Las Posas Valley Basin Groundwater Sustainability Plan 2021 Annual Report: Covering Water Year 2020

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Fox Canyon Groundwater Management Agency

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Executive Summary

The Fox Canyon Groundwater Management Agency (FCGMA), the Groundwater Sustainability Agency (GSA) for the portions of the Las Posas Valley Basin (LPVB) within its jurisdictional boundaries, in coordination with the other two GSAs in the LPVB, has prepared this second annual report for the Las Posas Valley Basin (LPVB) Groundwater Sustainability Plan (GSP) in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.). This annual report covers the entire LPVB. The GSP for the LPVB was submitted to the Department of Water Resources (DWR) on January 13, 2020. SGMA regulations require that an annual report be submitted to the Department of Water Resources (DWR) by April 1 of each year following the adoption of the GSP. The data presented in the LPVB GSP ends in water year 2015. The first annual report provided an update on conditions in the Subbasin from water year 2016 through water year 2019. This annual report provides an update on the groundwater conditions in the LPVB for water year 2020 (October 1, 2019 through September 30, 2020).

Since 2015, the LPVB experienced two dry water years, 2016 and 2018, in which precipitation was below 75% of the long-term average precipitation for the LPVB, and two above normal water years, 2017 and 2019, in which precipitation was greater than the average precipitation. Water year 2020 was an above normal water year, in which precipitation was approximately 0.2 inches greater than the historical average precipitation within the LPVB.

Groundwater elevation changes between spring 2019 and 2020 in the Fox Canyon aquifer varied by geographic location. In the western West Las Posas Management Area (WLPMA), groundwater elevations rose by approximately 20 feet, while groundwater elevations declined by approximately 2 feet in the central WLPMA. In the East Las Posas Management Area (ELPMA), groundwater elevations rose by up to 30 feet along the Moorpark anticline. In water years 2019 and 2020, Calleguas Municipal Water District (CMWD) injected approximately 6,800 and 2,900 acre-feet (AF) of imported water into this region of the ELPMA for temporary storage via operation of its Aquifer Storage and Recovery (ASR) well field. Near the Arroyo Las Posas, groundwater elevations declined by approximately 5 feet between spring 2019 and spring 2020.

Calculations of change in storage in the LPVB are constrained by data coverage, with insufficient data in the Upper San Pedro Formation, Epworth Gravels aquifer, and Grimes Canyon aquifer to calculate a change in storage between 2016 and 2020. Groundwater elevation data in the Fox Canyon aquifer were used to calculate change in storage in both the ELPMA and the WLPMA, however, the change in storage calculations for these areas were limited by the data coverage to an area smaller than the lateral extent of the basin. Change in storage in the Fox Canyon aquifer was calculated for approximately 18% of the lateral extent of the WLPMA and 19% of the lateral extent of the ELPMA. In the WLPMA, the volume of groundwater in storage in the Fox Canyon aquifer increased by approximately 500 AF between spring 2019 and 2020, within the area over which the change in storage could be calculated. In the ELPMA the volume of groundwater in storage in the Fox Canyon aquifer increased by approximately 2,700 acre-feet between spring 2019 and spring 2020, within the area over which change in storage could be calculated. This increase of 2,700 acre-feet includes the influence of CMWD's net ASR injections. Since the spring of 2015, groundwater in storage in Fox Canyon Aquifer in the LPVB has increased by approximately 600 AF.

Data gaps identified in the GSP remain in this annual report. One of the critical data gaps is the limited spatial coverage of dedicated monitoring wells in the ELPMA and WLPMA, which impacts the resolution of groundwater elevation contour maps and corresponding estimates of change in groundwater storage. Data gaps associated with the current timeframe for reporting groundwater production, which facilitates reporting groundwater production on a calendar year, rather than on water year basis also remain. These data gaps will be closed as implementation of the GSP progresses.

FCGMA has undertaken several steps toward implementing the GSP, with implementation planning occurring concurrently with the GSP development process. At the request of FCGMA, DWR installed a nested well cluster in 2019 near the boundary between the Pleasant Valley Basin (PVB) and ELPMA, an area identified in the GSP as a critical location where groundwater elevation measurements were lacking. Construction of this well cluster helps address critical gaps in the monitoring network that impact the aerial coverage of groundwater elevation measurements.

The FCGMA Board of Directors adopted a new extraction allocation ordinance effective October 1, 2021. The new ordinance transitions to water year reporting and provides the regulatory framework to manage extractions consistent with the sustainable yield of the LPVB. The adoption of this allocation ordinance occurred concurrently with an ongoing adjudication of the LPVB that is pending in the Superior Court of the State of California. The extraction allocation adopted by the FCGMA Board of Directors will be interim and in effect until adjudication of the LPVB is finalized. In anticipation of additional reporting associated with the allocation ordinance, FCGMA is conducting an analysis of its data management system needs to target specific updates to the current data management system that facilitate FCGMA moving toward sustainable management of the LPVB by 2040.

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1 Plan Area and Background

1.1 Background

The FCGMA, the GSA for the portions of the LPVB within its jurisdictional boundaries, has prepared this second annual report for the LPVB GSP in compliance with SGMA (California Water Code, Section 10720 et seq.). SGMA requires that an annual report be submitted to the Department of Water Resources (DWR) by April 1 of each year following the adoption of the GSP. FCGMA adopted a GSP for the LPVB in December 2019 and submitted the GSP to DWR on January 13, 2020 (DWR 2020). FCGMA submitted the first annual report for the LPVB April 1, 2020.

FCGMA is one of three Groundwater Sustainability Agencies (GSAs) in the LPVB. The other two GSAs are the Camrosa Water District (CWD) Las Posas Basin GSA and the Las Posas Basin Outlying Areas GSA (County of Ventura). This annual report applies to the entirety of the LPVB. To coordinate management and reporting in the LPVB, FCGMA and CWD have executed a Memorandum of Understanding, and FCGMA and the County have formed a Joint Powers Authority.

1.1.1 Fox Canyon Groundwater Management Agency

FCGMA is an independent special district formed by the California Legislature in 1982 to manage and protect the aquifers within its jurisdiction for the common benefit of the public and all agricultural, and M&I users (FCGMA et al. 2007). FCGMA's boundaries include all land overlying the Fox Canyon Aquifer (FCA) and includes portions of the LPVB, the Oxnard Subbasin, the Pleasant Valley Basin, and the Arroyo Santa Rosa Valley Basin (ASRVB).

FCGMA is governed by a Board of Directors (Board) with five members who represent: (1) the County of Ventura (County), (2) the United Water Conservation District (UWCD), (3) seven mutual water companies and water districts within the Agency[1], (4) five incorporated cities which are all or a portion of each is within the FCGMA jurisdictional area[2], and (5) a farmer representative. The Board members representing the County, UWCD, the mutual water companies and water districts, and the incorporated cities are appointed by their respective organizations or groups. The representative for the farmers is appointed by the other four seated Board members from a list of candidates jointly supplied by the Ventura County Farm Bureau and the Ventura County Agricultural Association. An alternate Board member is selected by each appointing agency or group in the same manner as the regular member and acts in place of the regular member in case of absence or inability to act. All members and alternates serve for a 2-year term of office, or until the member or alternate is no longer an eligible official of the member agency. Information regarding current FCGMA Board representatives can be found on the FCGMA website[3].

1 The seven mutual water companies and water districts are: Alta Mutual Water Company, Pleasant Valley County Water District (PVCWD), Berylwood Mutual Water Company, Calleguas Municipal Water District (CMWD), CWD, Zone Mutual Water Company, and Del Norte Mutual Water Company.
2 The five incorporated cities within the FCGMA jurisdictional area are: Ventura, Oxnard, Camarillo, Port Hueneme, and Moorpark
3 FCGMA Website: https://fcgma.org/

1.1.2 LPVB Groundwater Sustainability Plan

The GSP for the LPVB defined the conditions under which the groundwater resources of the entire LPVB will be managed sustainably in the future (FCGMA 2019). Although DWR has defined the LPVB as a single groundwater basin, there is limited hydraulic connection between the east and west parts of the LPVB (FCGMA 2019). Hydrologic differences in the controls on groundwater recharge and groundwater production necessitated the definition of three management areas in the LPVB. These management areas are the West Las Posas Management Area (WLPMA), the East Las Posas Management Area (ELPMA) and the Epworth Gravels Management Area. The Epworth Gravels Management Area is a shallow unconfined aquifer located within the geographic boundaries of the ELPMA, but separated from the underling Fox Canyon and Grimes Canyon aquifers.

The GSP evaluated groundwater conditions in four hydrostratigraphic units in the WLPMA: the shallow alluvial system, the Upper San Pedro Formation, the Fox Canyon aquifer, and the Grimes Canyon aquifer (FCGMA 2019). The WLPMA is hydrologically connected to the Oxnard Subbasin to the west. The shallow alluvial system is connected with the Upper Aquifer System (UAS) in the Oxnard Subbasin, and the Upper San Pedro Formation, Fox Canyon aquifer, and Grimes Canyon aquifer compose the Lower Aquifer System (LAS) in the LPVB and the Oxnard Subbasin (FCGMA 2019).

In the ELPMA the GSP evaluated groundwater conditions in the Epworth Gravels, Shallow Alluvial aquifer, the Upper San Pedro Formation, the Fox Canyon aquifer, and the Grimes Canyon aquifer (FCGMA 2019). The Upper San Pedro Formation is not a primary aquifer but is a source of water to the underlying Fox Canyon aquifer. Geologic folding and faulting of the region has resulted in large differences in thickness, elevation, and exposure of the Fox Canyon aquifer in the ELPMA. This folding was found to result in differential impacts from groundwater elevation declines in the ELPMA (FCGMA 2019).

The primary sustainability goal for the LPVB adopted in the GSP is “to maintain a sufficient volume of groundwater in storage in each management area so that there is no significant and unreasonable decline in groundwater elevation or storage over wet and dry climatic cycles” (FCGMA 2019). Additionally, “groundwater levels in the WLPMA should be maintained at elevations that are high enough to not inhibit the ability of the Oxnard Subbasin to prevent net landward migration of the saline water impact front after 2040” (FCGMA 2019). These goals were established based on both historical and potential future undesirable results to the groundwater resources of the LPVB from six sustainability indicators: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. The LPVB was found not to experience direct impacts from seawater intrusion or depletion of interconnected surface water.

The GSP established minimum threshold groundwater elevations, which varied geographically within the WLPMA and ELPMA (FCGMA 2019). These groundwater elevations were selected to avoid undesirable results in the LPVB. In addition to minimum threshold groundwater elevations, the GSP also established measurable objective groundwater elevations. Measurable objective groundwater elevations are higher than the minimum threshold groundwater elevations in order to allow for operational flexibility during drought periods (FCGMA 2019). Minimum threshold and measurable objective groundwater elevations were established at one representative monitoring point (or “key well”) in the Epworth Gravels Management Area, fifteen representative monitoring points in the ELPMA, and five representative monitoring points in the WLPMA (FCGMA 2019).

The GSP documented conditions throughout the LPVB through the fall of 2015. The first annual report evaluated progress toward sustainability based on a review of groundwater elevation data, groundwater extraction data, surface water supply used, or surface water supply available for use, total water used, and change in groundwater storage between the fall of 2015and the end of water year 2019[4]. This annual report documents the conditions in the LPVB and the progress toward sustainability for water year 2020.

1.2 Plan Area

The LPVB (DWR Bulletin 118 Groundwater Basin 4-008) is bounded to the north by South Mountain and Oak Ridge; to the northeast and east by the foothills of Big Mountain; to the south by the Springville Fault (western segment of the Simi–Santa Rosa Fault) and the Las Posas Hills; and to the west by the Oxnard Subbasin of the Santa Clara River Valley Basin (DWR Groundwater Basin 4-04.02; Figure 1-1, Vicinity Map for the Las Posas Valley Basin).

In the Camarillo Hills area, the Springville Fault Zone is believed to form a groundwater flow barrier at depth between the aquifers in the LPVB and the PVB, based on historical hydraulic head differences of up to 60 feet across the fault zone (Turner 1975). However, shallow alluvial deposits in the vicinity of Arroyo Las Posas and the Somis Gap are in hydraulic communication with the PVB (CMWD 2017). On the west the WLPMA is in hydrogeologic communication with the Oxnard Subbasin. The boundary between the LPVB and Oxnard Subbasin is a jurisdictional boundary.

1.2.1 Climate

The climate of LPVB is typical of coastal Southern California, with average daily temperatures ranging generally from 54°F to 84°F in summer and from 40°F to 74°F in the winter (FCGMA 2019). Typically, the majority of the precipitation in the Ventura County region falls between November and April. Precipitation is measured at several stations in the LPVB (Figure 1-2; Precipitation and Stream Gauges in the Las Posas Valley Basin). Water year precipitation, measured at Stations 002 and 190, in the central LPVB is highly variable, ranging from 5.1 inches in 1958 to 39.0 inches in 2005 (Figure 1-3; Las Posas Valley Basin Historical Water Year Precipitation). On average, the LPVB received approximately 15.3 inches of precipitation per water year between 1956 and 2020.

The GSP for the LPVB included precipitation through the 2015 water year (FCGMA 2019). Since 2015, the LPVB has experienced three above normal[5] water years (2017, 2019, and 2020), and two dry water years (2016 and 2018). The LPVB received 15.5 inches of precipitation in water year 2020, which is 0.2 inches higher than the long-term mean precipitation. Overall, the LPVB has continued to experience drier than average conditions since 2015.

