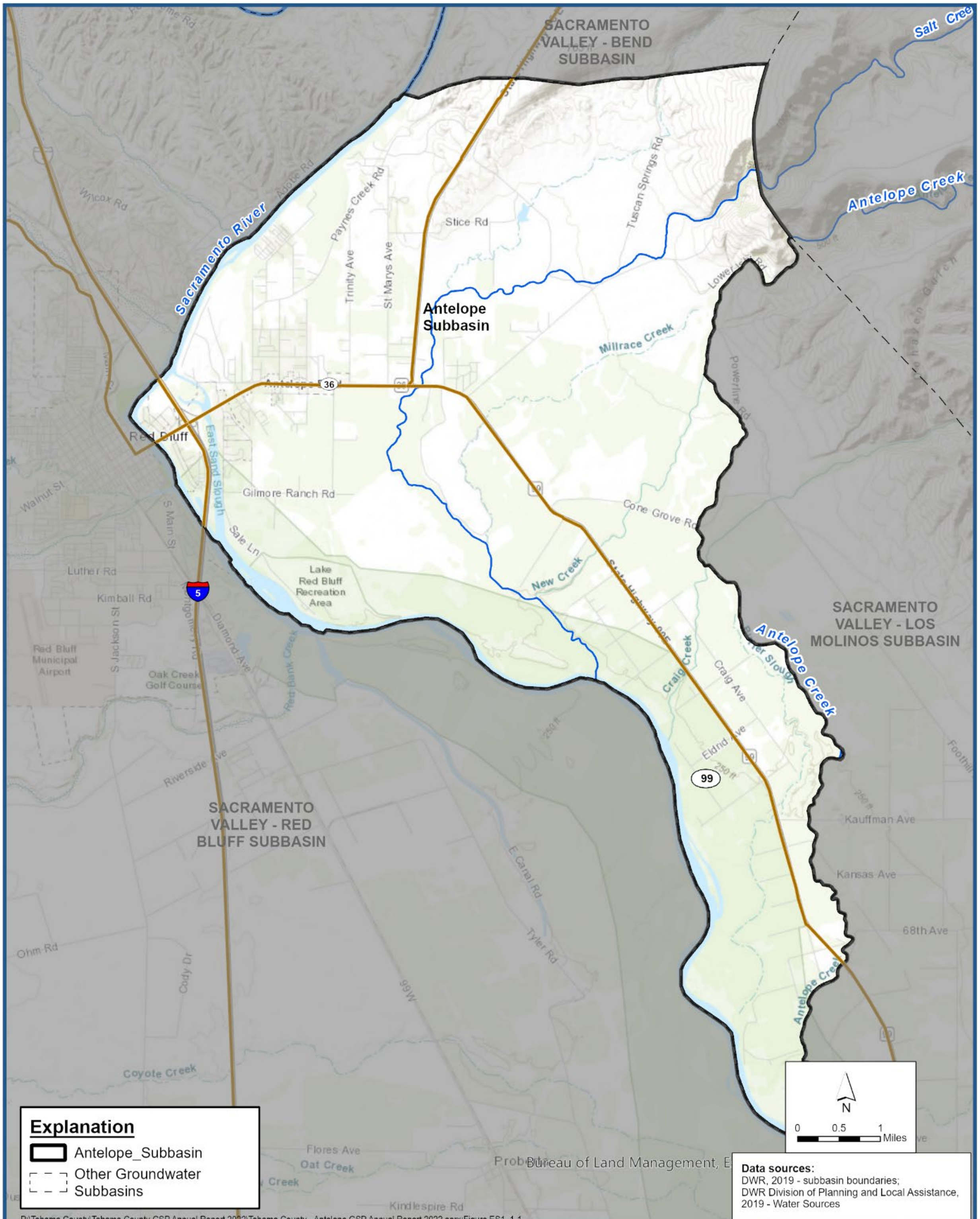
1. GENERAL INFORMATION

The annual report for the Antelope Subbasin (Subbasin) (5-021.54) was prepared on behalf of the Tehama County), Groundwater Sustainability Agency (GSA) to fulfill the statutory requirements of the Sustainable Groundwater Management Act (SGMA) legislation (Section 10728) and regulatory requirements developed by the California Department of Water Resources (DWR) included in the Groundwater Sustainability Plan (GSP) Regulations (Section 354.40 and Section 356.2). The Regulations require the GSA to submit an Annual Report to DWR by April 1st following the reporting year (October through September).

1.1. Subbasin Setting

The Antelope Subbasin (DWR Subbasin No. 5-021.54) covers 19,100 acres and is located in the Northern Sacramento Valley Groundwater Basin. The lateral extent of the Subbasin is defined by the Subbasin boundaries provided in Bulletin 118 (DWR, 2020). It is bounded on the north by the Bend Subbasin (DWR Subbasin No. 5-0.21.53) and Red Bluff Subbasin (DWR Subbasin No. 5-021.50), on the east and south by the Los Molinos Subbasin (DWR Subbasin No. 5-021.56), and on the south and west by the Red Bluff Subbasin (DWR Subbasin No. 5-021.50). The eastern and western boundaries of the Subbasin generally follow Antelope Creek and the Sacramento River, respectively, and the southern boundary ends at the confluence of both waterways. A small portion of the northeast border of the Subbasin is adjacent to the Cascade Mountain Range and does not border another groundwater subbasin (**Figure 1-1**).

Current data sources (discussed in Section 3.2) estimate 29% of the Subbasin is native vegetation, 50% is agricultural, and 3% is riparian vegetation. The Subbasin's agricultural water users rely on both surface water and groundwater to irrigate their crops. The Subbasin receives surface water supplies from the Central Valley Project (CVP) through surface water diverted by small CVP contractors to irrigated land along the Sacramento River.



Antelope Subbasin Area Map

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 1-1

Fresh groundwater bearing geologic deposits in the Subbasin are subdivided from previous studies into two units: The Upper Aquifer and the Lower Aquifer (DWR, 2003; DWR, 2004). The two-aquifer designation is based on an examination of groundwater elevation time-series, electric resistivity data from geophysical logs, lithologic logs, well construction details, and review of previous studies in the Subbasin. Generally, semi-confined, and confined aquifer conditions are encountered at depth and unconfined conditions are seen in the shallower porous media. The complexity of the geologic materials and the formations makes it difficult to define a singular widespread aquitard or distinctive change in geologic materials separating an Upper and Lower Aquifer. To delineate between areas with a higher likelihood of confined conditions, well construction data throughout the Subbasin were examined. Water bearing geologic units in the Upper Aquifer include the Quaternary formations and the upper portions of the Tehama and Tuscan Formations. Wells screened in the Upper Aquifer are largely for domestic purposes. The depth to the bottom of the Upper Aquifer is approximately 350-450 feet (ft) below ground surface (bgs).

The Lower Aquifer is defined as the freshwater bearing geologic units throughout the Subbasin from the bottom of model layer 5 at approximately 350-450 ft bgs, to the bottom of the Subbasin. The aquifer has confined to semi-confined conditions. Water bearing geologic units include the lower portions of the Tehama and Tuscan Formations. Wells screened in the Lower Aquifer are largely for non-domestic purposes.

1.2. Report Contents

This report is the second Annual Report prepared to support the adopted Antelope Subbasin GSP submitted in January 2022. The Annual Report includes data elements for the current reporting Water Year (WY), 2022. Data elements presented in this report refer to a Water Year (the 12-month periods from October through September) unless otherwise noted. Pursuant to of the GSP Regulations, the Annual Report includes:

1. Groundwater Elevation Data
2. Water Supply and Use
3. Change in Groundwater Storage
4. GSP Implementation Progress

2. GROUNDWATER ELEVATIONS SECTION 356.2(B)(1)

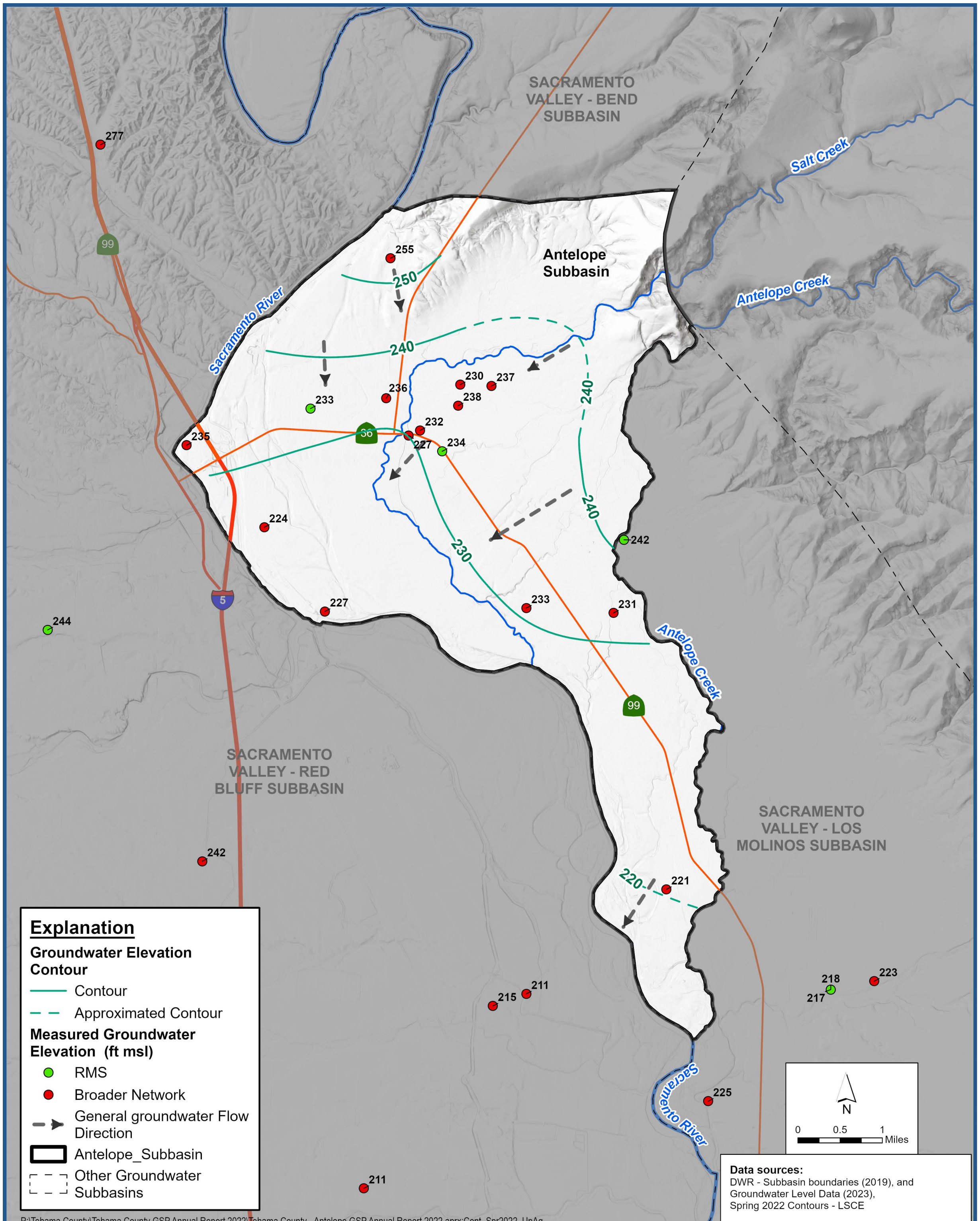
Currently, 20 wells are monitored as part of a broad network for groundwater levels and three are Representative Monitoring Site (RMS) wells assigned Sustainability Management Criteria (SMC). The wells are measured at least in the spring and fall each year. Groundwater elevation data in each of the principal aquifers for WY 2022 were analyzed. Hydrographs for these wells are included in **Appendix A**. **Appendix B** includes a copy of the monitoring data used to generate this Annual Report pursuant to GSP regulations (Section 354.40). Groundwater elevation contour maps for seasonal low and seasonal high water levels were prepared for WY 2022. Groundwater level data collected at RMS and other wells used to develop groundwater contours and RMS well hydrographs are collected by DWR, United States Geological Survey (USGS), The Nature Conservancy (TNC), and the District and records are maintained by the State Water Resources Control Board (GAMA) and DWR (CASGEM). Records of groundwater elevations are also maintained in the GSA's Data Management System (DMS).