1.2.2 Surface Water and Drainage Features

The dominant surface water body in the LPVB is Arroyo Las Posas, which is located in the ELPMA. In the easternmost portion of the LPVB, Arroyo Las Posas is named Arroyo Simi, and Arroyo Las Posas becomes Calleguas Creek in the PVB. Arroyo Las Posas, which drains a watershed greater than the area of the LPVB, is a source of recharge to the

[4] A water year begins on October 1 and ends on September 30 of the following year. The convention for naming the water year is to name the water year based on the year in which it ends. For example, the 2019 water year begins on October 1, 2018, and ends on September 30, 2019.

[5] Water years have been classified into five types based on their relationship to the mean water year precipitation. The five types are: critical, dry, below normal, above normal, and wet. Critical water years are < 50% of the mean annual precipitation. Dry water years are ≥ 50% and <75% of the mean annual precipitation. Below normal water years are ≥ 75% and <100% of the mean annual precipitation. Above normal water years are ≥ 100% and <150% of the mean annual precipitation. Wet water years are ≥ 150% of the mean annual precipitation.

ELPMA. Dry weather flows in Arroyo Las Posas result from upstream wastewater treatment plant and dewatering well discharges to the Arroyo (FCGMA 2019).

There is only one active streamflow gauging station in the LPVB. This station, gauge 841A, which is maintained by the Ventura County Watershed Protection District, is located on Arroyo Simi above Hitch Blvd (Figures 1-2 and 1-4). Streamflow measured at gauge 841 since water year 2010 is presented in Table 1-1.

Table 1-1. Streamflow on Arroyo Las Posas for Water Years 2010 through 2019

Water Year	Average Daily Flow (cfs) at Gauge 841A
2010	38.5
2011	51.1
2012	25.3
2013	17.5
2014	NM
2015	17.7
2016	15.0
2017	31.0
2018	14.7
2019	22.5
2020	22.6

Notes: cfs - cubic feet per second
NM – Not Measured

Winter flows in Arroyo Las Posas reflect the water year precipitation (Section 1.2.1) with the highest daily average flows measured at gauge 841A over the past 10 years occurring in 2010 and 2011, which were both above normal water years. The average daily flow measured in water year 2020 was similar to water year 2019, which reflects the similarity in water year type between the two years (Table 1-1; Figure 1-4).

1.3 Annual Report Organization

This is the second Annual Report prepared since the GSP for the LPVB was submitted to DWR. This annual report is organized according to the GSP Emergency Regulations. Chapter 1 provides the background information on the GSP, the LPVB, and the Fox Canyon Groundwater Management Agency. Chapter 2 provides information on the groundwater conditions in the LPVB since 2015, including groundwater elevations, groundwater extractions, surface water supply, total water available, and change in groundwater storage. Chapter 3 provides an update on the GSP implementation.

2 Groundwater Conditions

This chapter presents the change in groundwater conditions in the LPVB from water year 2019. Comparison of water year 2020 conditions to water year 2019 conditions characterizes the impact that water year type, groundwater production, surface water, imported water and recycled water availability in water year 2020 have had on groundwater conditions in the Subbasin. Additionally, data from water years 2016 through 2018 are provided as context. These data were discussed in detail in the first annual report (FCGMA 2020a).

2.1 Groundwater Elevations

Groundwater elevation contour maps are presented in Figures 2-1 through 2-10: the Shallow Alluvial aquifer in Figures 2-1 and 2-2, the Epworth Gravels aquifer in Figures 2-3 and 2-4, the Upper San Pedro Formation in Figures 2-5 and 2-6, the Fox Canyon aquifer in Figures 2-7 and 2-8, and the Grimes Canyon aquifer in Figures 2-9 through 2-10. These maps show the seasonal low groundwater elevations for the fall of 2019 and seasonal high groundwater elevations for the spring of 2020. Groundwater elevations are best defined in the Fox Canyon aquifer (Figures 2-7 and 2-8), and least well constrained in the Grimes Canyon aquifer (Figures 2-9 and 2-10).

Spring 2020 groundwater elevations were defined as any groundwater elevation measured during a six-week window between February 23, 2020 and April 4, 2020. This six-week window expands on the four-week window used when generating groundwater elevation contour maps for the 2020 Annual Report and for the GSP. This expansion was necessary to incorporate a similar spatial coverage of groundwater elevation measurements for comparison of groundwater contours, and corresponding changes in groundwater in storage, between water years 2016, 2017, 2018, 2019, and 2020. Fall groundwater elevations were defined as any groundwater elevation measured between September 30 and October 31 of each year. This four-week window is similar to the measurement window used to contour groundwater elevations in the 2020 Annual Report for the Las Posas Valley Basin. The GSP recommended collecting groundwater elevations within a two-week window in the future (FCGMA 2019a). FCGMA has begun the process of prioritizing recommendations made in the GSP and evaluating the timeframe and feasibility of implementing these recommendations.

The groundwater elevation contour maps are based on the groundwater elevations measured at wells screened solely within an individual aquifer. The intent of using groundwater elevations from wells screened within a single aquifer is to accurately represent groundwater flow directions within an aquifer, as well as vertical gradients between aquifers. It is important to note, that production wells in the LPVB may be screened in multiple aquifers.

2.1.1 Groundwater Elevation Contour Maps

2.1.1.1 Shallow Alluvial Aquifer

Groundwater elevations in the Shallow Alluvial aquifer, located in the ELPMA, were measured at 6 monitoring wells in spring 2020 (Figures 2-1 and 2-2). Groundwater elevations measured at these wells indicate that conditions between spring 2019 and 2020 were stable. Groundwater elevations did not decline at any of these wells and increased by a maximum of 1 foot (e.g. well 02N19W07K04). Since 2015, groundwater elevations in the

northeastern portion of the Shallow Alluvial aquifer have declined by approximately 2 feet (e.g., well 02N19W09E01) and have changed by less than one foot throughout the remainder of the aquifer.

Seasonal low groundwater elevations between fall 2018 and 2019 show similar trends across the majority of the Shallow Alluvial aquifer. In the central portion of the aquifer, groundwater elevations increased by a maximum of 1 foot (e.g. well 02N20WMMW1). In the northeastern-most portion of the aquifer, groundwater elevations declined by approximately 1 foot at well 02N19W09E01 between fall 2018 and 2019. In the southwestern portion of the aquifer, near the boundary between the LPVB and PVB, groundwater elevations measured at well 02N20W09Q08 increased by approximately 9 feet between fall 2018 and 2019. Groundwater elevations measured in the Shallow Alluvial aquifer in fall 2015 were 2 feet higher than fall 2019 groundwater elevations at 02N20W10K01 and were within 1-foot of fall 2019 groundwater elevations throughout the remainder of the aquifer.

2.1.1.2 Epworth Gravels Aquifer

There are only two wells in the Epworth Gravels aquifer for which groundwater elevations were reported in 2020 (Table 2-1; Figures 2-3 and 2-4). The spring groundwater elevation in well 03N19W30M02 did not change between 2019 and 2020. In contrast, the fall groundwater elevation declined by approximately 25 feet between fall 2018 and fall 2019. The spring 2020 groundwater elevation measured at well 03N19W30M02 of 620 feet mean sea level (ft msl) is 0.5 feet higher than spring 2015 groundwater elevation. The fall 2019 groundwater elevation measurement at 03N19W30M02 of 509.5 ft msl is approximately 112 feet lower than the fall 2015 groundwater elevation.

The spring groundwater elevation measured in well 03N19W29F06 was approximately 4 feet higher than spring 2019 groundwater elevation, and approximately 5 feet higher than the spring 2015 groundwater elevation. Fall groundwater elevations were not reported at this well in 2019.

2.1.1.3 Upper San Pedro Formation

Groundwater elevations in the Upper San Pedro Formation vary with depth (Figures 2-5 and 2-6) and generally reflect the presence of laterally discontinuous lenses of permeable sediments that characterize the Upper San Pedro Formation in the LPVB. In the spring of 2020 in the WLPMA, groundwater elevations in the Upper San Pedro Formation ranged from a minimum of -67.0 ft msl at well 02N21W15M03 (screened 406 to 1030 feet below ground surface [ft bgs]) to a maximum of 243.0 ft msl at well 02N21W16J05 (screened 182 to 295 ft bgs) (Figure 2-6). As noted in the 2020 Annual Report, these wells are both located in western WLPMA and are only separated by approximately 0.2 miles. Similar trends in groundwater elevation differences with depth were measured at wells 02N21W11J04 (screened 615 to 655 ft bgs), 02N21W11J05 (screened 340 to 380 ft bgs), and 02N21W11J06 (screened 190 to 230 ft bgs). In spring 2020, the groundwater elevation in well 02N21W11J06, the shallowest of the three wells, was 194.79 ft msl. During the same measurement event, the groundwater elevation at well 02N21W11J04, the deepest of the three wells, was -30.81 ft msl.

Between spring 2019 and 2020, groundwater elevations in the Upper San Pedro decreased by approximately 1 to 2 feet in western WLPMA and remained stable in central WLPMA. Fall groundwater elevations in central WLPMA were stable between 2018 and 2019. Fall groundwater elevations were not measured in western WLPMA in 2019.

In the ELPMA, fall 2019 and spring 2020 groundwater elevations were measured at four wells screened within the Upper San Pedro (Figure 2-6). Groundwater elevations were not measured at well 02N19W06F01 in fall 2018 or spring 2019. In spring 2020, groundwater elevations measured in the Upper San Pedro ranged from 265 ft msl at

well 03N2035R04 to 438 ft msl at well 02N19W07K03. Groundwater elevations at well 02N19W07K03S were the same in spring 2019 and spring 2020 but declined by approximately 10 feet at well 02N19W02J01S (Figure 2-6). Since 2015, groundwater elevations have consistently been highest in the Upper San Pedro at well 02N19W07K03, which is located adjacent to Arroyo Las Posas.

2.1.1.4 Fox Canyon Aquifer

Spring groundwater elevations in western WLPMA increased by approximately 20 feet between 2019 and 2020 (e.g. well 02N21W08L03). In central WLPMA, groundwater in well 02N21W11J03 was measured at an elevation of -58.11 ft msl, which is approximately 2 feet lower than spring 2019 conditions. North and east of 02N21W11J03, groundwater elevations in the WLPMA were not measured using the same set of wells between spring 2019 and 2020. In spring 2020, groundwater elevations located north and east of well 02N21W11J03, measured at 02N19W12H01, 02N20W08B01, 02N19W13A01, and 03N20W32H02, ranged from a low of -147 ft msl to a high of -35.41 ft msl (Figure 2-8). In spring 2019, the groundwater elevation at well 02N20W06R01 was -137.9 ft msl and at well 02N20W18A01 was -133.4 ft msl (Figure 2-8).

Fall groundwater elevations in the WLPMA rose between 2018 and 2019. In eastern WLPMA, near the Somis Fault Zone, the groundwater elevation measured at 02N20W06R01 rose by approximately 33 feet between fall 2018 and fall 2019. West of 02N20W06R01, the groundwater elevation measured at well 02N21W11J03 recovered by approximately 3 feet, and in western WLPMA, the groundwater elevations measured at well 02N21W08L03 recovered by approximately 30 feet.

In the ELPMA, spring groundwater elevation changes varied by geographic location within the Fox Canyon aquifer. In the southern portion of the ELPMA, near Arroyo Las Posas, groundwater elevations measured in spring 2020 were approximate 3 to 5 feet lower than in spring 2019. The largest measured decline in groundwater elevation between spring 2019 and spring 2020 occurred in the south-central portion of the ELPMA, where groundwater elevations declined by approximately 7 feet at well 02N20W03H01S. Along the Moorpark Anticline, and within the trough of the Moorpark Syncline, groundwater elevations rose by approximately 10 to 40 feet between spring 2019 and 2020. The rise in groundwater elevations in this area of the ELPMA include CMWD's operation of their Aquifer Storage and Recovery wells. During water years 2019 and 2020 combined, CMWD injected approximately 9,700 AF of imported water into the ELPMA via operation of their ASR program (Table 2-4). Spring 2020 groundwater elevations in this region of the ELPMA were approximately 30 feet higher than they were in spring 2015.

2.1.1.5 Grimes Canyon Aquifer

Of the eight wells screened solely within the Grimes Canyon aquifer in the WLPMA, groundwater elevations were only measured in wells 02N21W28A02 and 02N22W22G01 during water years 2019 and 2020 (Figures 2-9 and 2-10). The groundwater elevation in these wells was not measured in the fall of 2018 (FCGMA 2020a). Between spring 2019 and 2020, groundwater elevations in these wells increased by approximately 2 feet.

Groundwater elevations were not measured in the two wells screened solely in the Grimes Canyon aquifer in the ELPMA (Figures 2-9 through 2-10).