2.1. Groundwater Elevation Contours – Section 356.2(b)(1)(A)

Seasonal high and seasonal low groundwater elevation contour maps for WY 2022 are presented for the Upper Aquifer on **Figures 2-1** and **2-2**. The seasonal high contours were prepared based on observed maximum springtime (February-May) water levels, while the seasonal low contours were prepared based on minimum fall (July-October) water levels. Due to the limited number of wells in the subbasin and to resolve data gaps near the edge of the subbasin wells neighboring the Antelope subbasin were included in the contouring process. Wells were not displayed in contour maps if data did not exist at that well during the mapping period. Contours are shown solid if there is good confidence in the contour placement whereas contours are shown dashed if their position is inferred from data yet generally representative of the contour's true location. Contours are not drawn if confidence in contours is poor. Most notably this occurs on the northeastern side of the subbasin where coverage of monitoring wells is poor. Groundwater elevations on the contour maps are shown as feet above mean sea level (ft amsl) based on the North American Vertical Datum of 1988 (NAVD 88). No contours were produced for the Lower Aquifer due to the limited number of available Lower Aquifer wells.

The contour maps illustrate general features of the groundwater flow system in the Antelope Subbasin, including:

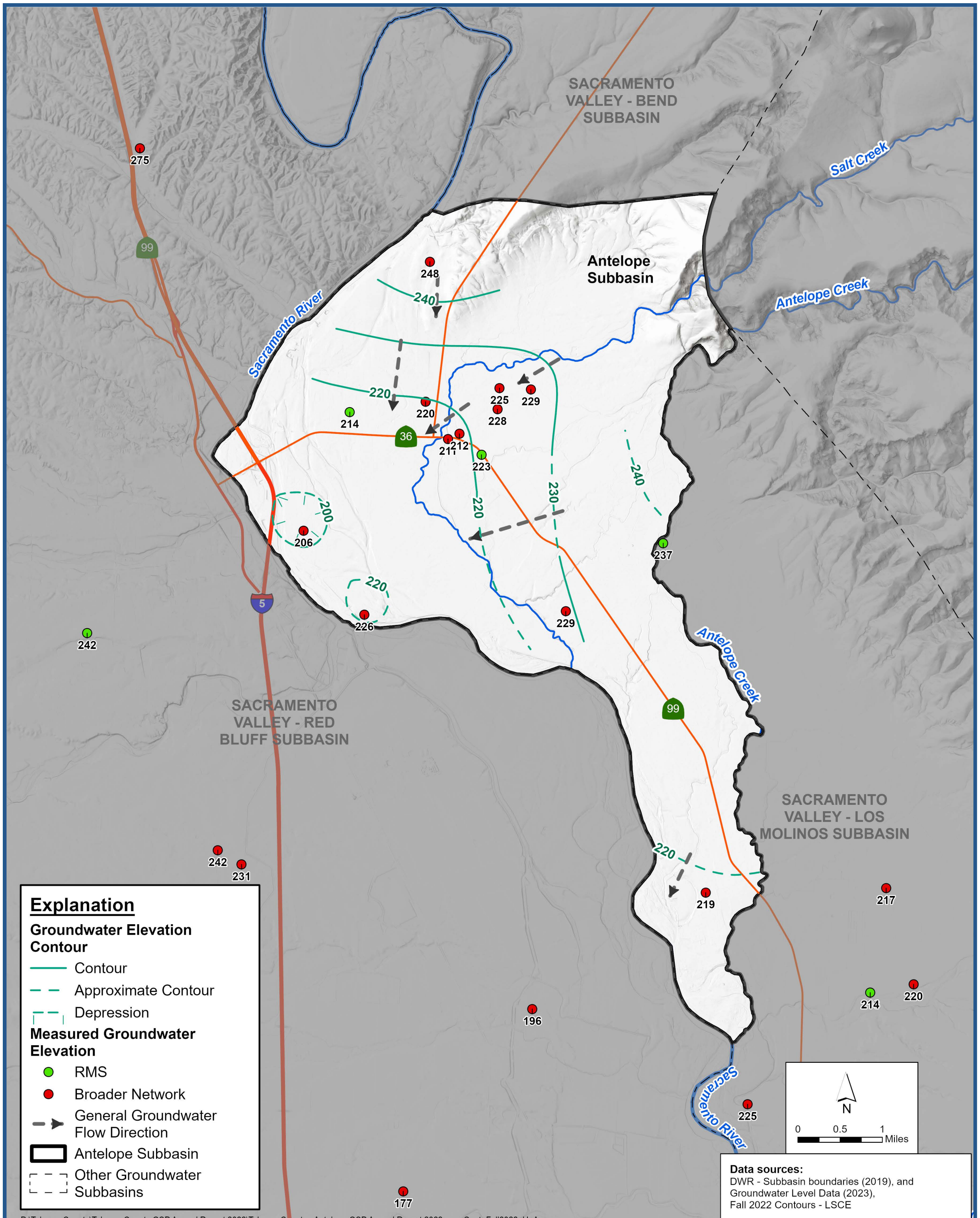
- A general groundwater flow moving from the north to south-southwest within the subbasin.
- Movement of water towards the Sacramento River in both fall and spring



Contours of Equal Groundwater Elevation
Upper Aquifer - Spring 2022

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 2-1



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Contours of Equal Groundwater Elevation
Upper Aquifer - Fall 2022

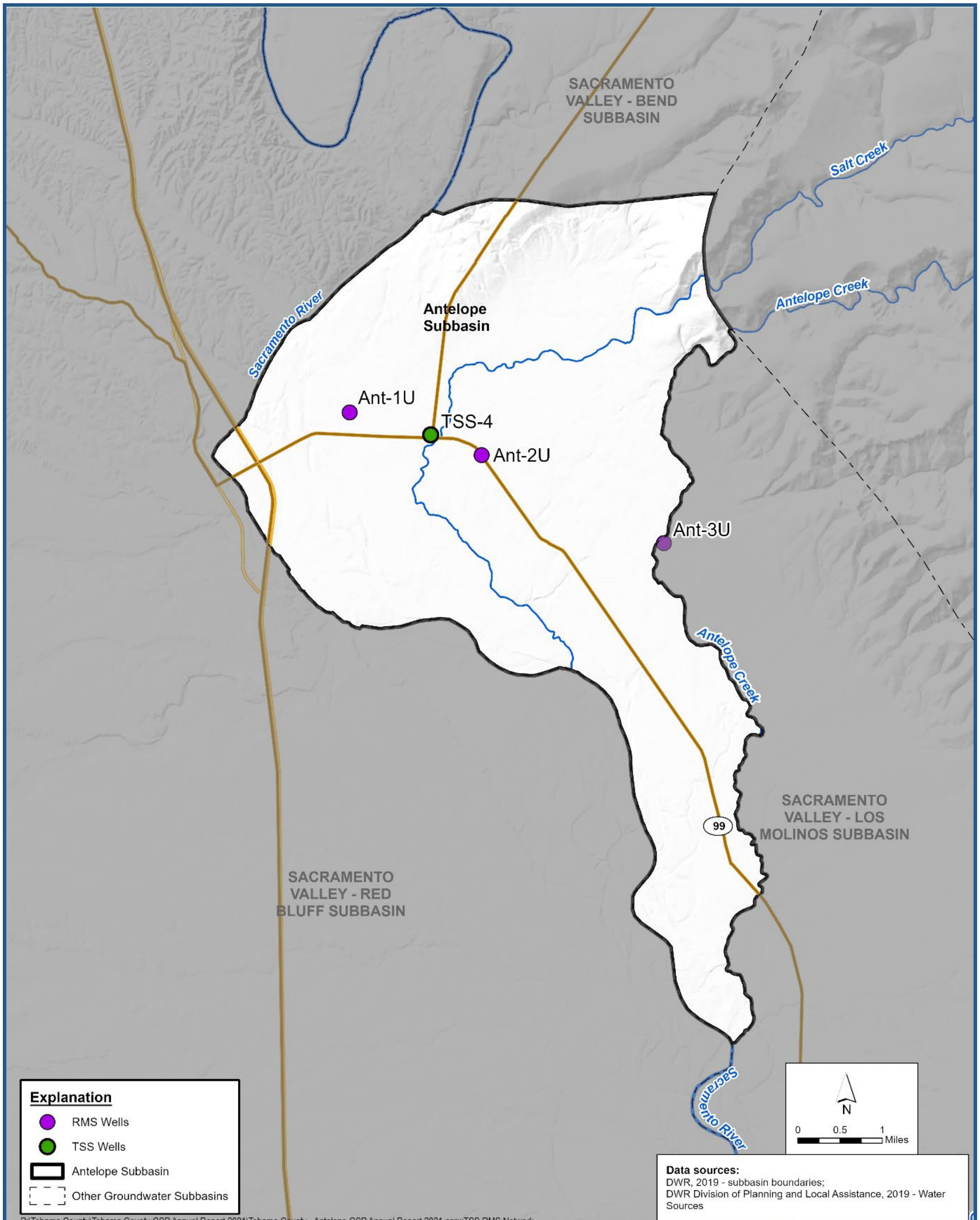
Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 2-2

2.2. Groundwater Elevation Hydrographs – Section 356.2(b)(1)(B)

Hydrographs of groundwater elevations were prepared for all three RMS wells in the Upper Aquifer. No RMS are screened in the Lower Aquifer therefore no Lower Aquifer hydrographs were produced. RMS wells are distributed throughout the Subbasin to provide broad spatial coverage of the Subbasin. **Figure 2-3** shows the distribution of the current RMS wells and the locations of the approved TSS well slated for installation in spring 2023. The process for selecting these sites is documented in the Antelope Subbasin GSP. Long-term fluctuations in groundwater levels (and groundwater in storage) occur when there is an imbalance between the volume of water recharged into the aquifer and the volume of water removed from the aquifer, either by extraction or natural discharge to surface water bodies. If, over a period of years, the amount of water recharged to the aquifer exceeds the amount of water removed from the aquifer, then groundwater levels will increase and groundwater storage increases (i.e., positive change in storage). Conversely, if, over time, the amount of water removed from the aquifer exceeds the amount of water recharged then groundwater levels decline. These long-term changes can be linked to various factors including increased or decreased groundwater extraction or variations in recharge associated with wet or dry hydrologic cycles.

All seasonal high groundwater elevations were above the Minimum Thresholds (MT) during WY 2022. Additionally, all wells experienced spring maximums that were above the Measurable Objectives (MO). Fall measurements at two wells (Ant-1U, Ant-2U) have a history of being below the MO, which was the case for WY 2022. Historically, the water level in Ant-3U has not usually been below the MO. However, in 2021 and 2022, fall water levels at Ant-3U were slightly below the MO and recovered to above the MO in the spring. Copies of hydrographs for all RMS wells are included in **Appendix A**.