Table 2-1. Water Year 2020 Groundwater Elevations, Minimum Thresholds, Measurable Objectives, and Interim Milestones for Representative Monitoring Wells in the LPVB

Well Number	Management Area	Aquifer	Fall Groundwater Conditions		Spring Groundwater Conditions		Minimum Threshold (ft MSL)	Measurable Objective (ft MSL)	2025 Interim Milestone (ft MSL)
			2019 Groundwater Elevation (ft MSL)	Change from 2018 to 2019 (feet)[a]	2020 Groundwater Elevation (ft MSL)	Change from 2019 to 2020 (feet)[a]			
03N19W29F06	Epworth Gravels	Epworth Gravels	594.3		606.2	4.10	555	585	581
02N20W09Q08	ELPMA	Shallow Alluvial	271	9.00	274	1.00	170	270	–
02N20W12MMW1	ELPMA	Shallow Alluvial	369	1.00	372	-1.87	300	370	–
02N20W01B02	ELPMA	Fox	NM		NM		80	120	–
02N20W03H01	ELPMA	Fox	140		158		100	135	–
02N20W04F02	ELPMA	Fox	Destroyed		Destroyed		100	145	–
02N20W10D02	ELPMA	Fox	142.23	9.33	150.43	9.50	80	130	–
02N20W10G01	ELPMA	Fox	250.67		260.27	7.20	100	230	–
02N20W10J01	ELPMA	Fox	280.1		287.1	1.23	110	250	–
03N19W19J01	ELPMA	Fox	174.8		181.2	15.00	130	160	–
03N19W28N03	ELPMA	Fox	NM		NM		130	170	–
03N19W31B01	ELPMA	Fox	163	38.90	147	15.90	105	145	–
03N20W34G01	ELPMA	Fox	NM		153.78	21.50	75	130	–
03N20W35R03	ELPMA	Fox	183.07		NM		105	145	139
03N20W26R03	ELPMA	Fox	174.81		NM		100	120	–
03N20W35R02	ELPMA	Grimes	181.77	51.20	NM		105	145	133
02N20W06R01S	WLPMA	LAS[b]	-160.01		-149.91	-12.00	-170	-125	-147
02N20W08F01S	WLPMA	LAS	NM[c]		NM[c]		-195	-150	–
02N21W16J03S	WLPMA	LAS	NM[d]		NM[d]		-75	-45	-71
02N21W11J03S	WLPMA	LAS	-69.81	3.20	-58.11	-1.70	-70	-50	-64
02N21W12H01S	WLPMA	LAS	-43.51		-35.41	4.20	-70	-45	–

ft MSL = feet mean sea level
NM = not measured

[a] Data in this column shows the difference between water year 2020 and water year 2019 groundwater elevations measured at each representative monitoring site. Positive (+) values indicate that seasonal high or low groundwater elevations have increased from water year 2019 conditions. Groundwater elevation increases from 2019 conditions are presented in blue font. Negative (-) values indicate that seasonal high or low groundwater elevations have decreased from water year 2019 conditions. Groundwater elevation declines from 2019 conditions are presented in red font with a red-filled cell. Blank cells in this column indicate that data was not measured in the current, or previous, water year.

[b] In the WLPMA, the LAS consists of the Fox Canyon aquifer and Grimes Canyon aquifer (FCGMA 2019)

[c] Groundwater elevations not reported after 4/01/2017.

[d] Groundwater elevations not reported after 5/25/2016.

2.1.2 Groundwater Elevation Hydrographs

Groundwater elevation hydrographs for each of the key wells identified in the GSP are presented in Figures 2-11 through 2-13. These key wells are the designated representative monitoring sites for the LPVB (FCGMA 2019). Since the GSP was prepared, well 02N20W04F02, one of the representative monitoring wells in the ELPMA, was destroyed (Table 2-1). FCGMA is currently working to identify a suitable replacement monitoring site for inclusion in the next annual report. Additionally, groundwater elevations in wells 02N20W08F01S and 02N21W16J03S have not been measured since 2016 or 2017 (Table 2-1). FCGMA is continuing to assess whether these wells can be accessed and included in future monitoring, or whether suitable replacement wells need to be identified.

The spring 2020 groundwater elevation measured at well 03N19W29F06 in the Epworth gravels management area was 51 feet higher than the minimum threshold groundwater elevation defined for this well (Table 2-1; Figure 2–13; FCGMA 2019). In the WLPMA, the spring 2019 groundwater elevations were above the minimum threshold groundwater elevation in four of the five representative monitoring sites (Table 2-1; Figure 2-11). Spring 2019 groundwater elevations measured in the ELPMA were above the minimum threshold groundwater elevations established at each representative monitoring point (Table 2-1; Figures 2-12a through 2-12c).

2.2 Groundwater Extraction

Historically, groundwater extractions in the FCGMA have been reported in two periods over the course of a single calendar year. Because groundwater extractions are not reported monthly, groundwater production cannot be reported on a water year basis. Therefore, the groundwater extractions reported in Tables 2-2 and 2-3 and shown on Figure 2-14 follow the historical precedent and represent calendar year extractions for 2020.

It should be noted that groundwater extraction reporting for 2020 is preliminary and expected to change. Additional extraction reporting is anticipated. Based on the available data, groundwater production in the WLPMA and ELPMA was stable between 2018 and 2019 (Table 2-3). Reported groundwater extractions in the ELPMA were stable during calendar years 2016, 2017, and 2018. In calendar year 2019, groundwater extractions from the Fox Canyon aquifer and from wells screened in multiple or unassigned aquifers decreased by approximately 4,400 AF as a result of reduced agricultural production and/or unreported extractions (Table 2-3).

2.3 Surface Water Supply

There are no locally derived sources of surface water in the LPVB (FCGMA 2019).

Table 2-2. Calendar Year Groundwater Extractions in the WLPMA by Aquifer System and Water Use Sector

Calendar Year	Shallow Alluvial System (Acre-Feet)				Lower Aquifer System (Acre-Feet)				Wells in Unassigned Aquifer Systems (Acre-Feet)				Total (Acre-Feet)
	AG	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	
2016	1,555	0	1	*1,556*	11,052	2,371	0	*13,423*	178	372	33	*583*	**15,562**
2017	1,536	0	1	*1,537*	11,009	2,321	0	*13,330*	569	386	44	*899*	**15,766**
2018	1,103	0	1	*1,104*	9,984	1,511	0	*11,495*	1,287	376	42	*1,705*	**14,304**
2019[a]	675	0	16	*692*	10,099	2,023	0	*12,123*	1,085	218	25	*1,327*	**14,142**
2020	647	0	17	*664*	6,770	1,914	0	*8,684*	1,067	89	28	*1,175*	**10,523**

Notes: AG = Agriculture ; Dom = domestic; M&I = Municipal and Industrial

[a] Groundwater extractions updated based on receipt of additional groundwater extraction data for the 2019 reporting period.

[b] Groundwater extraction reporting for 2018 is preliminary and expected to change. Additional extraction reporting is anticipated.

Table 2-3. Calendar Year Groundwater Extractions in the ELPMA by Aquifer System and Water Use Sector

Calendar Year	Epworth Gravels Aquifer (Acre-Feet)				Upper San Pedro Formation (Acre-Feet)				Fox Canyon Aquifer (Acre-Feet)				Grimes Canyon Aquifer (Acre-Feet)				Wells in Multiple or Unassigned Aquifers (Acre-Feet)				Total (Acre-Feet)
	AG	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	
2016	1,052	0	0	*1,052*	583	0	0	*583*	11,270	1,128	0	*12,398*	384	87	1	*472*	8,424	98	18	*8,540*	**23,045**
2017	924	0	0	*924*	580	0	0	*580*	11,900	1,093	0	*12,993*	453	91	1	*545*	9,008	131	29	*9,168*	**24,210**
2018	766	0	0	*766*	562	0	0	*562*	10,944	1,393	0	*12,337*	500	92	1	*593*	8,579	418	29	*9,026*	**23,284**
2019[a]	744	0	0	*744*	217	0	0	*217*	9,713	591	0	*11,019*	272	99	0	*371*	6,411	128	20	*6,559*	**18,911**
2020[b]	463	0	0	*463*	56	0	0	*56*	7,768	1,601	0	*9,369*	256	47	0	*303*	4,181	221	21	*4,413*	**14,603**

Notes: AG = Agriculture; Dom = domestic; M&I = Municipal and Industrial

[a] Groundwater extractions updated based on receipt of additional groundwater extraction data for the 2019 reporting period.

[b] Groundwater extraction reporting for 2018 is preliminary and expected to change. Additional extraction reporting is anticipated

2.4 Imported Water Supply

Imported water supplies consist of imported Metropolitan Water District of Southern California (State Water Project and/or Colorado River water) water provided by the CMWD and imported groundwater and Conejo Creek water provided by CWD. CMWD is largest imported water supplier to the LPVB and has provided approximately 97% of the imported water to the LPVB since water year 2015 (Table 2-4). Table 2-4 summarizes imported water supplies to the LPVB from water year 2016 to water year 2020.

CWD provided historical imported water supplies to the LPVB for calendar years 2016 through 2020 to support preparation of this 2021 Annual Report. In order to convert the imported water supply data from calendar year to water year, 25% of CWD's imported water from a given calendar year was assigned to the following water year, and 75% of the calendar year imported water was assigned to the current water year. This division, while approximate, is based on the monthly split between water year and calendar year, with January through September (75% of the calendar year) belonging to the current water year, and October through December (25% of the calendar year) belonging to the following water year.

Table 2-4. Total Imported Water Supplies in the LPVB

Water Year	CMWD (Acre-Feet)						CWD (Acre-feet)								
	WLPMA		*ELPMA*			*Sub-total*	*GW Pumped in PVB and used in LPVB*		*GW Pumped in SRV and used in LPVB*		*Imported from CMWD to ELPMA*		*Sub-total*	Nonpotable water delivered for Ag	Total[c]
	M&I	*Ag*	*M&I*	*Ag*	*ASR Injections* [b]		*M&I*	*Ag*	*M&I*	*Ag*	*M&I*	*Ag*			
2016	697	762	5,210	1,966	946	9,581	10	13	21	29	54	76	203	122	**9,906**
2017	541	372	5,526	1,896	4,066	12,401	9	13	33	43	51	69	218	99	**12,718**
2018	1,011	772	6,296	2,298	2,056	12,433	10	13	33	45	53	71	225	97	**12,754**
2019	666	384	5,195	1,802	6,814	14,861	9	13	26	35	54	73	210	139	**15,210**
2020	544	379	5,460	1,884	2,866	*11,133*	11	15	17	24	69	90	226	132	**11,493**

Notes: M&I = Municipal and Industrial; Ag = Agriculture; ASR = Aquifer Storage and Recovery; NR = Not Reported, SRV = Santa Rosa Valley Basin, PVB = Pleasant Valley Basin
CWMD = Calleguas Municipal Water District; CWD = Camrosa Water District

[a] Total imported water is preliminary pending receipt of data requested from CWD.

[b] ASR injections are stored water in the ELPMA.

[c] Total imported water supplies for water year 2016 through 2019 updated to incorporate CWD imported water supply data that was not available during 2020 Annual reporting.

2.5 Total Water Available

Total available water was tabulated from the groundwater extractions reported in Tables 2-2 and 2-3, the imported water supplies reported in Table 2-4, and treated wastewater sent to the Moorpark Wastewater Treatment Plant (MWTP) percolation ponds. Total available water is reported in Table 2-5 by water year. Total water supplies for water years 2016 through 2019 were updated to reflect CWD's imported water supplies to the LPVB. In order to convert the reported groundwater pumping from calendar year to water year, 25% of groundwater production from a given calendar year was assigned to the following water year, and 75% of the calendar year production was assigned to the current water year. This division, while approximate, is based on the monthly split between water year and calendar year, with January through September (75% of the calendar year) belonging to the current water year, and October through December (25% of the calendar year) belonging to the following water year. Preliminary advanced metering infrastructure (AMI) data reported to FCGMA indicates that this division is reasonable for M&I and domestic groundwater extractions. AMI data from agricultural users in the Subbasin indicate that production can be highly variable, but preliminary data suggest the January through September period accounts for 70% of the total calendar year extractions, while the October through December period accounts for the remaining 30% of the total calendar year extraction. Using a 70-30% division based on this AMI data to convert from calendar year to water year results in an estimate of agricultural extractions equal to approximately 23,700 AF in water year 2020. This estimate is approximately 500 AF, or 2%, more than the water year 2020 agricultural extractions estimated using a 75-25% division.

FCGMA is in the process of switching reporting periods to the water year. When FCGMA groundwater extraction reporting is shifted to a water year schedule, the approximation will no longer be necessary.

Table 2-5. Total Water Available in the LPVB

Water Year	Groundwater (acre-feet)			Recycled Water (acre-feet)	Imported Water[a] (acre-feet)		Total[b] (acre-Feet)
	Ag	*Dom*	*M&I*	*M&I*	*Ag*	*M&I*	
2016	34,872	53	4,160	598	2,969	5,991	48,643
2017	35,610	69	4,031	765	2,492	6,160	49,127
2018	34,296	72	3,848	897	3,296	7,402	49,811
2019	29,234	61	3,757	823	2,446	5,950	42,271
2020[c]	23,214	58	3,836	861	2,525	6,102	36,596

Notes: Ag = Agriculture; Dom = Domestic; M&I = Municipal and Industrial.

[a] Imported water updated to include data provided by CWD.

[b] Total water available in the LPVB does not include CMWD ASR injections which are considered stored water in the ELPMA. ASR injection totals were 946 AF in 2016, 4,066 AF in 2017, 2,056 in 2018, 6,814 AF in 2019, and 2,866 AF in 2020.

[c] Groundwater extraction reporting for 2020 is preliminary and expected to change. Additional extraction reporting is anticipated.

2.6 Change in Groundwater Storage

Change in storage estimates were calculated in the LPVB by comparing seasonal high groundwater elevations between 2015 and 2020. Annual change in storage was calculated using the change in groundwater elevation for each period and the aquifer storage properties defined by the Ventura Regional Groundwater Flow numerical model (UWCD, 2018) in the WLPMA and the CMWD numerical groundwater flow model in the ELPMA (CMWD 2018). Due

to limited data coverage within the Upper San Pedro, Shallow Alluvial aquifer, Epworth Gravels, and Grimes Canyon aquifer, storage change was only calculated for the Fox Canyon aquifer.