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RMS Network With TSS Wells

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 2-3

3. WATER SUPPLY AND USE

Water supply and use information are presented below. Water use data by sector (required per Section 356.2) is summarized in **Section 3** and categorized by groundwater extraction, surface water supply and total supply using the best data available. Water use sectors are broadly identified as agricultural, urban, and native vegetation land uses.

Groundwater use data was taken from records where available and otherwise estimated from 2022 land use data, climate conditions, and crop coefficients consistent with those used in the Tehama Integrated Hydrogeological Model (Tehama IHM). Surface water use was estimated from historic deliveries when records were not available. Numbers are rounded to two significant digits, except totals which are unrounded.

3.1. Water Budget Approach

Water supply and use in the Subbasin was quantified using the best available data sources and information. Where available, groundwater extraction and surface water supplies were quantified directly from measured and reported groundwater pumping, surface water diversions, and deliveries data. However, groundwater extraction data has historically been limited, particularly for privately-owned wells. Thus, a water budget approach has been used to estimate the remaining, unmeasured volume of groundwater extraction that has occurred to meet demand in the Subbasin.

The Tehama IHM model was used to prepare water budgets for the Subbasin during GSP development. The model was adapted from the Sacramento Valley Groundwater-Surface Water Simulation Model (SVSim, version BETA 3-19-2020; DWR, 2020). Direct measurements of groundwater extraction data could not be used in the model calibration to determine accuracy due to the limited number of observations. Instead, water levels and stream flows were used to calibrate the model resulting in a normalized root mean of squared residual error of five percent. The first Annual Report for WY 2021 leveraged information from the Tehama IHM model to quantify subregion-scale water budgets in the Subbasin through WY 2021. More information about the model's development process can be found in the GSP Appendix 2-J. In WY 2022, a modified approach to the water budget calculation is utilized to enhance the resolution of the water budget. The method follows the framework laid out in Hessels et al. (2022).

Building on past work, the water budget approach used in this Annual Report utilizes available geospatial data and information to quantify crop water demand, precipitation, and other parameters with pixel-scale resolution (30-meter (m) x 30 m), corresponding to the spatial resolution of satellite imagery used in developing these inputs. In addition to geospatial data, available surface water supply and groundwater extraction data is incorporated into the water budget by distributing that water out to specific regions where that water is used (e.g., surface water supplier service areas). The remaining groundwater extraction needed to meet demand is then calculated based on the balance of water demand and available water supplies, with consideration for rainfall, irrigation, and soils characteristics. The result is a spatially distributed water budget calculated with a finer spatial resolution than was possible in the previous water budgets. The pixel-scale water budget results provide greater insight into where water use occurs in the Subbasin and are configurable to create water budget summaries for any region of the Subbasin.

This approach was used to calculate monthly water budgets by water use sector in the Subbasin during the current reporting year (WY 2022), as required in Title 23 of the California Code of Regulations Section 356.2. Key water budget inflows and outflows calculated in this water budget approach were compared with equivalent values from the Tehama IHM model and the first Annual Report, allowing verification of the consistency between this water budget approach and previous approaches.

Data and information that is used in the water budget approach generally includes:

- Actual evapotranspiration (ET) estimates, extracted from OpenET remote sensing analyses. OpenET is a multi-agency web-based geospatial information system (GIS) utility that quantifies spatial ET using satellite imagery. While OpenET is a new utility, the underlying methodologies to quantify ET apply a variety of well-established modeling approaches that are widely used in government and research. The OpenET modeling approaches utilize the same surface energy balance approach used to develop daily crop coefficient curves in the Tehama IHM model used in GSP development. OpenET results are available in the Subbasin with a spatial resolution of 30 m x 30 m (approximately 0.22 acres), allowing easily scalable ET quantification.
    - Additional information about the OpenET team, data sources, and methodologies are available at: https://openetdata.org/.
- Precipitation estimates, extracted from the Parameter-elevation Regressions on Independent Slopes Model (PRISM), developed by the PRISM Climate Group at Oregon State University. PRISM quantifies spatial precipitation estimates, among other climate parameters, based on available weather station data and modeled spatial relationships with topography and other factors influencing weather and climate. PRISM data is available in the Subbasin with a spatial resolution of 4 kilometer (km) x 4 km.
    - Additional information about the PRISM data and methodologies are available at: https://prism.oregonstate.edu.
- 2022 land use data, evaluated through two approaches. Both datasets were compared and evaluated to identify changes in land use as well as the spatial extent of water use sectors in the Subbasin.
    - Pixel-scale (30 m x 30 m) land use coverages of the Subbasin were prepared through analysis of the following datasets:
        - DWR 2019 statewide crop mapping dataset (https://data.cnra.ca.gov/dataset/statewide-crop-mapping)
        - United States Department of Agriculture (USDA) CropScape 2022 Cropland Data Layer coverage (https://nassgeodata.gmu.edu/CropScape/).
            - Measured surface water diversions data, reported from water supplier records, or collected from publicly available sources (water rights diversion records, etc.). Surface water diversions data are generally available at the supplier scale. In this water budget approach, diversions were distributed evenly across the irrigated pixels associated with that supplier's service area.

- Measured groundwater extraction data, reported from municipal and agricultural water supplier pumping records and private pumping records, where available. Groundwater extraction data is generally available at the supplier scale and was distributed evenly across the urban or irrigated pixels associated with that supplier's service area.
- Measured boundary water outflow data, reported from water supplier records where available.

Additional details for groundwater extraction and surface water supply data sources are given in the sections below.

3.2. Groundwater Extraction – Section 356.2(b)(2)

Groundwater extraction in the Subbasin is summarized in **Table 3-1**. Groundwater extraction is reported from pumping records where available, while the remaining groundwater extraction in the Subbasin is estimated through the water budget approach described in the previous section.

The majority of the Subbasin is dependent on groundwater for agricultural irrigation. During dry and critically dry years, agricultural groundwater extraction increases relative to long-term average demand due to less rainfall, reduced soil moisture, increased evapotranspiration associated with hotter, drier conditions, and less surface water available for diversion. There are a total of 9,600 cropped acres in the Antelope Subbasin, and the agricultural groundwater extraction for these lands (estimated through the water budget approach described above) for WY 2022 was 23,000 acre-feet (af). Agricultural groundwater extraction was estimated through the water budget approach described above.

Municipal water supplies in the Subbasin are all provided through groundwater. The largest municipal supplier is the City of Red Bluff (14% of the city lies within the Subbasin; the remainder is in the neighboring Red Bluff Subbasin). In contrast to agricultural water use, municipal water use during drought years may decrease relative to long-term averages due to urban conservation efforts. Municipal water supplies in the Antelope Subbasin are measured and were provided by each utility/water agency. The total volume during WY 2022 was 1,700 af.

Additionally, private domestic wells provide rural residential water needs throughout the Subbasin. Rural Residential groundwater extraction through domestic wells was estimated based on the City of Red Bluff's 2020 Urban Water Management Plan's (UWMP) 2020 water use (City of Red Bluff, 2020), which is considered to be representative of the area. Water use in 2020 was 253 gallons per capita per day (GPCD). In order to estimate Rural Residential groundwater extraction, the 2020 GPCD was applied to residential parcels located within the subbasin but outside of municipal service areas. To obtain this information, census data from 2020 was combined with parcel data obtained from county GIS portals. The census designated value of 2.63 persons per household for the county was multiplied by the selected residential parcels to determine the number of people in those households. This value was then used to estimate water usage using the GPCD. The total volume during WY 2022 was 130 af.

Environmental groundwater use in the Subbasin includes uptake of shallow groundwater from deeply--rooted plants. Although no groundwater is directly pumped or extracted for use in these areas, the consumptive use of shallow groundwater has been estimated through the water budget approach described above for areas classified as riparian vegetation. The estimated volumes are based on the evaporative demand unable to be met through precipitation that must be met through shallow groundwater. There are roughly 530 acres of riparian vegetation that had a total estimated groundwater use of 1,300 acre-feet (af), roughly 2.4 af per acre (af/ac). This method of estimating environmental groundwater use is dependent on both precipitation and ET estimates, and small changes or uncertainties in precipitation, ET, or ET from precipitation have a large impact on the overall estimated volume. Additionally, the method does not differentiate between evapotranspiration coming from changes in root zone soil moisture storage and the shallow groundwater system. As a result, a portion of the quantified environmental groundwater demand may be met through a depletion of root zone soil moisture rather than uptake of shallow groundwater from the aquifer. All else being equal, larger depletions of root zone soil moisture are more likely to occur (1) during below normal, dry, and critical water years and (2) in landscapes with deeply rooted vegetation.

Also, there are a total of 5,500 additional acres of native vegetation, which is primarily grasslands and oak woodlands in the northeastern portion of the Subbasin. Potential shallow groundwater use from deeply-rooted plants in these areas has not been quantified for the Annual Report, but could be considered and further evaluated in future years.

The Antelope Subbasin did not have managed recharge or groundwater extraction for managed wetlands in WY 2022. The recorded municipal supplies do not distinguish between urban and industrial water uses.

The total estimated groundwater extraction in WY 2022 was approximately 26,000 af. This is about 1,000 af less than WY 2021 total groundwater extraction of approximately 27,000 af for the Subbasin reported in the last Annual Report (WY 2021). **Figure 3-1** shows the location and volumes of 2022 groundwater extractions in the Subbasin. **Table 3-1** shows groundwater use by sector. WY 2022 has been preliminarily classified as Critical by DWR (DWR, 2022).

The agricultural sector had the greatest decrease in use from 26,000 af in WY 2021 to 23,000 af in WY 2022. Native vegetation experienced an increase from 460 af in WY 2021 to 1,300 af in WY 2022, while urban groundwater use saw an increase from 1,000 af in WY 2021 to approximately 1,700 af in WY 2022. In WY 2021 Urban use included an estimated Rural Residential use, in WY 2022 they are reported separately. In WY 2022 the agricultural sector accounted for approximately 88% of the total groundwater extraction, while the remaining 12% was utilized for Urban, Rural Residential, and Native Vegetation water needs.

Table 3-1. Groundwater Use by Water Use Sector	
Sector	**2022 (af)**
Agricultural	23,000
Urban	1,700
Rural Residential	130
Native Vegetation (Plant groundwater uptake)	1,300
Total	**26,130**
Total (excluding Native Vegetation[1])	**24,830**

[1] *Excludes native vegetation which involves only natural plant uptake of shallow groundwater, not direct pumping, and extraction.*

3.3. Surface Water Supply – Section 356.2(b)(3)

Surface water supplies used or available for use in the Subbasin are summarized in **Table 3-2**. Surface water supplies are reported directly from water supplier records or collected from publicly available sources (water rights diversion records, etc.) where available.

Surface water provided about 34% of the agricultural water demand in the Subbasin for WY 2022. Diversions from surface water features such as Antelope Creek were accessed from the State Water Resource Control Board's (SWRCB) Electronic Water Rights Information Management System (eWRIMS; SWRCB, 2023). Surface Water users in the Antelope Subbasin include Los Molinos Mutual Water Company and private diverters. Although Central Valley Project (USBR, 2023) supplies are used by some riparian diverters along the Sacramento River; diversions in WY 2022 were reported and estimated to be zero. Local supplies constitute the entirety of supplies available within the Subbasin in WY 2022.

There are currently no surface water supplies for use by the urban or riparian/native vegetation sectors in the Antelope Subbasin; all surface water use is for agricultural purposes. Two surface water supply volumes are included and reported in this section. **Table 3-2** depicts total diverted surface water, which are the volumes obtained from the sources described above. Total surface water diversions for the Antelope Subbasin were estimated to be about 17,000 af for WY 2022.

Table 3-2. Surface Water Diversions by Water Use Sector and Source		
Sector	**2022 (af) Supply Source**	
	CVP	**Local**
Agricultural	0	17,000
Urban	0	0
Native Vegetation	0	0
Total	**17,000**	

Table 3-3 depicts total surface water deliveries, which has been estimated from total surface water diversions by accounting for conveyance losses, reuse, and boundary outflows. Total surface water

deliveries for the Antelope Subbasin were estimated to be about 12,000 af for WY 2022, as shown in **Table 3-3**.

Table 3-3. Surface Water Deliveries by Water Use Sector and Source		
Sector	2022 (af) Supply Source	
	CVP	Local
Agricultural	0	12,000
Urban	0	0
Native Vegetation	0	0
Total	**12,000**	

3.4. Total Water Use by Sector – Section 356.2(b)(4)

Total water use in the Subbasin was tabulated from groundwater extraction volumes reported in **Table 3--1** and the surface water supply deliveries reported in **Table 3-3**. Total water available is summarized in **Table 3-4** for WY 2022. The results are either based on measured data or estimates as described in the previous two sections.

In total, groundwater supplied approximately 66% of the agricultural water demand in the Subbasin and also constituted approximately 68% of the total water supplies for all water demand sectors in WY 2022.

Table 3-4. Total Water Use by Water Use Sector			
Sector	2022 (af)		
	Groundwater	Surface Water	Total
Agricultural	23,000	12,000	35,000
Urban	1,700	0	1,700
Rural Residential	130	0	130
Native Vegetation (Plant groundwater uptake)	1,300	0	1,300
Total	**26,130**	**12,000**	**38,130**
Total (excluding Native Vegetation[1])	**24,830**	**12,000**	**36,830**

[1] Excludes native vegetation which involves only natural plant uptake of shallow groundwater, not direct pumping, and extraction.

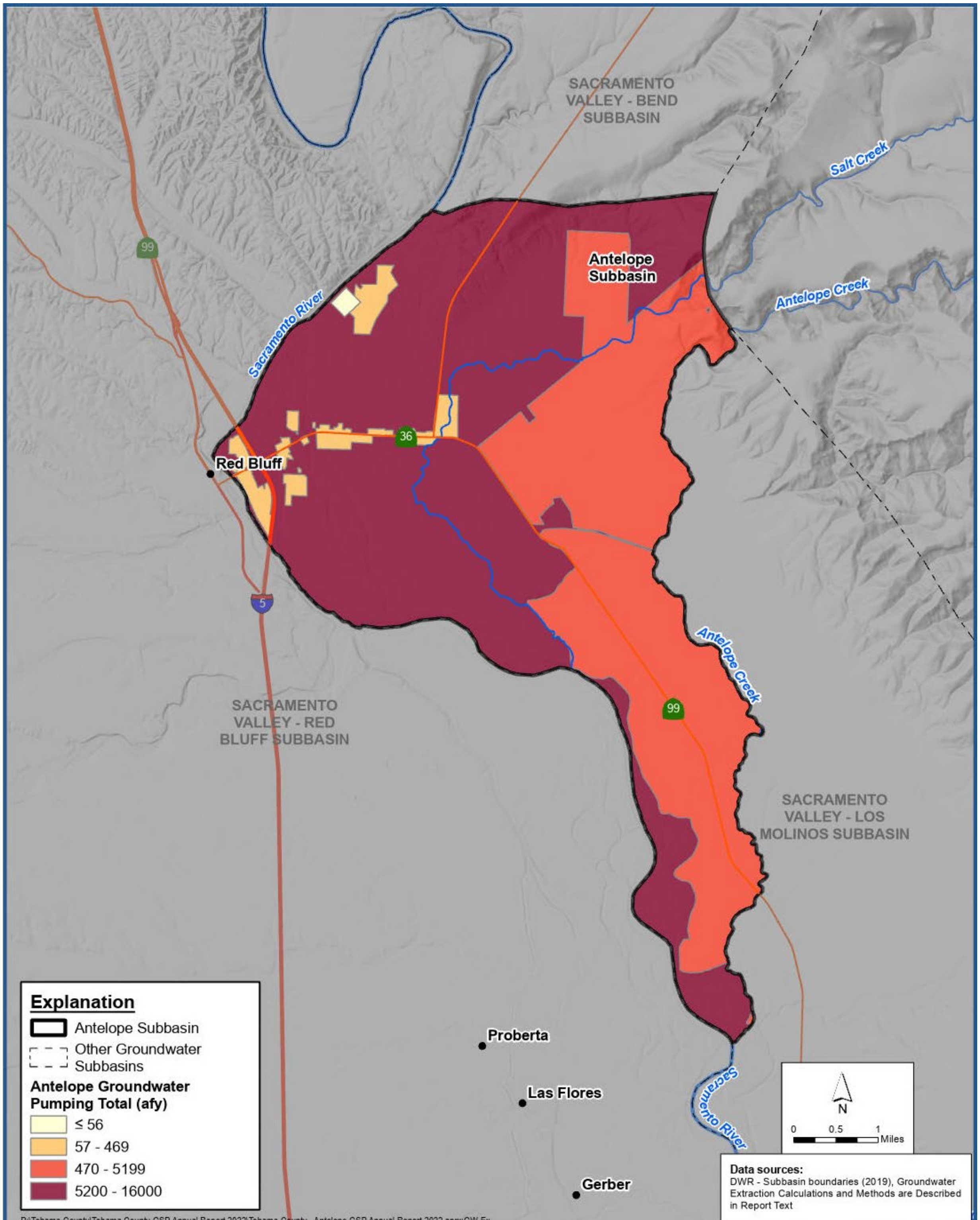
3.5. Uncertainties in Water Use Estimates

Uncertainties in water budget estimates are presented below in **Table 3--5.** The uncertainty of these water budget components is based on typical accuracies given in technical literature and the cumulative estimated accuracy of all inputs used to calculate the components.

Table 3-5. Estimated Uncertainty in Water Use Estimates

Water Budget Component	Data Source	Estimated Uncertainty (%)	Source
Groundwater Water			
Agricultural	Measurement	20%	Typical uncertainty from water balance calculation.
Urban	Measurement/ Estimate	5%	Typical accuracy of urban water system reporting.
Rural Residential	Calculation	15%	Estimated from per capita water use and Census information.
Native Vegetation (Plant groundwater uptake)	Calculation	25%	Estimated based on land use classification, precipitation, and ET.
Surface Water			
Agricultural	Calculation	10%[1]	Estimated from SB 88 measurement accuracy standards.

[1] Higher uncertainty of 10%-20% is typical for estimated surface water inflows, including un-gaged inflows from small watersheds into creeks that enter the Basin.



Groundwater Extraction in the Subbasin Water Year 2022

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 3-1

4. GROUNDWATER STORAGE

Changes in groundwater storage from Spring 2021 to Spring 2022 were calculated for the Upper and Lower Aquifers. Spring (seasonal high) groundwater levels are less influenced by groundwater pumping compared to Fall (seasonal low) groundwater levels; therefore, they are more reliable to calculate groundwater storage change.

Change of groundwater levels from Spring 2021 to Spring 2022 at wells screened in the Upper Aquifer were interpolated to estimate the groundwater elevation change in areas where sufficient data were available. Estimated elevation change was multiplied by a spatially variable aquifer storage coefficient available from the Tehama Integrated Hydrogeological Model (Tehama County FCWCD, 2022) to estimate the groundwater storage change volume in the Upper Aquifer. The spatial extent of this estimate was limited to areas where measured groundwater levels were available (**Figure 4-1**). Therefore, an area-weighted adjustment was applied to the estimated storage to estimate the subbasin-wide change in storage.

Sufficient groundwater level data were not available to interpolate water level changes in the Lower Aquifer. Therefore, Lower Aquifer storage change was estimated using the Upper Aquifer storage change and historical ratio of storage changes in the two aquifers for critical years. The summation of the changes in the Upper and Lower Aquifers provides the total groundwater storage change in the Subbasin. **Table 4-1** presents the annual storage change values for both the Upper and Lower Aquifers.

It should be noted that the groundwater model was not used to estimate storage changes for 2020 through 2022. Therefore, future updates to the model may result in different estimates for 2020 through 2022 groundwater storage changes. The approach of using measured groundwater elevation changes to estimate storage changes is considered reasonable and cost effective for the purposes of the annual report. **Table 4-2** includes estimates of annual groundwater pumping, groundwater uptake, storage change and cumulative storage change for WYs 1990-2022. Change in storage and cumulative change in storage for WYs 2020-2022 was estimated based on the above method. The Tehama IHM Model was used to estimate groundwater pumping, groundwater uptake, change in storage, and cumulative change in storage for WYs 1990-2019.

Table 4-1. Change in Groundwater Storage Based on Seasonal High Groundwater Levels

Aquifer	2022 (af)
Upper Aquifer	-3,000
Lower Aquifer	-2,000
Total	**-5,000**

Table 4-2. Change in Groundwater Storage				
Water Year & Type[a]	Groundwater Pumping (af)	Groundwater Uptake (af)	Annual Groundwater Storage Change[b] (af)	Cumulative Groundwater Storage Change (af)
1990 (C)	-14,000	-1,000	-7,200	-7,200
1991 (C)	-14,000	-620	-5,900	-13,000
1992 (C)	-15,000	-550	-4,100	-17,000
1993 (AN)	-11,000	-870	8,000	-9,200
1994 (C)	-14,000	-620	-4,800	-14,000
1995 (W)	-11,000	-1,900	12,000	-2,000
1996 (W)	-12,000	-1,900	2,600	600
1997 (W)	-12,000	-2,100	-600	0
1998 (W)	-7,200	-4,400	11,000	11,000
1999 (W)	-11,000	-3,600	-4,000	7,000
2000 (AN)	-9,600	-3,200	-880	6,100
2001 (D)	-13,000	-1,800	-7,500	-1,400
2002 (D)	-14,000	-1,300	-3,700	-5,100
2003 (AN)	-12,000	-1,800	3,700	-1,400
2004 (BN)	-14,000	-2,200	81	-1,300
2005 (AN)	-9,900	-1,700	780	-520
2006 (W)	-9,400	-3,800	7,600	7,100
2007 (D)	-13,000	-1,600	-9,100	-2,000
2008 (C)	-17,000	-920	-8,100	-10,000
2009 (D)	-14,000	-670	-3,700	-14,000
2010 (BN)	-11,000	-700	2,600	-11,000
2011 (W)	-9,900	-980	6,800	-4,400
2012 (BN)	-14,000	-740	-7,100	-12,000
2013 (D)	-16,000	-680	-2,000	-14,000
2014 (C)	-17,000	-560	-7,300	-21,000
2015 (C)	-21,000	-490	-4,800	-26,000
2016 (BN)	-15,000	-570	4,400	-21,000
2017 (W)	-15,000	-1,200	9,600	-12,000
2018 (BN)	-18,000	-600	-6,300	-18,000
2019 (W)	-13,000	-920	7,700[b]	-10,000
2020 (D)	-21,000	-590	-8,000[b]	-18,000

Table 4-2. Change in Groundwater Storage				
Water Year & Type[a]	Groundwater Pumping (af)	Groundwater Uptake (af)	Annual Groundwater Storage Change [b] (af)	Cumulative Groundwater Storage Change (af)
2021 (C)	-27,000	-460	-15,000 [b]	-33,000
2022 (C)	-25,000	-1,300	-5,000 [b]	-38,000
Average	**-14,000**	**-1,400**	**-1000**	**-**