Change in groundwater elevations was calculated by mapping the spring 2015 through spring 2020 groundwater elevation contours onto two uniform grids that covered the areal extent of the WLPMA and ELPMA, separately. Each grid was assigned a groundwater elevation equal to half the elevation of the up-gradient and down-gradient contours. This way the seasonal high groundwater elevation in each grid cell could be subtracted from the previous seasonal high groundwater elevation in the same cell to generate a gridded map of groundwater elevation change on the same scale as the grid used in the Ventura Regional Groundwater Flow numerical model and the CMWD groundwater flow model developed for the ELPMA. Change in storage was subsequently calculated for each grid cell using the aquifer properties defined for each grid cell in the two models and the storage change equations presented in Appendix K of the LPVB GSP (FCGMA 2019)

Groundwater elevations were not measured over the same areal extent in each aquifer during the spring of each water year. The data coverage between consecutive water years (color flood) and the common area between all the years (black outline) is shown in Figures 2-15. Change in storage calculated within the common area for all water years is reported in Tables 2-6a and 2-6b.

2.6.1 Fox Canyon Aquifer

Change in groundwater storage in the Fox Canyon aquifer was calculated for 3,200 acres of the 17,400 acres of the WLPMA and 5,100 acres of the 27,200 acres of the ELPMA. Therefore, the change in storage estimates below describe storage change for approximately 18% of the WLPMA and 19% of the ELPMA.

Between spring 2019 and spring 2020, groundwater in storage increased within the Fox Canyon aquifer in the ELPMA (Figure 2-16). During this period, groundwater elevations increased by 30 to 40-feet along the Moorpark Anticline and north of the anticline (Section 2.1.1.4). This increase in groundwater elevation, which reflects CMWD's ASR injections, resulted in an increase in groundwater in storage in these areas of the ELPMA. Near Arroyo Las Posas, groundwater elevations declined between spring 2019 and 2020, which resulted in a localized reduction of groundwater in storage. Within the common area of measurement (black outline in Figure 2-16), groundwater in storage increased by approximately 2,700 AF between spring 2019 and 2020 in the ELPMA.

In the WLPMA, groundwater in storage increased in the central portion of the WLPMA. It should be noted, the only well in which groundwater elevations were measured in both spring 2019 and 2020 was well02N21W11J03 (Figure 2-15). Groundwater elevation contours east of this well were constrained using a different set of groundwater wells between spring measurement events (see discussion in section 2.1.1.4). As noted in the 2020 Annual Report, estimates of groundwater storage change based on groundwater elevation contours are sensitive to the availability of consistently measured groundwater elevation wells between water years. Groundwater elevation changes inferred from these two datasets results in an estimate of groundwater storage increase between spring 2019 and 2020 of approximately 500 AF.

The change in groundwater storage in the Fox Canyon aquifer is reported by management area in Tables 2-6a and Table 2-6b, and compared to groundwater production in each management area in Figures 2-16through 2-19.Table 2-6a and 2-6b contain two columns that report estimates of groundwater storage change within the WLPMA. The left-most WLPMA column in Tables 2-6a and 2-6b represent the estimates of groundwater storage change in the Fox Canyon aquifer in the WLPMA reported in the 2020 Annual Report. Changes in groundwater storage computed for the 2020 Annual Report contained an error in the computation of the change in groundwater elevations (see

Appendix A for discussion). To reconcile this error, groundwater storage change in the WLPMA was recomputed for water years 2016, 2017, 2018, and 2019 as part of the 2021 Annual Report. The right-most column within the WLPMA section of Tables 2-6a and 2-6b reflect these corrected change in storage calculations. In water year 2019, this correction resulted in an increase in storage of approximately 600 AF, compared to the original estimate of a loss in storage of approximately 40 AF (Table 2-6a). This difference highlights the sensitivity of this method for calculating groundwater storage change to the groundwater elevation measurement dataset from one year to the next and resulting groundwater elevation contours.

Neither annual nor cumulative changes in groundwater storage correspond to water year types (Tables 2-6a and 2-6b; Figures 2-16 through 2-19). Based on the available data, groundwater storage declined at similar rates in 2016 (dry water year) and 2017 (above normal water year). However, it should be noted that (1) the change in storage volumes reported in Tables 2-6a and 2-6b are an approximate change in storage over the areas of the aquifer in which groundwater elevations were measured and (2) the change in storage volumes reported include ASR injections between 2016 and 2020[6].

Annual and cumulative change in storage from 1985 through 2015 were reported in the GSP (FCGMA 2019). The change in storage volumes reported in the GSP were extracted from UWCD and CMWD model calculations and covered the entire lateral extent of the LPVB for each principal aquifer. Therefore, the results of the long-term change in storage calculations presented in the GSP cannot be directly compared to the change in storage estimates in the annual report.

[6] CMWD's ASR operations impact groundwater elevations in the vicinity of the Moorpark Anticline in the ELPMA. Groundwater elevation changes that result from CMWD's ASR operations are incorporated into the groundwater elevation contour maps prepared as part of the Annual Report. Change in groundwater storage is computed using these groundwater elevation contour maps.

Table 2-6a. Annual Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB for the Area with Water Level Measurements

Water Year	Water Year Type	LPVB				
		WLPMA	*WLPMA*[a]	*ELPMA*[b]	*Total*	*Total*[a]
2016	Dry	*-705*	-497	-861	*-1,566*	-1,357
2017	Above Normal	*-596*	-349	-914	*-1,510*	-1,263
2018	Dry	*-36*	49	-35	*-71*	14
2019	Above Normal	*-38*	603	-621	*-659*	-18
2020	Above Normal	494		2,724	3,218	

Notes: ELPMA change in storage includes ASR injections in 2016 through 2019.

a) Change in groundwater storage for water years 2016 through 2019 was updated to address error in mapping of groundwater elevation contours onto storage calculation grid. A discussion of this is provided in Appendix A. Storage change calculated in the 2020 Annual report is provided for reference.

b) Change in storage includes CMWD Aquifer Storage and Recovery well operations.

Table 2-6b. Cumulative Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB for the Area with Water Level Measurements

Water Year	Water Year Type	LPVB				
		WLPMA	*WLPMA*[a]	*ELPMA*[b]	*Total*	*Total*[a]
2016	Dry	*-705*	-497	-861	*-1,566*	-1,357
2017	Above Normal	*-1,301*	-845	-1,774	*-3,076*	-2,620
2018	Dry	*-1,338*	-797	-1,809	*-3,147*	-2,606
2019	Above Normal	*-1,376*	-194	-2,430	*-3,806*	-2,625
2020	Above Normal	*-882*	299	294	*-589*	593

Notes: ELPMA change in storage includes ASR injections in 2016 through 2019.

a) Change in groundwater storage for water years 2016 through 2019 was updated to address error in mapping of groundwater elevation contours onto storage calculation grid. A discussion of this is provided in Appendix A. Storage change calculated in the 2020 Annual report is provided in italics for reference.

b) Change in storage includes CMWD Aquifer Storage and Recovery well operations.

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3 GSP Implementation Progress

The GSP for the LPVB was submitted to DWR in January 2020. This is the second annual report to be prepared since the GSP was submitted. The GSP implementation progress reported in this report covers work begun during development of the GSP as well as work that has been conducted over the 15 months since the GSP was submitted. Concurrent with FCGMA's ongoing GSP implementation efforts in the LPVB, the basin is under adjudication in the California Superior Court. FCGMA continues to engage with stakeholders both as part of the GSP implementation efforts and in the context of basin adjudication.

Project Implementation Progress

During development of the GSP, FCGMA identified the northern Pleasant Valley, adjacent to the boundary between the PVB and the ELPMA, as a critical area in which aquifer specific groundwater elevations were lacking. This is an area where subsurface flows between the two basins are poorly constrained. At FCGMA's request, DWR installed two new nested monitoring wells in this area in 2019 per FCGMA's technical specifications. Combined the new nested wells are screened in the Older Alluvium (one each in the Oxnard aquifer equivalent, and Mugu aquifer equivalent), Upper San Pedro Formation (Hueneme aquifer equivalent), and the Fox Canyon aquifer (one each in the upper and basal portions). Groundwater elevation data from these wells will be incorporated into future annual reports, to better represent groundwater conditions at the boundary between the LPVB and PVB.

Management Action Implementation Progress

FCGMA has made progress on several management actions since publication of the 2020 annual report. First, the FCGMA Board adopted a fixed-extraction allocation ordinance for the LPVB in December 2020. This ordinance will go into effect on October 1, 2021. The allocation system is designed to "facilitate the transition from [FCGMA's] current groundwater management programs to sustainable groundwater management under SGMA" (FCGMA, 2020). As part of the new allocation system, FCGMA changed the reporting time periods for groundwater production to better quantify groundwater production by water-year, rather than calendar year. The new allocation system sets fixed allocations for each well rather than variable efficiency allocations for agricultural pumpers, which will allow for improved management of the LPVB.

Second, in anticipation of the additional reporting associated with implementing the allocation ordinance, FCGMA is conducting an analysis of its data management system needs. The updated data management system will incorporate the new AMI data and will be structured to allow for land-based extraction assignments. Changes to the data management system will target the specific needs of the FCGMA moving toward sustainable management of the LPVB by 2040.

The progress made over the past year on projects and management actions applicable to the LPVB demonstrates FCGMA's commitment to allocating the necessary time and resources to ensure the long-term sustainable management of the groundwater resources of the LPVB.

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4 References

CMWD (Calleguas Municipal Water District). 2017. *Development of a Conceptual Model for the Las Posas Valley Basin – East and South Sub-Basins*. Technical Memorandum – Final. Thousand Oaks, California: CH2M Hill Inc. January 2017.

CMWD (Calleguas Municipal Water District). 2018. *Groundwater Flow Model of the East and South Las Posas Sub-basins – Preliminary Draft Report*. Torrance, California: Intera Geoscience and Engineering Solutions. January 2018.

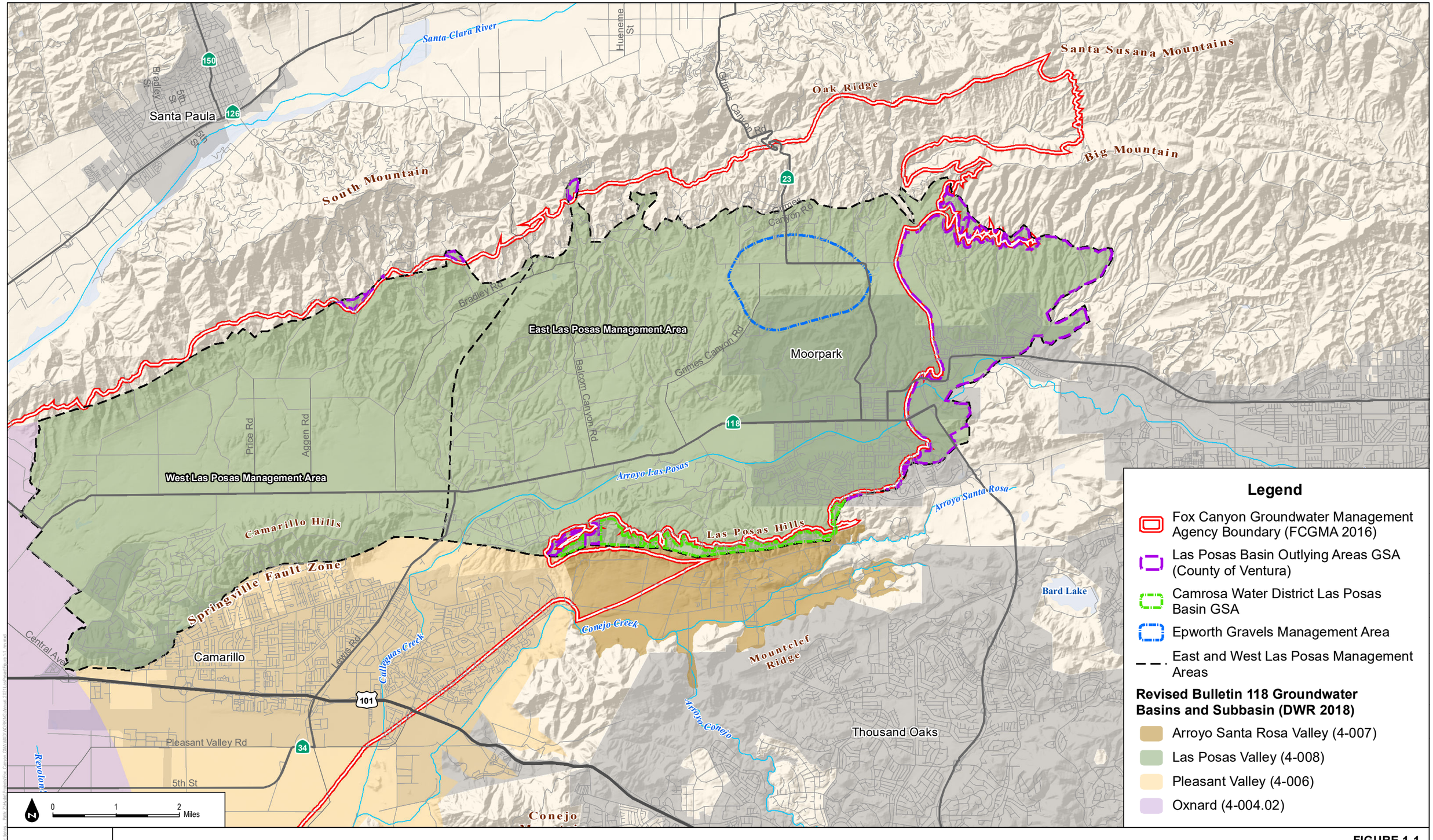
DWR (California Department of Water Resources). 2020. DWR SGMA Portal Website: All submitted GSPs. https://sgma.water.ca.gov/portal/gsp/all. Accessed February 17, 2020.