Note: All volumes are rounded to two significant digits

[a] Sacramento Valley Water Year Type is provided by DWR for the years 1990-2021. Water Year 2022 has been preliminarily classified as Critical by DWR (DWR, 2022). W = Wet; AN = Above Normal; BN = Below Normal; D = Dry; C = Critical

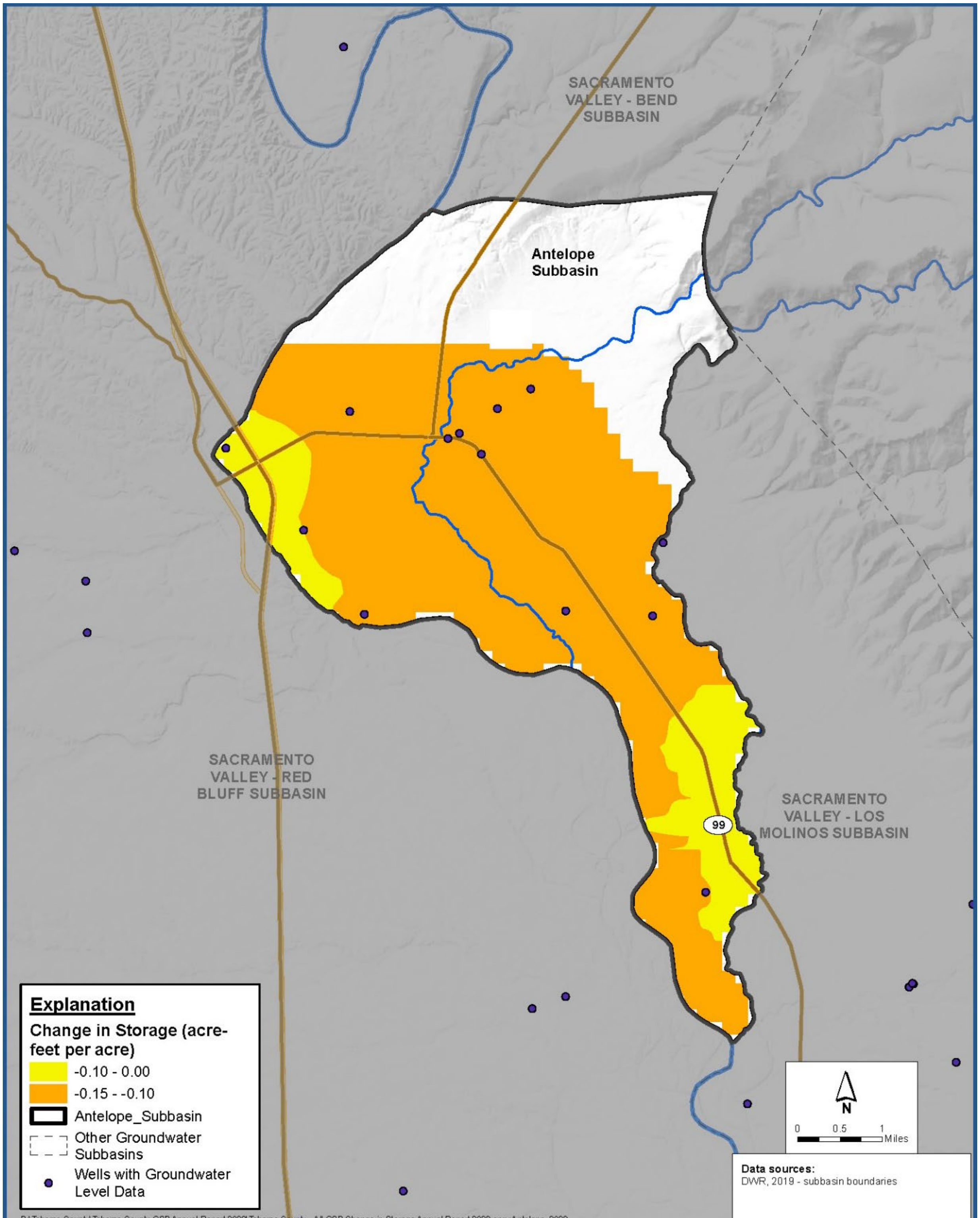
[b]Storage change in water years 2019-2022 were estimated using the change in seasonal high spring to spring water levels.

4.1. Groundwater Storage Maps – Section 356.2(b)(5)(A)

Figure 4-1 presents the distribution of storage change in the Upper Aquifer for WY 2022. Maps include the groundwater wells used to calculate the change in storage. Groundwater storage change is not shown on **Figure 4-1** outside the established monitoring area to avoid extrapolating beyond the control points (i.e., reliable monitoring well data). Lower Aquifer storage change maps were not prepared due to lack of Lower Aquifer wells.

4.2. Subbasin Water Budget – Section 356.2(b)(5)(B)

A graph depicting Water Year type, groundwater pumping, groundwater uptake, the annual change in groundwater storage, and the cumulative change in groundwater storage is presented on **Figure 4-2**.

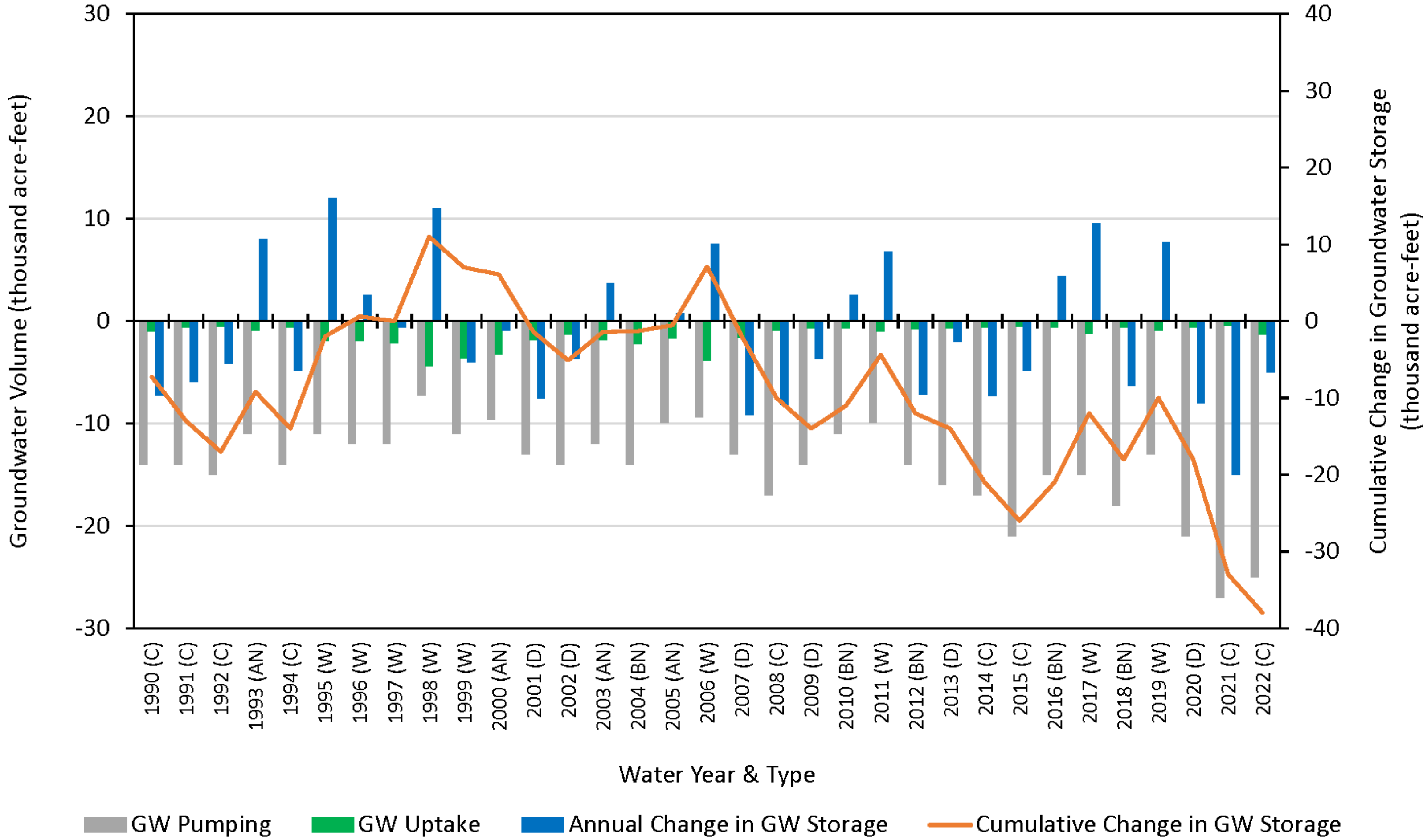


TEHAMA COUNTY
LSCE Team

Change in Groundwater Storage,
Upper Aquifer - Spring 2021 to Spring 2022

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 4-1



TEHAMA COUNTY

LSCE Team

Groundwater Extraction and Change in Groundwater Storage

Groundwater Sustainability Plan - Annual Report WY 2022
Antelope Subbasin

Figure 4-2

5. GSP IMPLEMENTATION PROGRESS – SECTION 356.2(B)

The GSP for the Antelope Subbasin was adopted by the GSA in December 2021 and submitted to DWR in January 2022. This is the second annual report to be prepared since the GSP was submitted. The GSP implementation progress reported in this report covers ongoing work during WY 2022. Projects and management actions (PMAs) were developed to manage groundwater conditions in the Subbasin and achieve groundwater sustainability objectives described in the GSP.