FCGMA (Fox Canyon Groundwater Management Agency). 2019. Groundwater Sustainability Plan for the Las Posas Valley Basin.

FCGMA (Fox Canyon Groundwater Management Agency). 2020a. Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report: Covering Water Years 2016 through 2019.

FCGMA (Fox Canyon Groundwater Management Agency). 2020b. An Ordinance to Establish and ExtractionAllocation System for the Las Posas Valley Groundwater Basin.

Turner, J.M. 1975. "Aquifer Delineation in the Oxnard-Calleguas Area, Ventura County." In *Compilation of Technical Information Records for the Ventura County Cooperative Investigation: Volume I*. Prepared by the Ventura County Public Works Agency Flood Control and Drainage Department for the California Department of Water Resources. 1-45.



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Basin Outlying Areas GSA (County of Ventura)
- Camrosa Water District Las Posas Basin GSA
- Epworth Gravels Management Area
- East and West Las Posas Management Areas

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

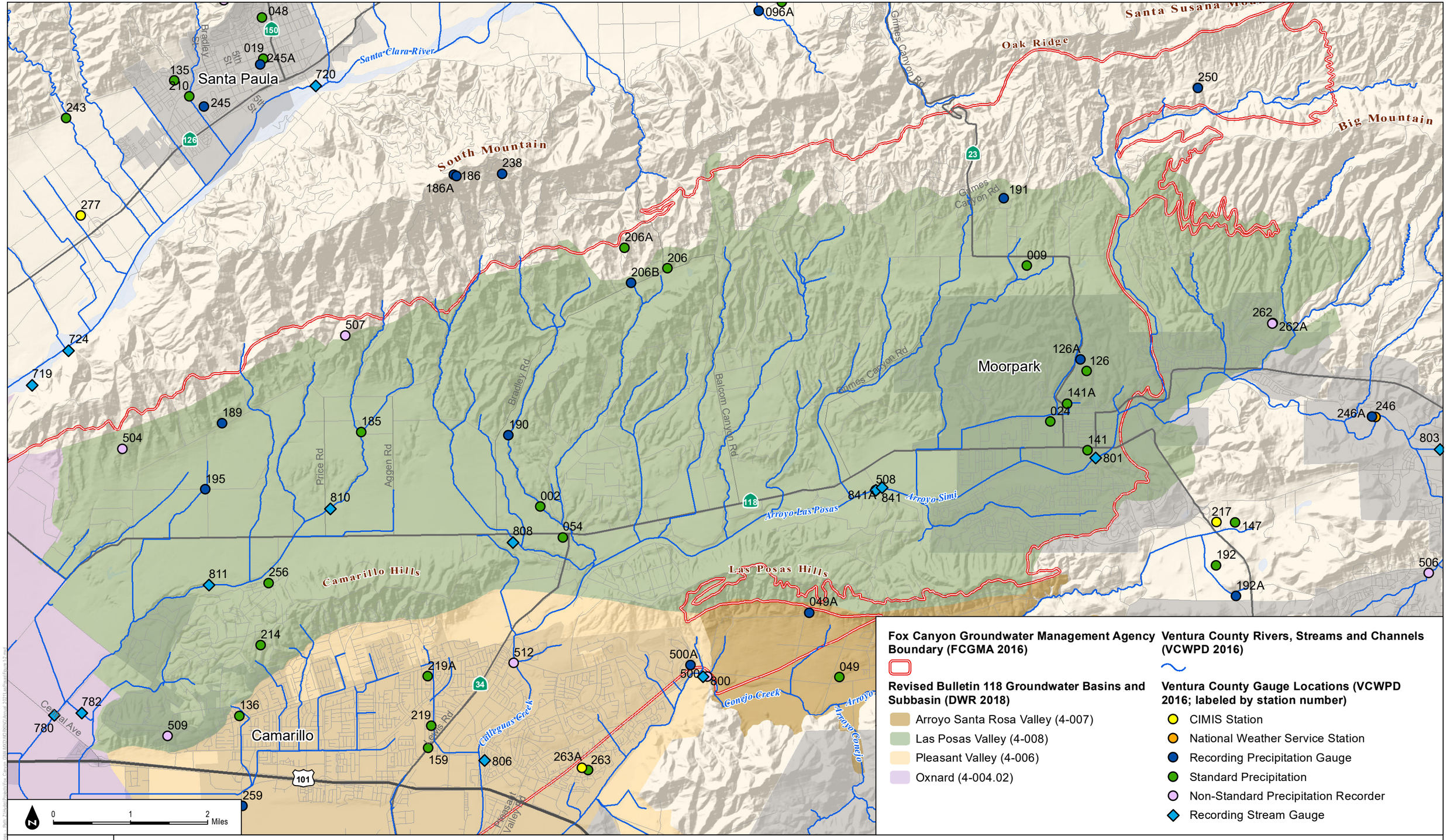
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

DUDEK

SOURCE: DWR; Ventura County

FIGURE 1-1

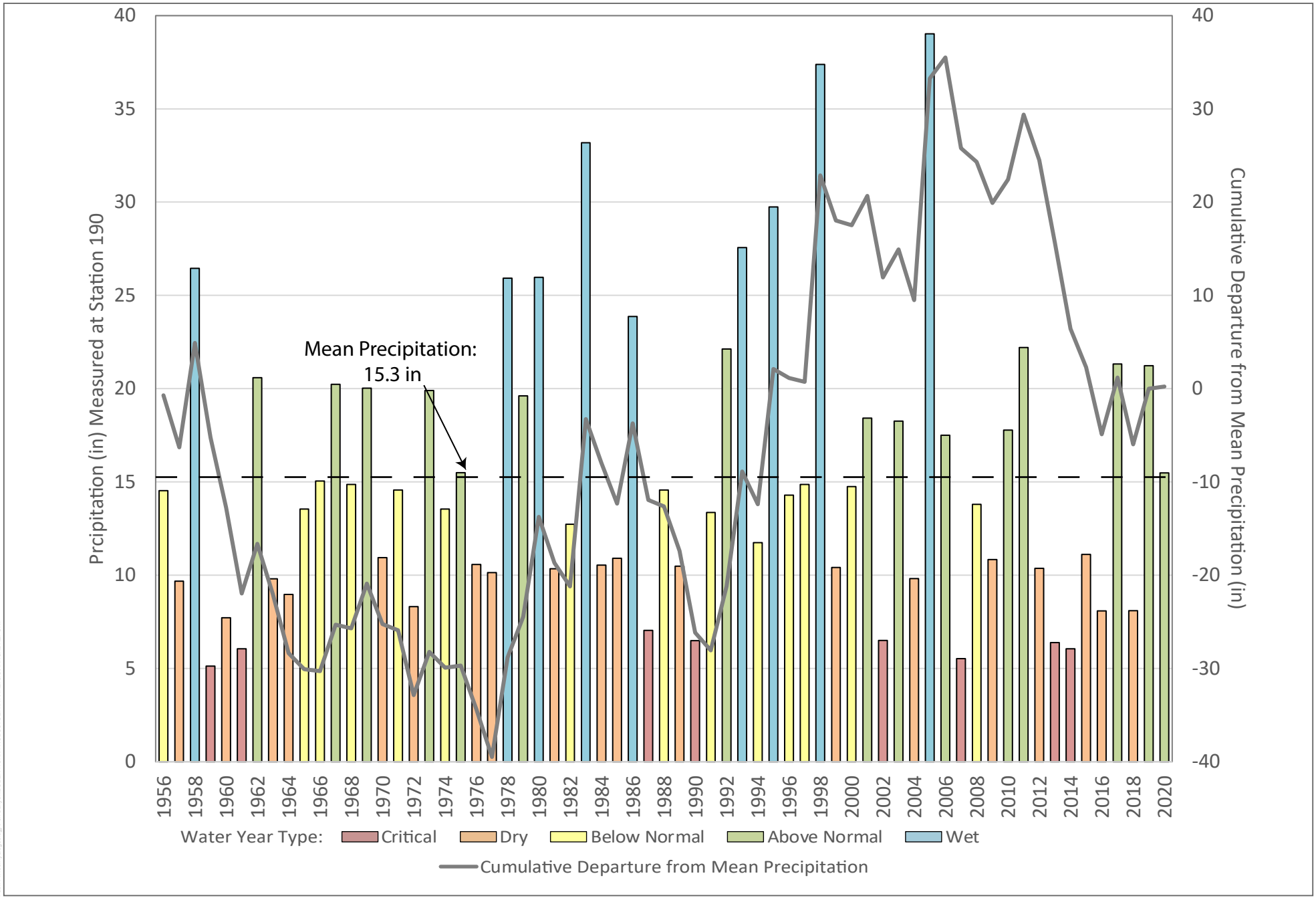
Vicinity Map for the Las Posas Valley Basin



SOURCE: DWR; Ventura County; VCWPD

FIGURE 1-2

Precipitation and Stream Gauges in the Las Posas Valley Basin



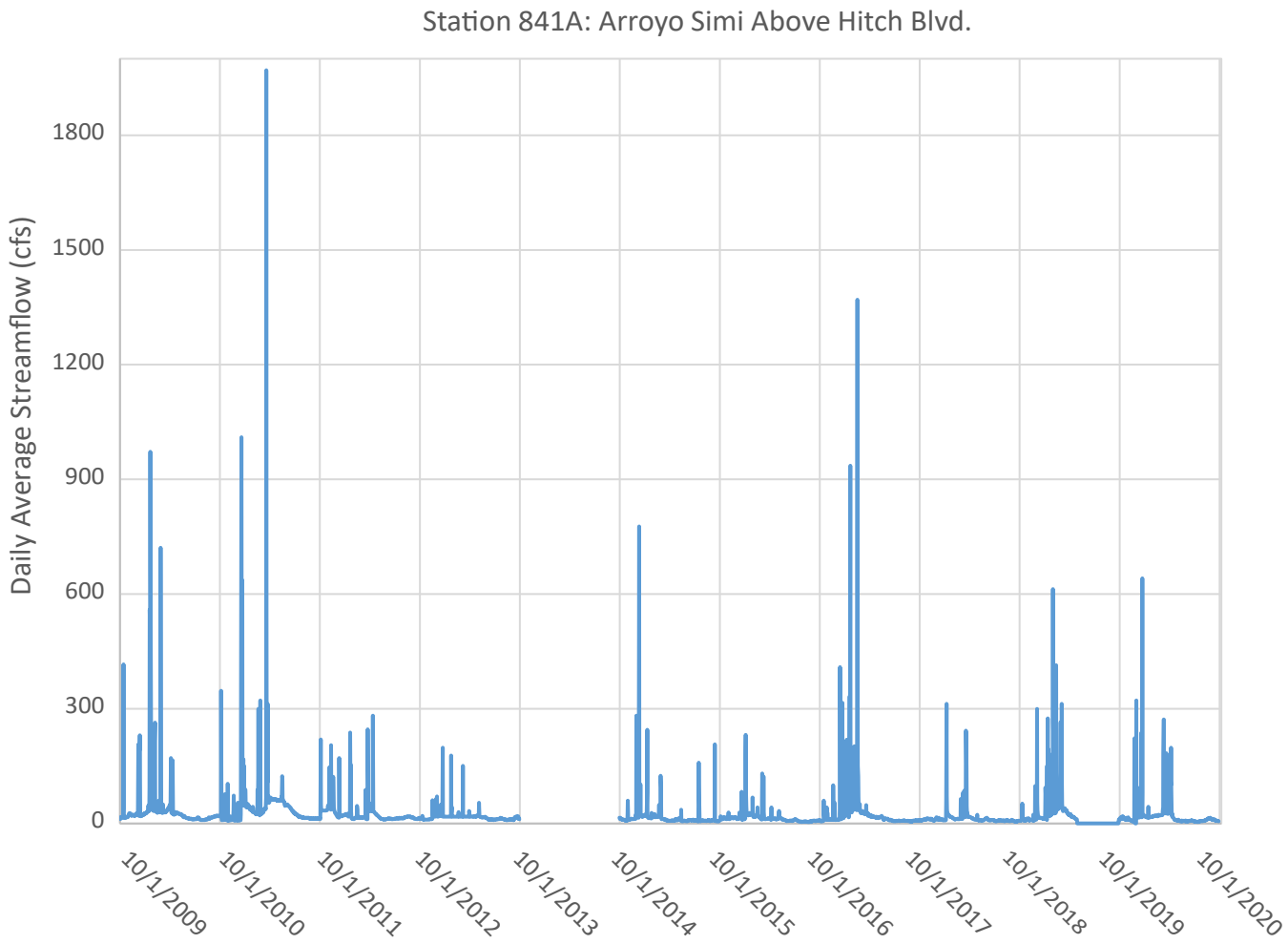
Note: Water year is from October 1 through September 30. Water year type is based on the percentage of the water year precipitation compared to the mean precipitation. Types are defined as: Wet (≥150% of mean), Above Normal (≥100% to <150% of mean), Below Normal (≥75% to <100% of mean), Dry (≥50% to <75% of average), and Critical (<50% of mean)

FIGURE 1-3

Las Posas Valley Basin Historical Water Year Precipitation

Las Posas Valley Basin Groundwater Sustainability Plan 2021 Annual Report

DUDEK



SOURCE: Ventura County Watershed Protection District (VCWPD) Hydrologic Data Server (https://www.vcwatershed.net/hydrodata/)

FIGURE 1-4

Las Posas Valley Basin Stream Gauge Data

Legend

Gaining or losing reach in Arroyo Simi-Las Posas (Larry Walker 2012)

- Strongly Gaining
- Gaining
- No Change
- Losing
- Strongly Losing
- Unknown

- Well screened in the Shallow Alluvium
- WWTP Shallow Alluvium Wells
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.

Gaining and losing reaches in Arroyo Simi-Las Posas reflect conditions at the time of study in 2012. The presence and extent of gaining and losing reaches may change over time.

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Extent of Shallow Alluvium
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

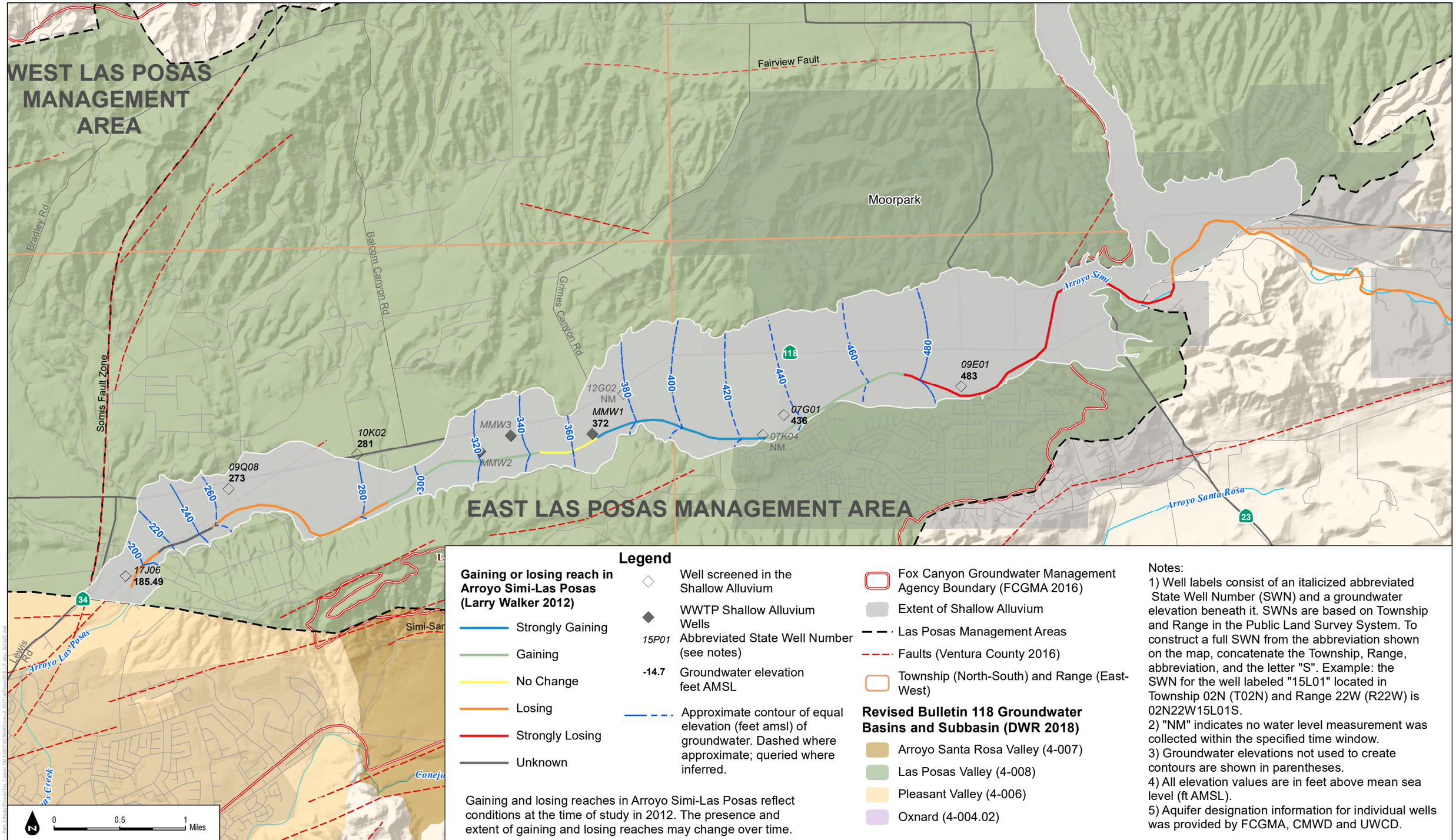
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-1

Groundwater Elevation Contours in the Shallow Alluvium, September 30 to October 31, 2019



Legend

Gaining or losing reach in Arroyo Simi-Las Posas (Larry Walker 2012)

- Strongly Gaining
- Gaining
- No Change
- Losing
- Strongly Losing
- Unknown

- Well screened in the Shallow Alluvium
- WWTP Shallow Alluvium Wells
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.

Gaining and losing reaches in Arroyo Simi-Las Posas reflect conditions at the time of study in 2012. The presence and extent of gaining and losing reaches may change over time.

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Extent of Shallow Alluvium
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

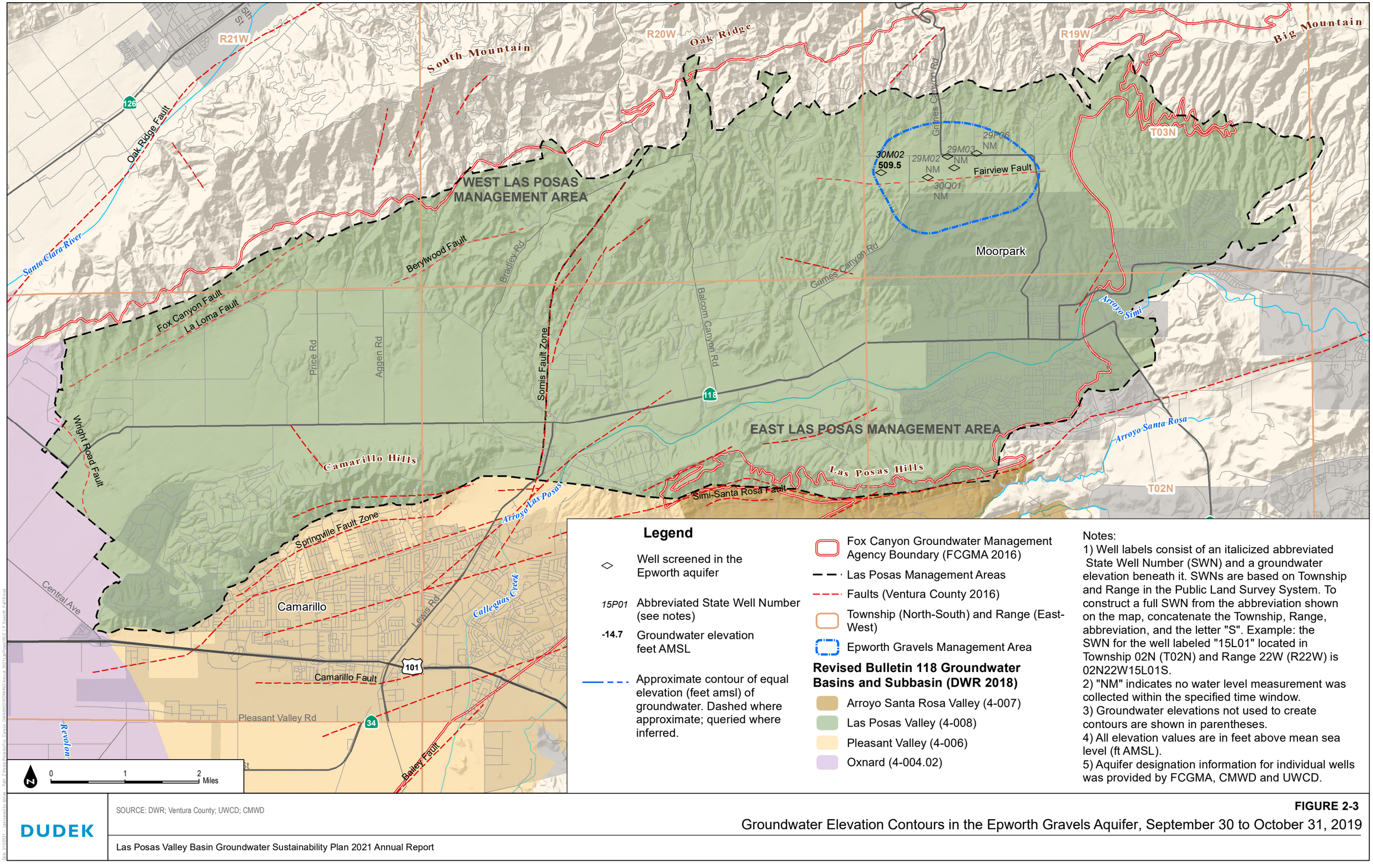
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

FIGURE 2-2

Groundwater Elevation Contours in the Shallow Alluvium, February 23 to April 4, 2020



Legend

- ◇ Well screened in the Epworth aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)
- Epworth Gravels Management Area

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

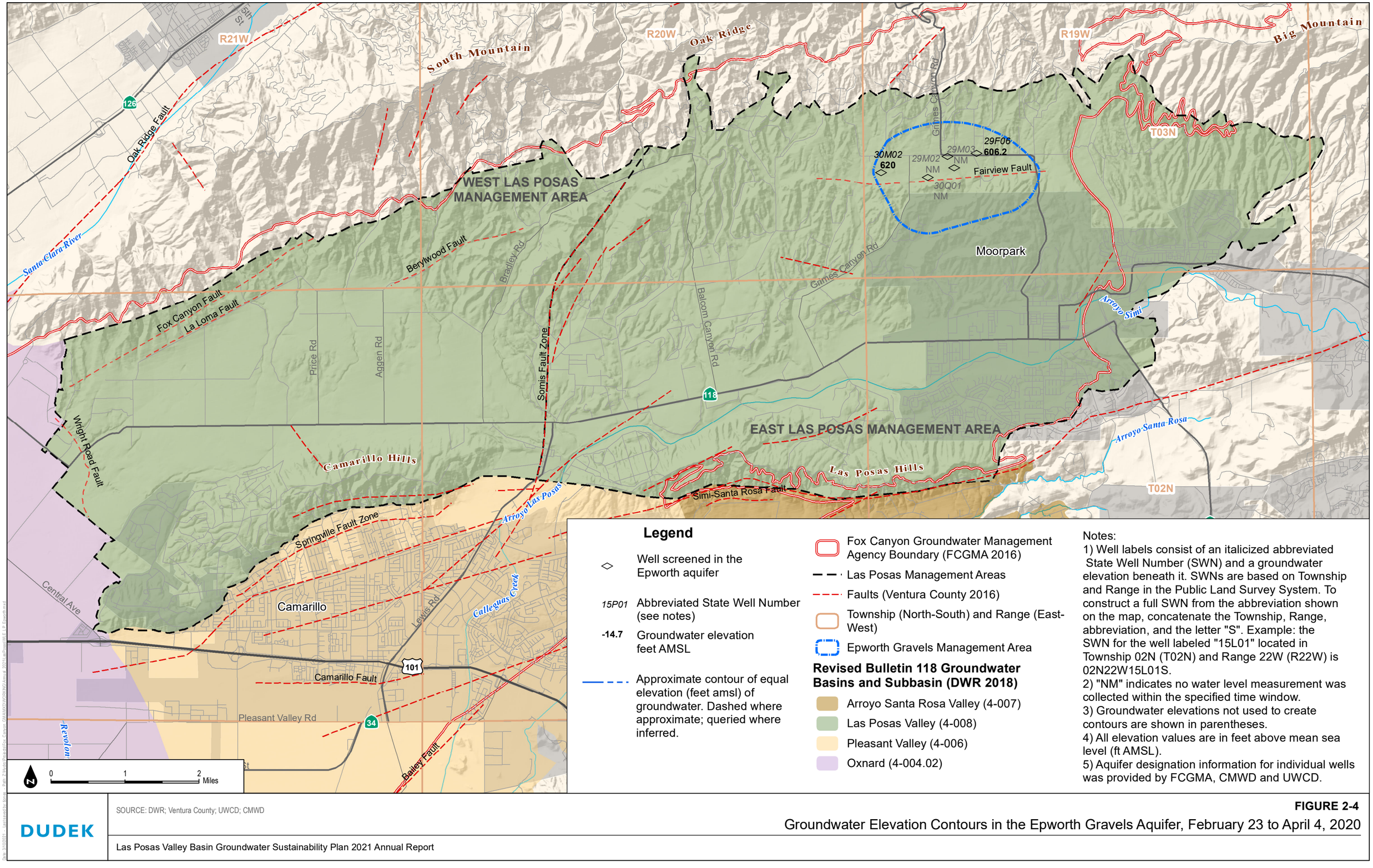
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-3

Groundwater Elevation Contours in the Epworth Gravels Aquifer, September 30 to October 31, 2019

DUDEK



Legend

- ◇ Well screened in the Epworth aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)
- Epworth Gravels Management Area