5.1. Progress Toward Achieving Sustainability

5.1.1. Chronic Lowering of Groundwater Levels and Reduction in Groundwater Storage SMC

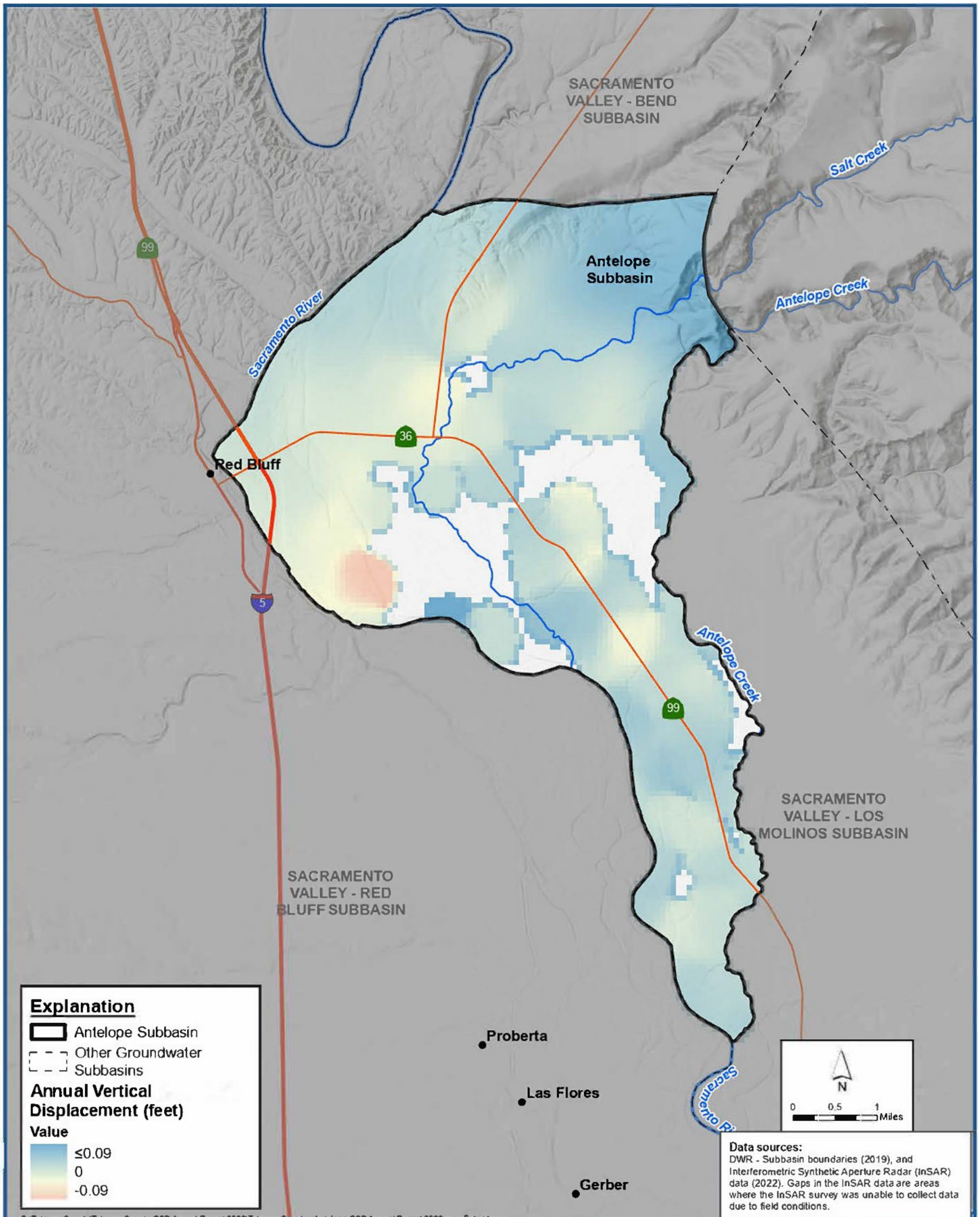
The reduction in groundwater storage SMC utilizes the chronic lowering of groundwater levels SMC as a proxy. Thus, groundwater conditions related to storage and chronic lowering of groundwater levels are discussed together. Groundwater conditions in the Subbasin are on track to meet the first 5- year 2027 interim milestone (IM) for groundwater levels at each of the RMS wells. In Spring 2022, all groundwater elevations were above the established MTs (as indicated in **Table 5-1**). Lower water levels were expected in Spring 2022 compared to Spring 2021 due to extended drought conditions, which have caused reductions in surface water supplies and increased demands for groundwater in the Subbasin.

Table 5-1. Groundwater Level Measurements and MT Exceedances

Well ID	State Well Number	MT	MO	2027 IM	Recent Spring Groundwater Level Measurements		Spring 2022 MT Exceedance	Two Consecutive WY MT Exceedances
					2021	2022		
Ant-1U	27N03W16K003M	193.4	231.1	234.3	235.3	233.1	-	-
Ant-2U	27N03W23D001M	181.4	231.2	236.0	237.6	234.1	-	-
Ant-3U	27N02W30C003M	193.0	231.1	244.8	243.2	241.8	-	-

5.1.2. Land Subsidence SMC

The land subsidence MT is 0.5 feet per five years (i.e., averaged 0.1 foot per year) and the MO for land subsidence is zero throughout the subbasin. Only inelastic subsidence, defined as subsidence solely due to lowered groundwater elevations, will be considered in this SMC. Due to the measurement error of 0.1 feet associated with the Interferometric Synthetic Aperture Radar (InSAR) method, any measurements must be beyond the error to be considered inelastic subsidence. Subsidence measured by InSAR in WY 2022 (**Figure 5-1**) ranged from 0.02 feet of subsidence to 0.0 feet of uplift. No subsidence measured during WY 2022 is considered inelastic due to being less than the measurement error of 0.1 feet. The total subsidence measured from 2015 through WY 2022 (**Figure 5-2**) ranged from 0.09 feet of subsidence to 0.04 feet of uplift. The GSA is on track to stay above the MT for land subsidence.

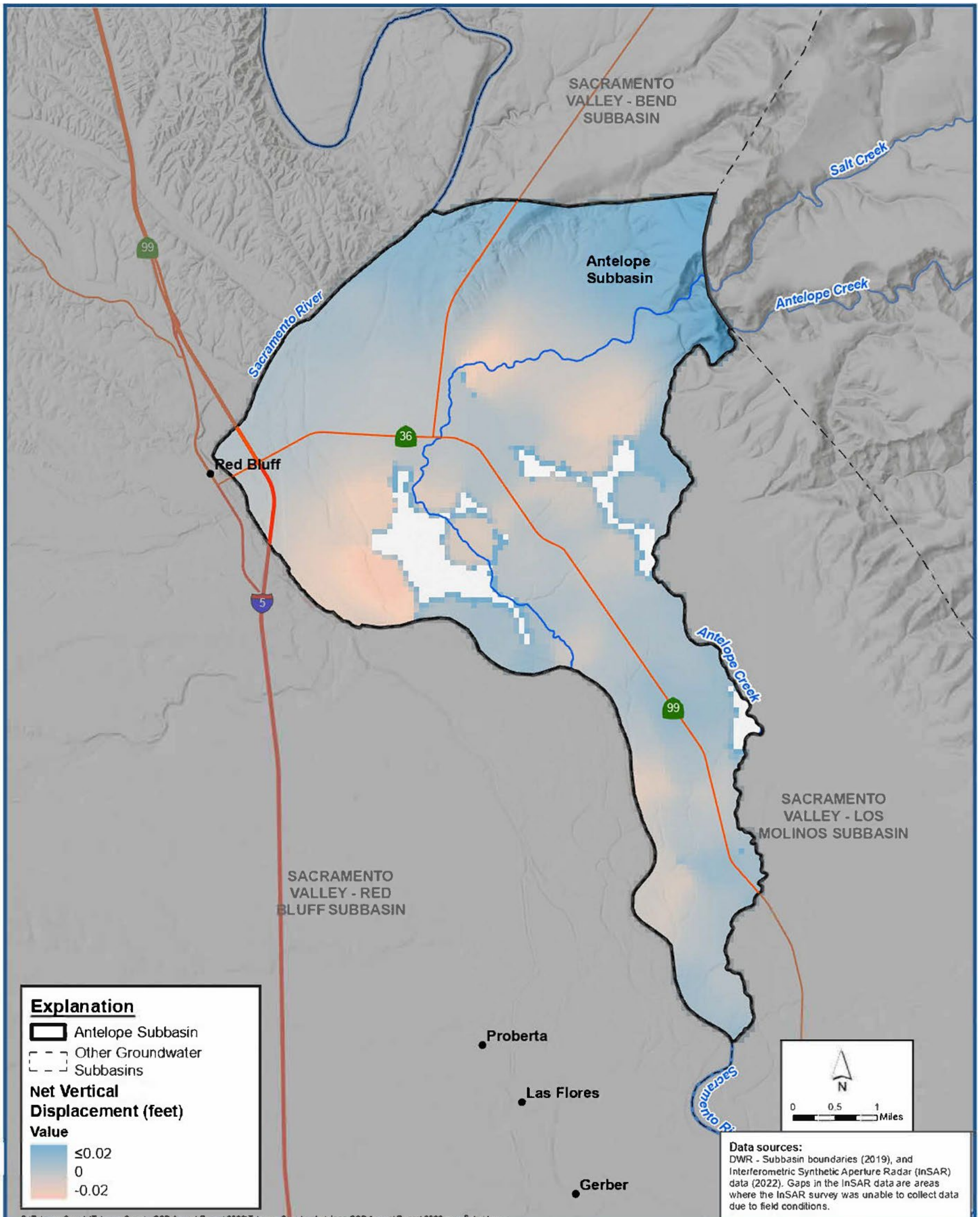


TEHAMA COUNTY
LSCE Team

Annual Vertical Displacement in 2022

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 5-1



TEHAMA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LSCE Team

Net Vertical Displacement 2015 through 2022

Groundwater Sustainability Plan – Annual Report WY 2022
Antelope Subbasin

Figure 5-2

5.1.3. Depletion of Interconnected Surface Water SMC

Depletion of Interconnected Surface Water (ISW) SMC uses spring groundwater elevations in wells within the groundwater level monitoring network within 1-mile of water bodies. For the Antelope Subbasin, the ISW monitoring network is identical to the groundwater level monitoring network. All interconnected surface water RMS wells' water levels were above MT levels (**Table 5-1**).

5.2. Progress Toward PMA Implementation

The GSA is pursuing grants through DWR's SGM Grant Program for funding to assist in the implementation of PMAs. The grant application was submitted in December 2022, and a draft awards list is anticipated to be released by DWR in June 2023. The grant application included three components, each fulfilling a different need of the GSAs:

- GSP Implementation Outreach and Compliance Activities
- Ongoing Monitoring, Data Gaps, and Enhancements
- Project and Management Action Implementation – Recharge Focused

Together, if funded, these projects will assist the GSAs in meeting the sustainability goals set forth in the GSP.

As part of the GSA's efforts to address data gaps in the subbasin, An Airborne Electromagnetic (AEM) Survey by DWR took place in the summer of 2022. The data collected provides a better understanding of aquifer characteristics and will help to refine the current hydrogeologic conceptual model. Data is available at data.cnra.ca.gov/dataset/aem/resource/29c4478d-fc34-44ab-a373-7d484afa38e8.

6. CONCLUSIONS

In WY 2022, groundwater conditions are considered sustainable. No water levels fell below the MTs. WY 2022 and subsidence data indicate sustainable conditions and no MTs were exceeded. Recent progress made on all of the above-mentioned activities applicable to the GSA since late 2021, demonstrates the commitment of the GSA to implement the GSP by allocating the necessary time and resources to achieve long-term sustainable management of the groundwater resources in the Subbasin.