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

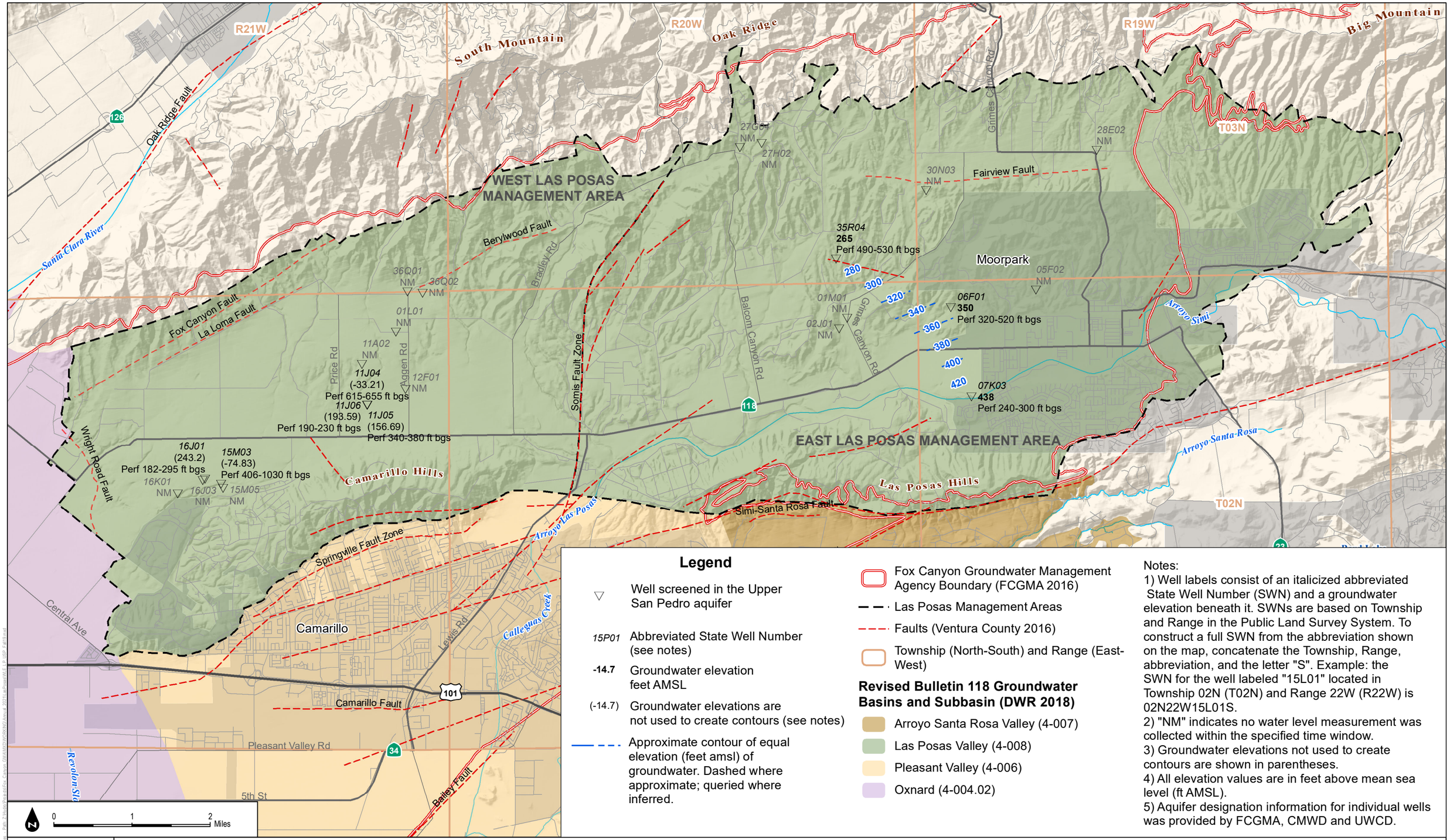
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-4

Groundwater Elevation Contours in the Epworth Gravels Aquifer, February 23 to April 4, 2020



Legend

- ▽ Well screened in the Upper San Pedro aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- (-14.7) Groundwater elevations are not used to create contours (see notes)
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

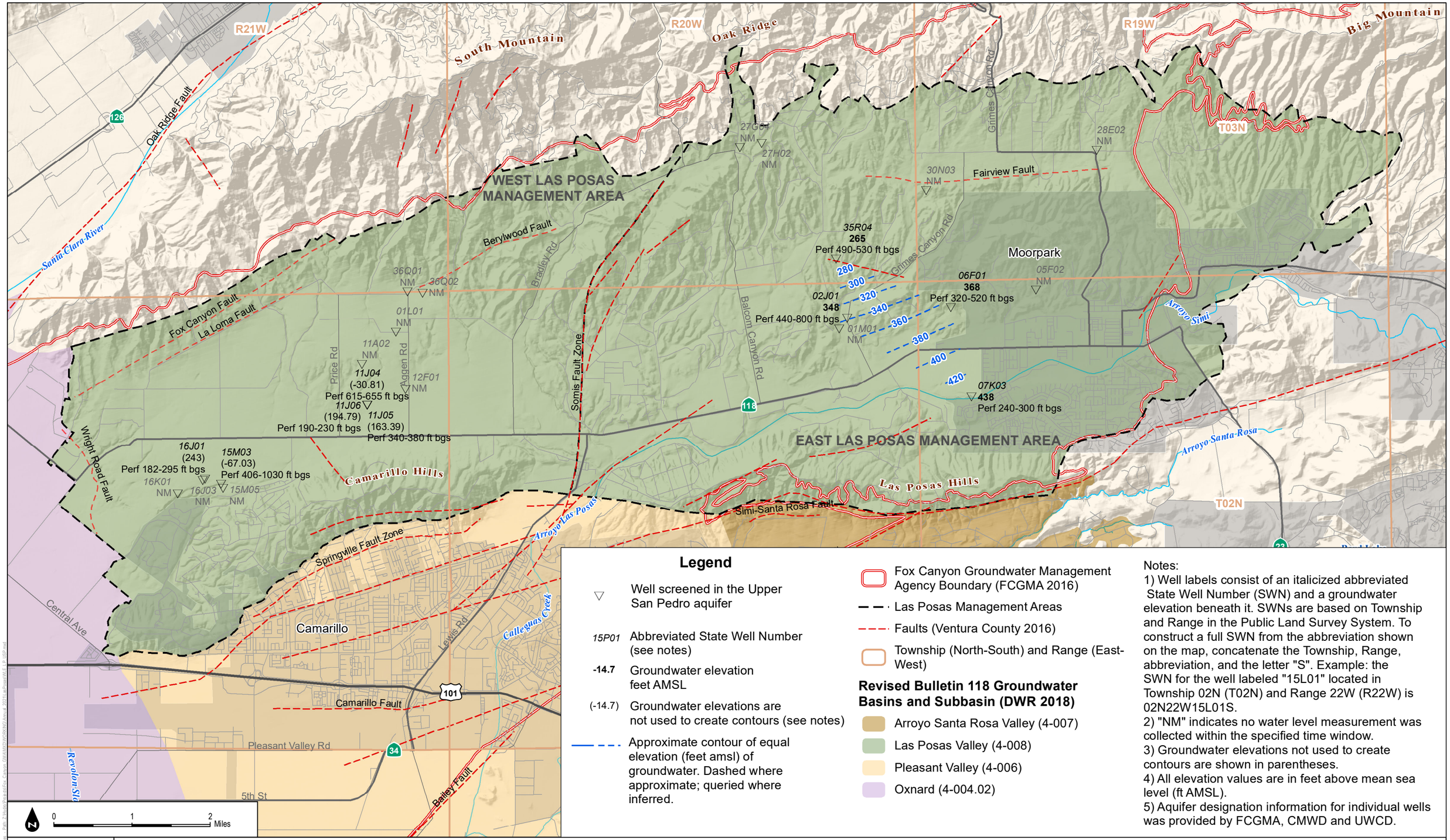
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-5

Groundwater Elevation Contours in the Upper San Pedro Formation, September 30 to October 31, 2019



Legend

- ▽ Well screened in the Upper San Pedro aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- (-14.7) Groundwater elevations are not used to create contours (see notes)
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

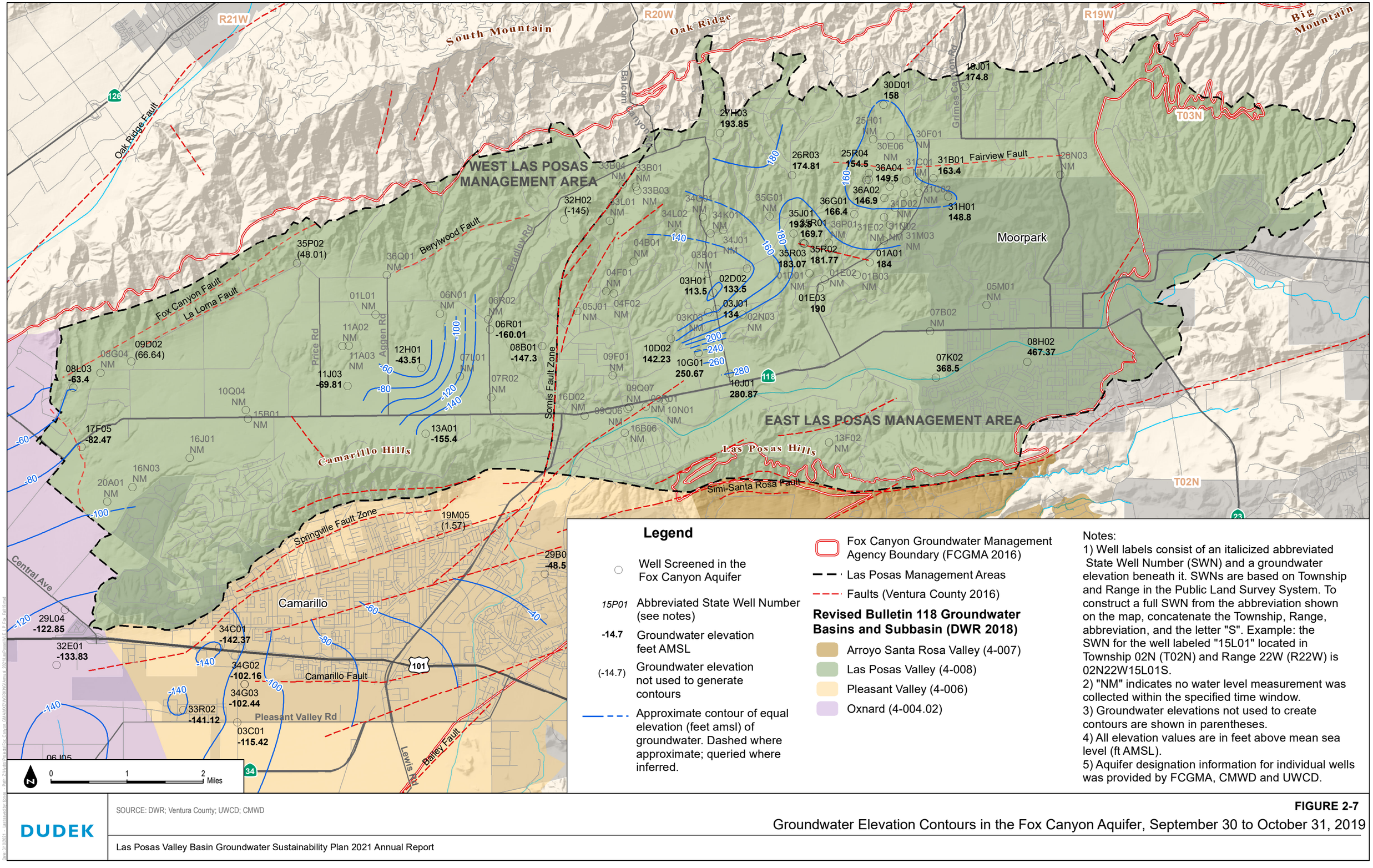
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-6

Groundwater Elevation Contours in the Upper San Pedro Formation, February 23 to April 4, 2020



Legend

- Well Screened in the Fox Canyon Aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- (-14.7) Groundwater elevation not used to generate contours
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

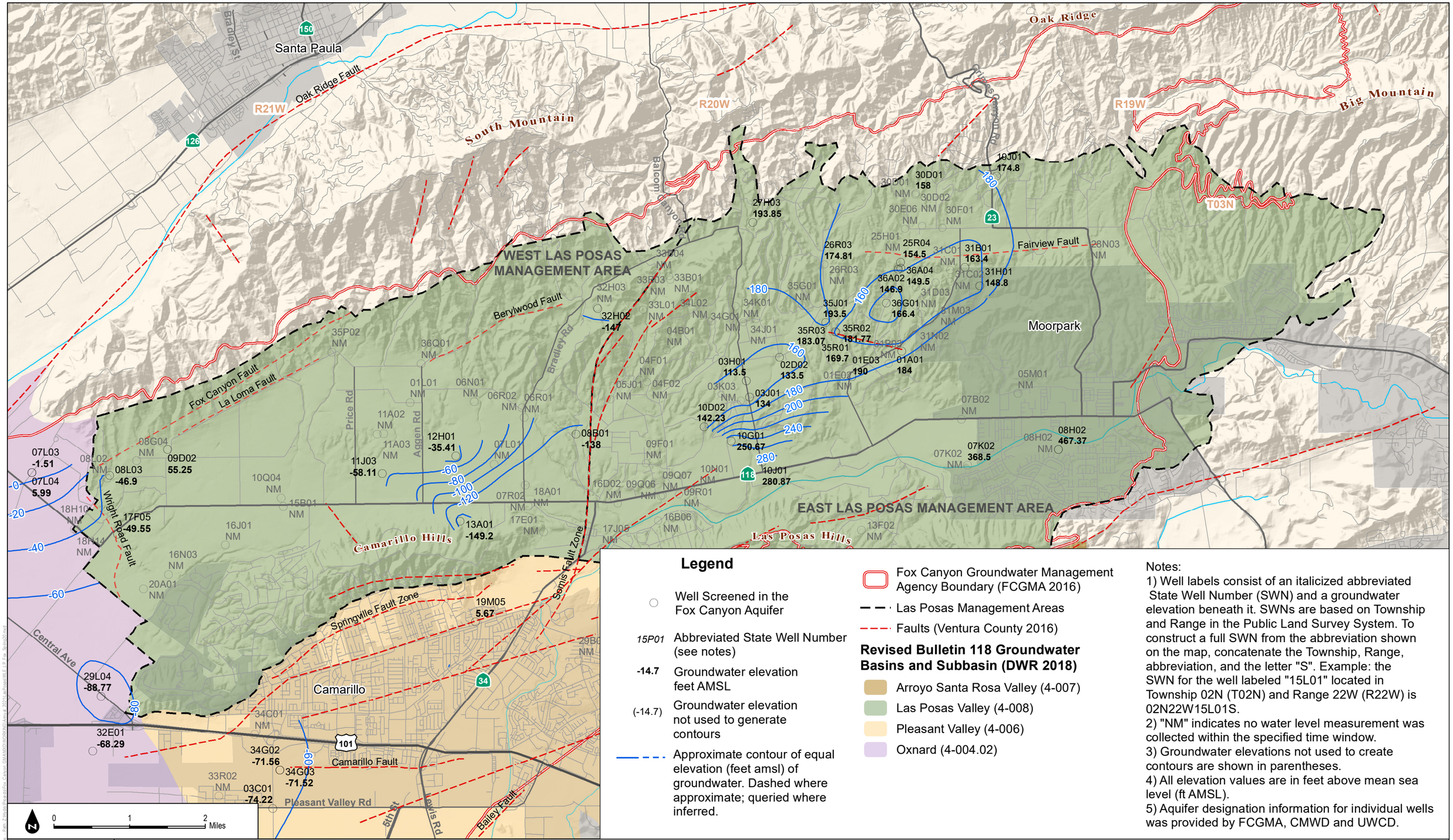
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-7