7. REFERENCES

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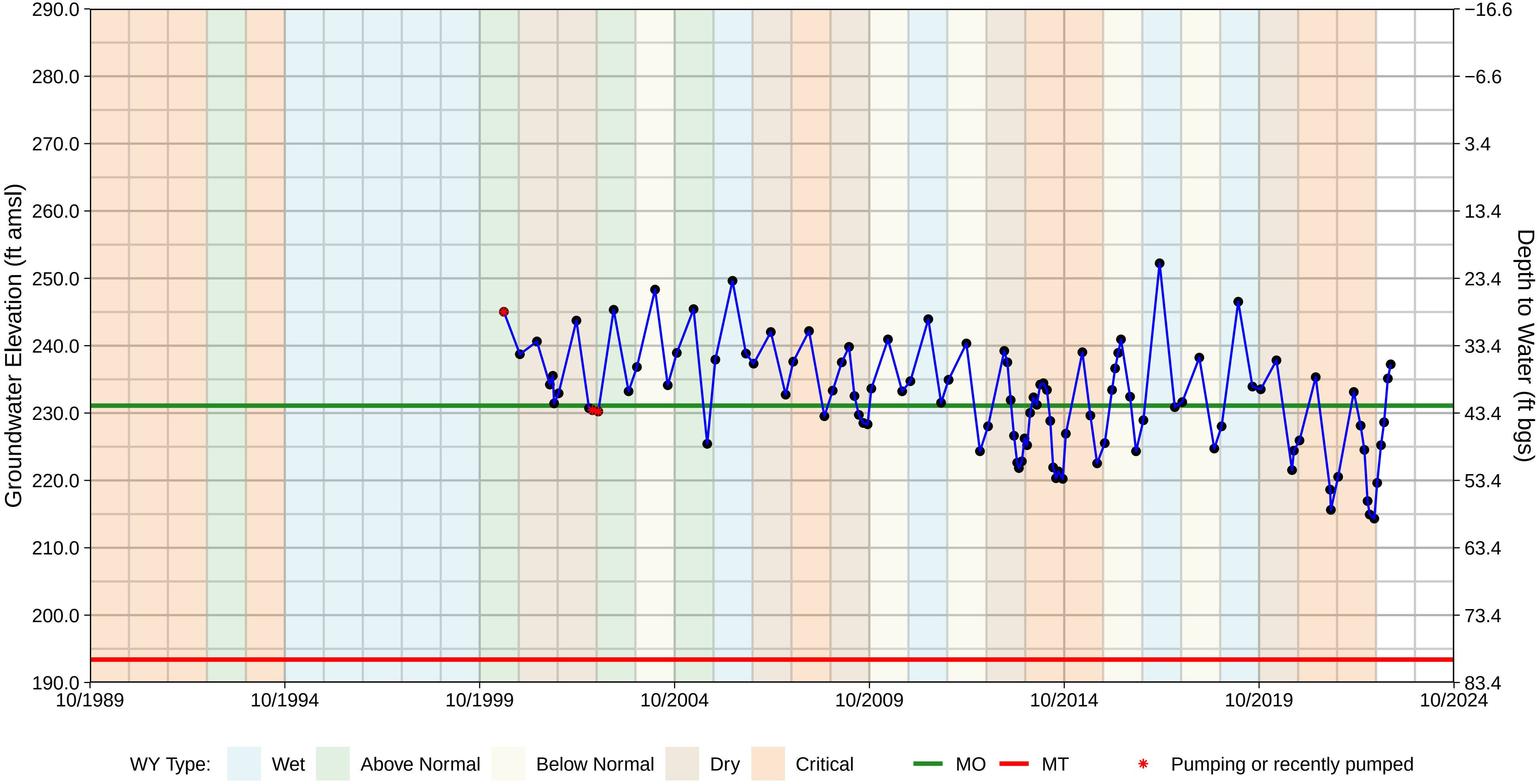
Appendix A

Water Level Hydrographs of Representative Monitoring Wells for Groundwater Level

Ant−1U   Antelope Subbasin − Upper Aquifer



SWN: 27N03W16K003M

Site Code: 401897N1222049W001

Total Depth (ft):137

Perf. Top (ft bgs): 117

Perf. Bottom (ft bgs): 137

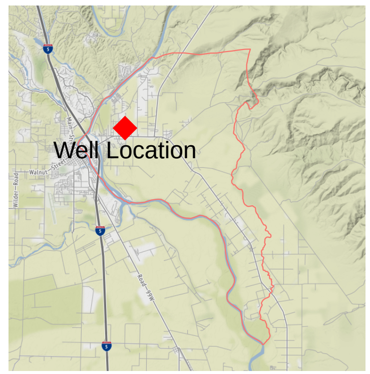
Well Type: Residential

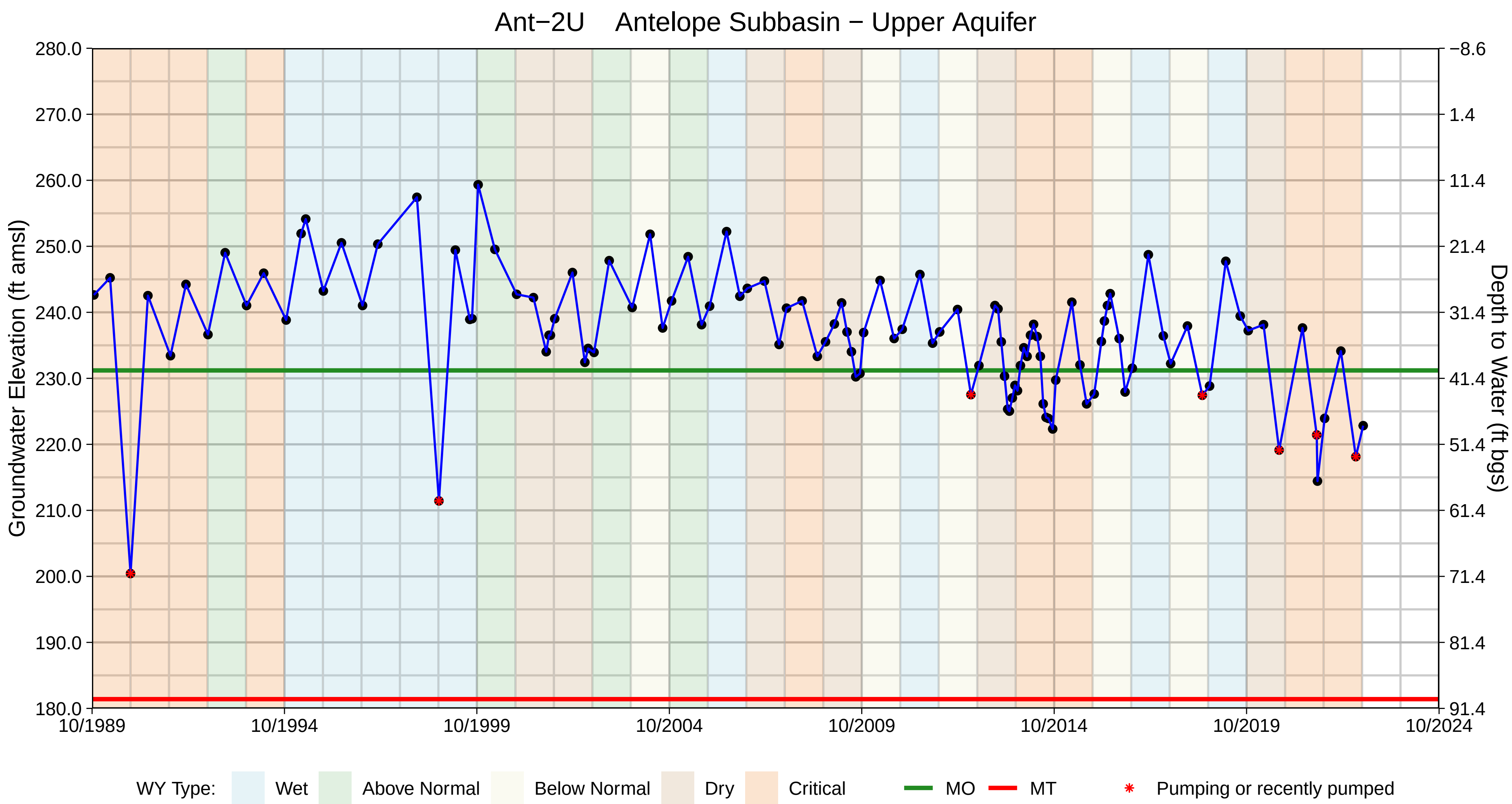
GSE (ft amsl): 273.4

Sustainable Management Criteria

MO: 231.1 ft amsl (42.3 ft bgs)

MT: 193.4 ft amsl (80 ft bgs)





SWN: 27N03W23D001M

Site Code: 401829N1221752W001

Total Depth (ft):250

Perf. Top (ft bgs): 30

Perf. Bottom (ft bgs): 155

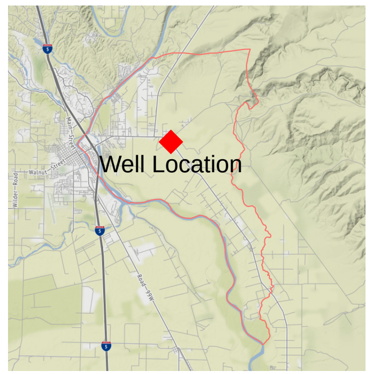
Well Type: Irrigation

GSE (ft amsl): 271.4

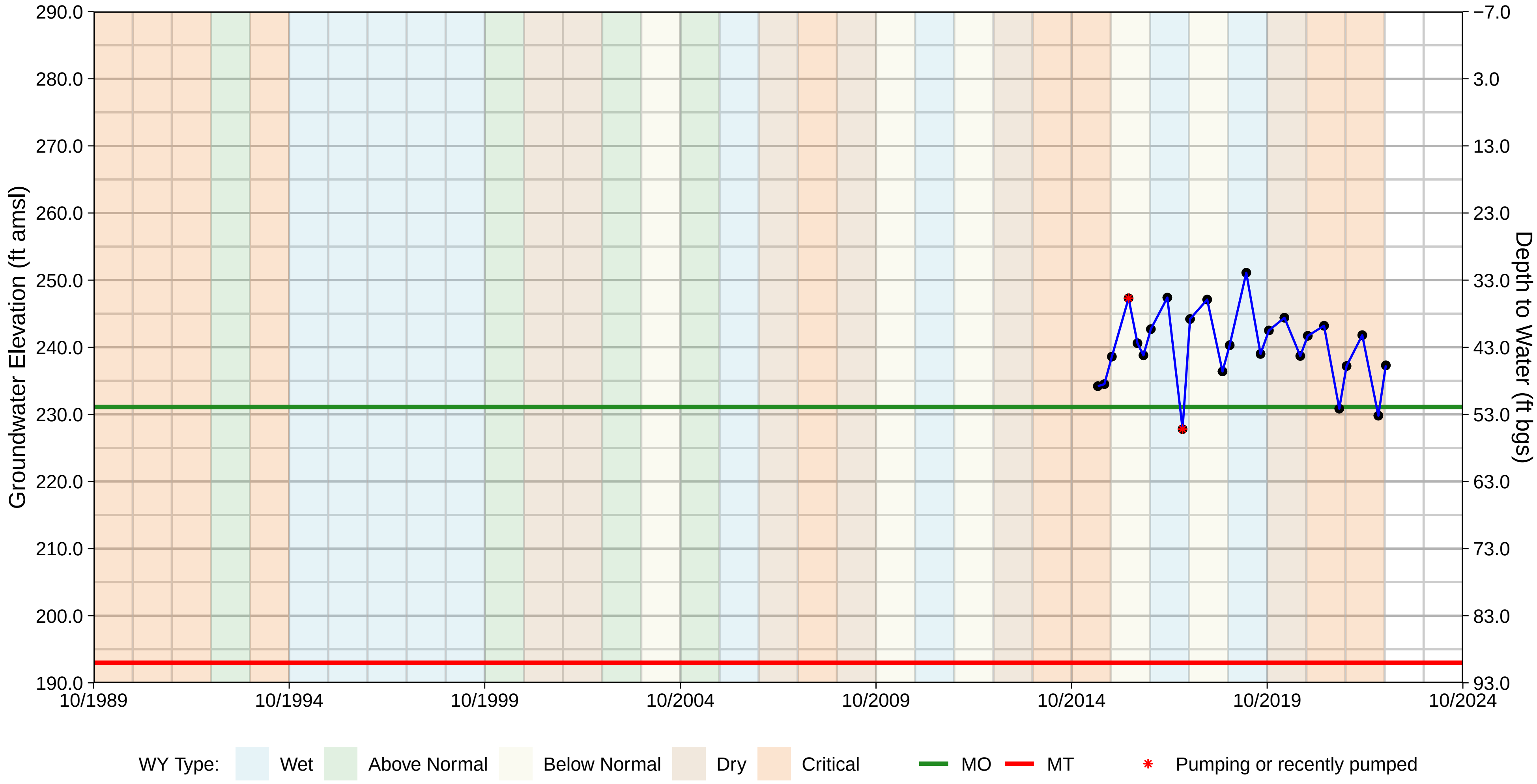
Sustainable Management Criteria

MO: 231.2 ft amsl (40.2 ft bgs)

MT: 181.4 ft amsl (90 ft bgs)



Ant−3U   Antelope Subbasin − Upper Aquifer



SWN: 27N02W30C003M

Site Code: 401684N1221341W002

Total Depth (ft):170

Perf. Top (ft bgs): 157

Perf. Bottom (ft bgs): 170

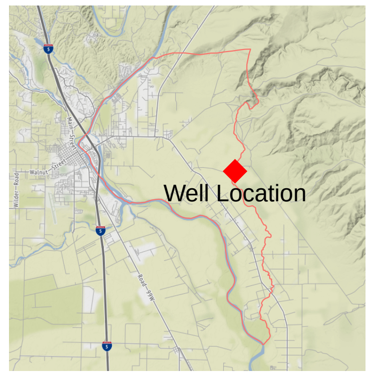
Well Type: Irrigation

GSE (ft amsl): 283

Sustainable Management Criteria

MO: 231.1 ft amsl (51.9 ft bgs)

MT: 193 ft amsl (90 ft bgs)



APPENDIX B

Annual Report Water Level Data

Data sources:

CA Department of Water Resources

LSCE

Water Level Data for Water Year 2022								
Well ID	Measure Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments
26N02W17E001M	3/7/2022	241.41	240.41	19.5	20.5	220.91		
26N02W17E001M	8/3/2022	241.41	240.41	23.3	24.3	217.11		
26N02W17E001M	10/12/2022	241.41	240.41	21.5	22.5	218.91		
27N03W33A002M	3/10/2022	258.5	258	30.55	31.05	227.45		
27N03W33A002M	10/12/2022	258.5	258	32.1	32.6	225.9	6	Pipe spraying water, pump surging on and off
27N02W31C001M	3/7/2022	263.43	263.43	32.8	32.8	230.63		
27N03W36C002M	3/7/2022	261.6	261	27.95	28.55	233.05		
27N03W36C002M	8/4/2022	261.6	261	33.68	34.28	227.32		
27N03W36C002M	10/12/2022	261.6	261	32.1	32.7	228.9		
27N03W28D002M	3/10/2022	263.2	263	38.6	38.8	224.4	8	
27N03W28D002M	8/3/2022	263.2	263	58.8	59	204.2	8	
27N03W28D002M	10/12/2022	263.2	263	56.9	57.1	206.1	8	
27N03W23D001M	3/14/2022	272.43	271.43	37.3	38.3	234.13		
27N03W23D001M	8/3/2022	272.43	271.43	53.3	54.3	218.13	4	
27N03W23D001M	10/12/2022	272.43	271.43	48.6	49.6	222.83		
27N03W20C001M	3/8/2022	262	261.9	26.45	26.55	235.45		
27N03W22A001M	3/14/2022	265	265	37.8	37.8	227.2		
27N03W22A001M	8/3/2022	265	265	53.1	53.1	211.9		
27N03W22A001M	10/12/2022	265	265	53.7	53.7	211.3		
27N03W14N001M	3/7/2022	268.1	266	33.9	36	232.1		
27N03W14N001M	5/10/2022	268.1	266	45.7	47.8	220.3		
27N03W14N001M	6/14/2022	268.1	266	48.3	50.4	217.7		

[1]WL QM CD: 3-Casing leaking or wet, 4-Pumped recently, 6-Other, 8-Oil or foreign substance in casing

Water Level Data for Water Year 2022								
Well ID	Measure Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments
27N03W14N001M	7/14/2022	268.1	266	48.3	50.4	217.7		
27N03W14N001M	8/3/2022	268.1	266	50.4	52.5	215.6		
27N03W14N001M	9/15/2022	268.1	266	53.7	55.8	212.3		
27N03W14N001M	10/12/2022	268.1	266	53.9	56	212.1	4	
27N03W14N001M	12/16/2022	268.1	266	37.3	39.4	228.7		
27N03W16K003M	3/7/2022	274.73	273.43	40.3	41.6	233.13		
27N03W16K003M	5/10/2022	274.73	273.43	45.3	46.6	228.13		
27N03W16K003M	6/14/2022	274.73	273.43	48.9	50.2	224.53		
27N03W16K003M	7/14/2022	274.73	273.43	56.5	57.8	216.93		
27N03W16K003M	8/3/2022	274.73	273.43	58.5	59.8	214.93		
27N03W16K003M	9/15/2022	274.73	273.43	59.1	60.4	214.33		
27N03W16K003M	10/12/2022	274.73	273.43	53.8	55.1	219.63		
27N03W16K003M	11/17/2022	274.73	273.43	48.2	49.5	225.23		Run 95
27N03W16K003M	12/16/2022	274.73	273.43	44.8	46.1	228.63		
27N03W14L001M	3/7/2022	279.93	277.43	39	41.5	238.43		
27N03W14L001M	8/3/2022	279.93	277.43	53.95	56.45	223.48		
27N03W14L001M	10/12/2022	279.93	277.43	49.8	52.3	227.63		
27N03W15K005M	4/22/2022	273.8	273	37.4	38.2	235.6		Initial well measurement
27N03W15K005M	8/3/2022	273.8	273	50.6	51.4	222.4		
27N03W15K005M	10/12/2022	273.8	273	53.1	53.9	219.9		
27N03W14H001M	3/7/2022	281.3	280	43	44.3	237		
27N03W14H001M	8/3/2022	281.3	280	51.2	52.5	228.8		

[1]WL QM CD: 3-Casing leaking or wet, 4-Pumped recently, 6-Other, 8-Oil or foreign substance in casing

Water Level Data for Water Year 2022								
Well ID	Measure Date	RPE (ft amsl)	GSE (ft amsl)	DTW (ft bgs)	DTW (ft brp)	WSE (ft amsl)	WL QM CD[1]	Comments
27N03W14H001M	10/12/2022	281.3	280	51.3	52.6	228.7		
27N03W14F001M	3/7/2022	277.93	277.43	47.37	47.87	230.06		
27N03W14F001M	8/3/2022	277.93	277.43	56.6	57.1	220.83		
27N03W14F001M	10/12/2022	277.93	277.43	52.4	52.9	225.03		
27N03W03Q002M	3/9/2022	310.3	309	55.4	56.7	253.6		
27N03W03Q002M	3/10/2022	310.3	309	54.3	55.6	254.7		
27N03W03Q002M	5/10/2022	310.3	309	55.7	57	253.3		
27N03W03Q002M	6/14/2022	310.3	309	58.5	59.8	250.5		
27N03W03Q002M	7/14/2022	310.3	309	58.5	59.8	250.5		
27N03W03Q002M	8/3/2022	310.3	309	62.6	63.9	246.4		
27N03W03Q002M	9/15/2022	310.3	309	59.8	61.1	249.2		
27N03W03Q002M	10/12/2022	310.3	309	60.6	61.9	248.4		
27N03W03Q002M	11/17/2022	310.3	309	57.9	59.2	251.1		
27N03W03Q002M	12/16/2022	310.3	309	56.5	57.8	252.5		

[1]WL QM CD: 3-Casing leaking or wet, 4-Pumped recently, 6-Other, 8-Oil or foreign substance in casing

APPENDIX C

DWR Upload Tables

LSCE

A. Groundwater Extractions

Total Groundwater Extractions (AF)	Water Use Sector Urban (AF)	Water Use Sector Industrial (AF)	Water Use Sector Agricultural (AF)	Water Use Sector Managed Wetlands (AF)	Water Use Sector Managed Recharge (AF)	Water Use Sector Native Vegetation (AF)	Water Use Sector Other (AF)	Water Use Sector Other Description
26,130	1,700	0	23,000	0	0	1,300	130	Rural Residential

B. Groundwater Extraction Methods

Meters Volume (AF)	Meters Description	Meters Type	Meters Accuracy (%)	Meters Accuracy Description	Electrical Records Volume (AF)	Electrical Records Description	Electrical Records Type	Electrical Records Accuracy (%)	Electrical Records Accuracy Description	Land Use Volume (AF)	Land Use Description	Land Use Type	Land Use Accuracy (%)	Land Use Accuracy Description	Groundwater Model Volume (AF)	Groundwater Model Description	Groundwater Model Type	Groundwater Model Accuracy (%)	Groundwater Model Accuracy Description	Other Method(s) Volume (AF)	Other Method(s) Description	Other Method(s) Type	Other Method(s) Accuracy (%)	Other Method(s) Accuracy Description
1,650	Metered municipal wells	Direct	5-10	Metered connection maintained by the City of Red Bluff and Los Molinos Mutual Water Company	0					0					0					24,480	Where available, groundwater extraction and surface water supplies were quantified directly from measured and reported groundwater pumping, surface water diversions, and deliveries data. However, groundwater extraction data has historically been limited, particularly for privately-owned wells. Thus, a water budget approach has been used to estimate the remaining, unmeasured volume of groundwater extraction that has occurred to meet demand in the Subbasin. Water budget approach used in this Annual Report utilizes available geospatial data and information to quantify crop water demand, precipitation, and other parameters with pixel-scale resolution (30-meter (m) x 30 m), corresponding to the spatial resolution of satellite imagery used in developing these inputs. In addition to geospatial data, available surface water supply and groundwater extraction data is incorporated into the water budget by distributing that water out to specific regions where that water is used (e.g., surface water supplier service areas).	Estimate	20-30 %	The uncertainty of these water budget components is based on typical accuracies given in technical literature and the cumulative estimated accuracy of all inputs used to calculate the components.

C. Surface Water Supply

Total Surface Water Supply (AF)	Methods Used To Determine	Water Source Type Central Valley Project (AF)	Water Source Type State Water Project (AF)	Water Source Type Colorado River Project (AF)	Water Source Type Local Supplies (AF)	Water Source Type Local Imported Supplies (AF)	Water Source Type Recycled Water (AF)	Water Source Type Desalination (AF)	Water Source Type Other (AF)	Water Source Type Other Description
12,000	Surface water supplies are reported directly from water supplier records or collected from publicly available sources (water rights diversion records, etc.) where available.	0	0	0	12,000	0	0	0	0	

D. Total Water Use

Total Water Use (AF)	Methods Used To Determine	Water Source Type Groundwater (AF)	Water Source Type Surface Water (AF)	Water Source Type Recycled Water (AF)	Water Source Type Reused Water (AF)	Water Source Type Other (AF)	Water Source Type Other Description	Water Use Sector Urban (AF)	Water Use Sector Industrial (AF)	Water Use Sector Agricultural (AF)	Water Use Sector Managed Wetlands (AF)	Water Use Sector Managed Recharge (AF)	Water Use Sector Native Vegetation (AF)	Water Use Sector Other (AF)	Water Use Sector Other Description
38,130	Where available, groundwater extraction and surface water supplies were quantified directly from measured and reported groundwater pumping, surface water diversions, and deliveries data. However, groundwater extraction data has historically been limited, particularly for privately-owned wells. Thus, a water budget approach has been used to estimate the remaining, unmeasured volume of groundwater extraction that has occurred to meet demand in the Subbasin. water budget approach used in this Annual Report utilizes available geospatial data and information to quantify crop water demand, precipitation, and other parameters with pixel-scale resolution (30-meter (m) x 30 m), corresponding to the spatial resolution of satellite imagery used in developing these inputs. In addition to geospatial data, available surface water supply and groundwater extraction data is incorporated into the water budget by distributing that water out to specific regions where that water is used (e.g., surface water supplier service areas). Surface water supplies are reported directly from water supplier records or collected from publicly available sources (water rights diversion records, etc.) where available.	26,130	12,000	0	0	0		1,700	0	35,000	0	0	1,300	130	Rural Residential