Groundwater Elevation Contours in the Fox Canyon Aquifer, September 30 to October 31, 2019



Legend

- ○ Well Screened in the Fox Canyon Aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- (-14.7) Groundwater elevation not used to generate contours
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

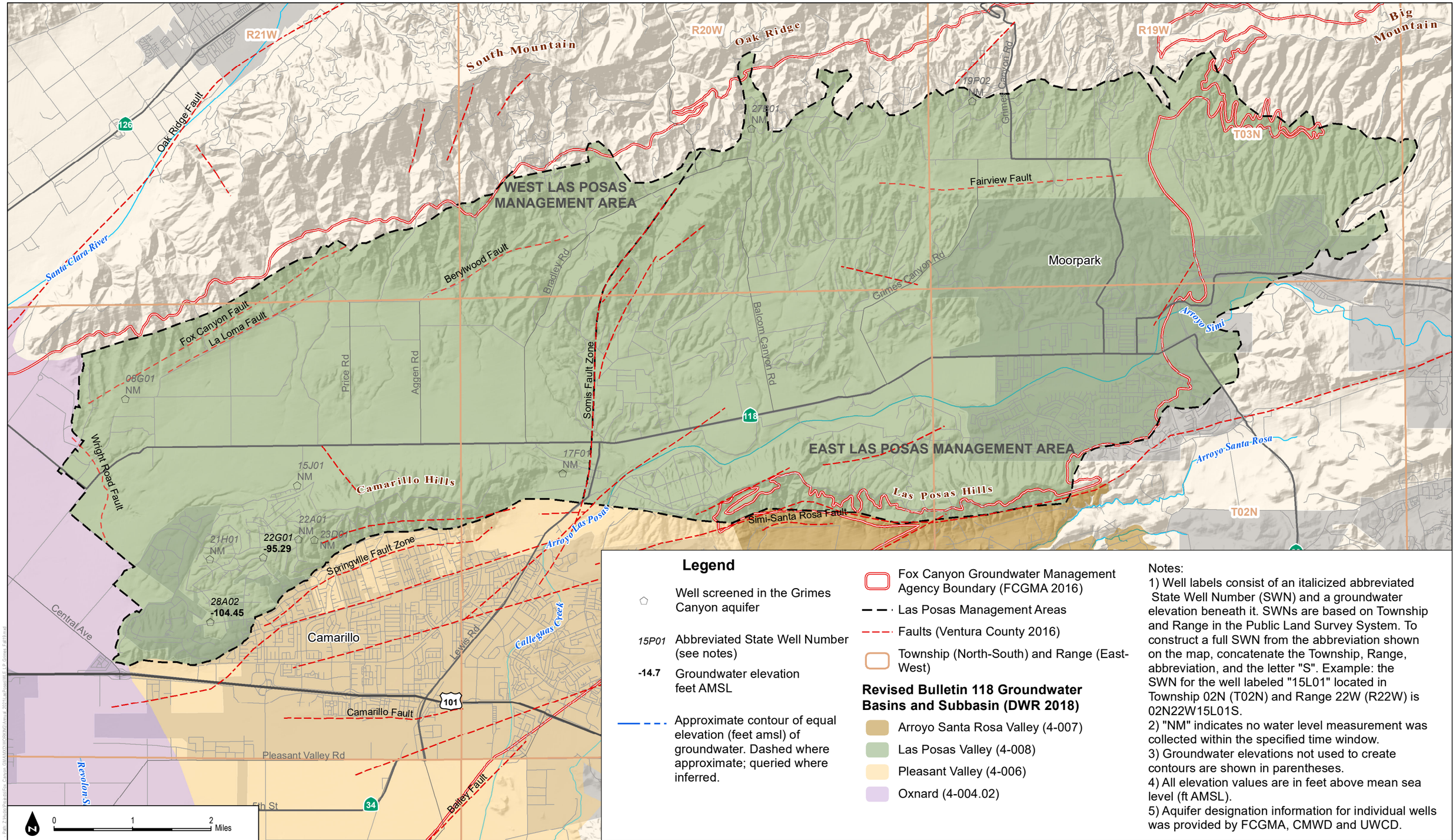
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-8

Groundwater Elevation Contours in the Fox Canyon Aquifer, February 23 to April 4, 2020



Legend

- Well screened in the Grimes Canyon aquifer
- *15P01* — Abbreviated State Well Number (see notes)
- **-14.7** — Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

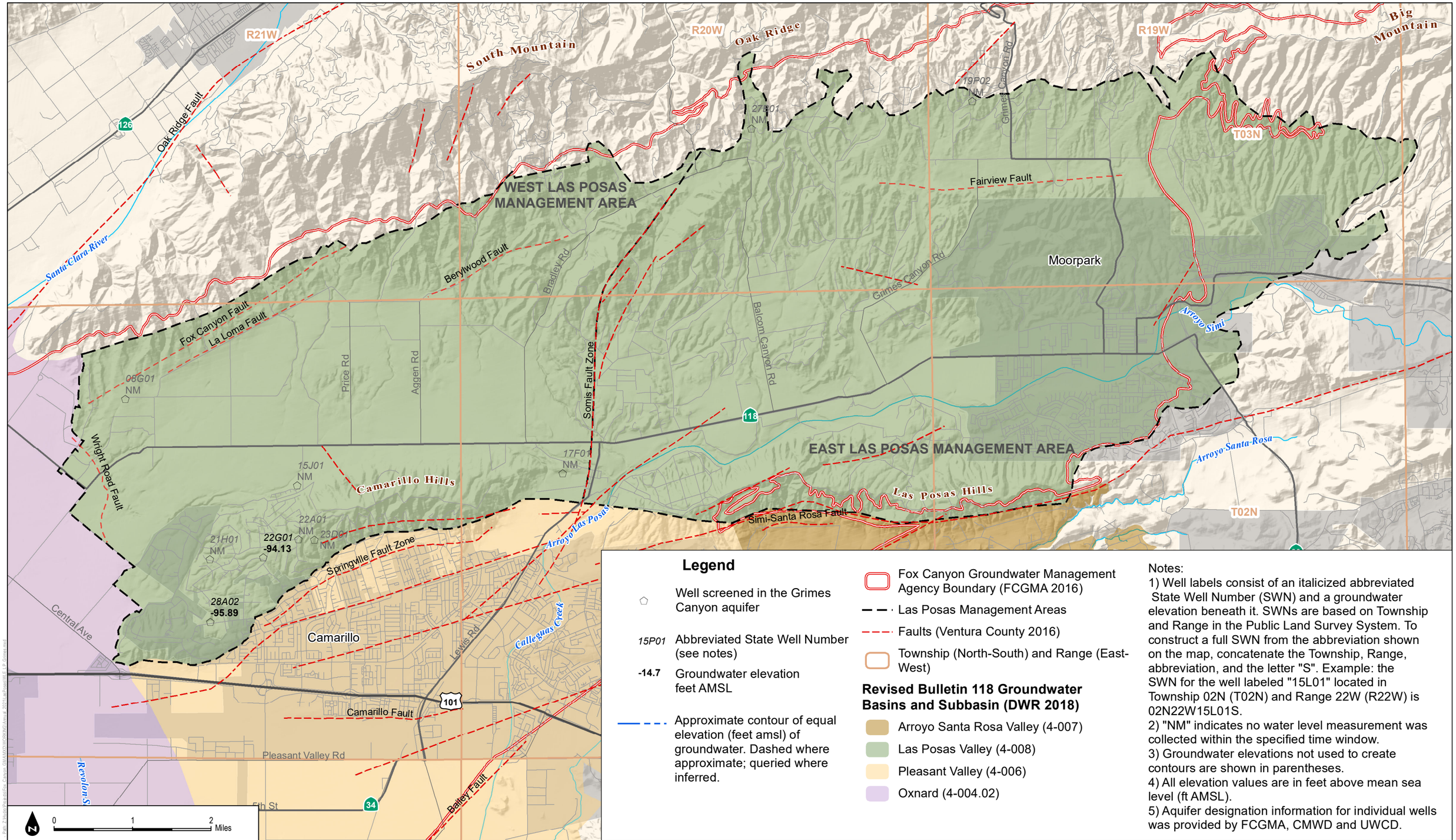
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-9

Groundwater Elevation Contours in the Grimes Canyon Aquifer, September 30 to October 31, 2019



Legend

- Well screened in the Grimes Canyon aquifer
- *15P01* — Abbreviated State Well Number (see notes)
- **-14.7** — Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

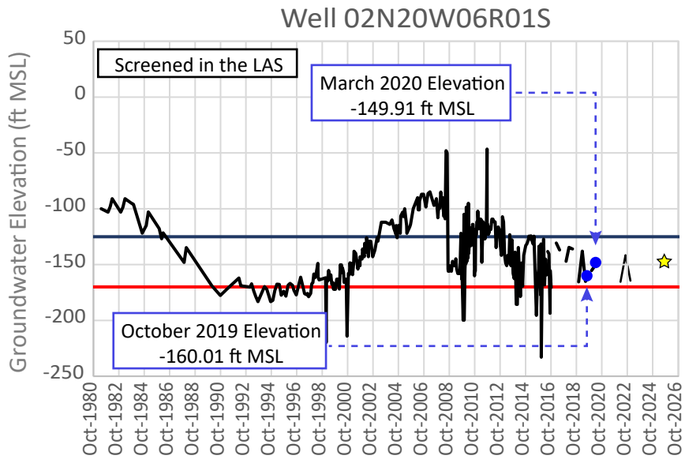
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

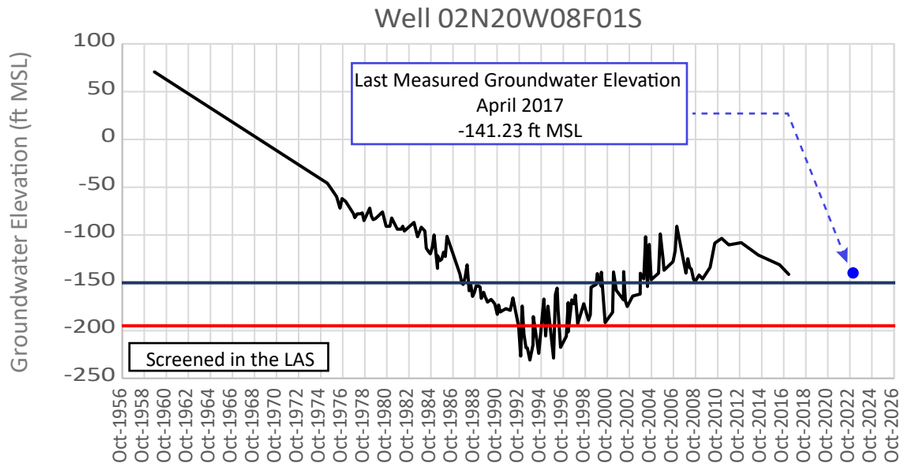
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

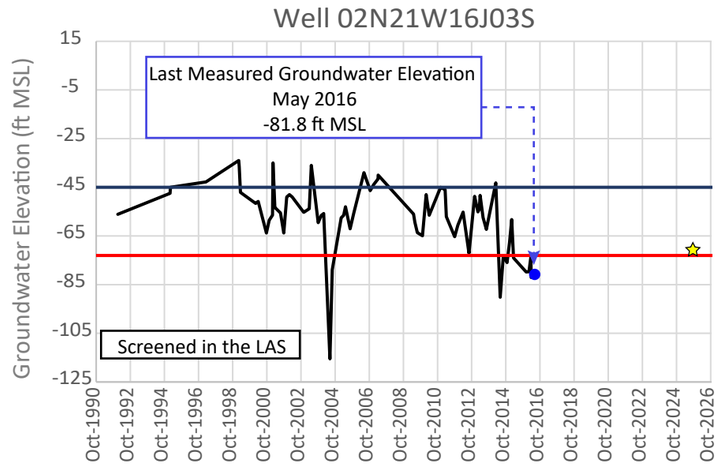
SOURCE: DWR; Ventura County; UWCD; CMWD

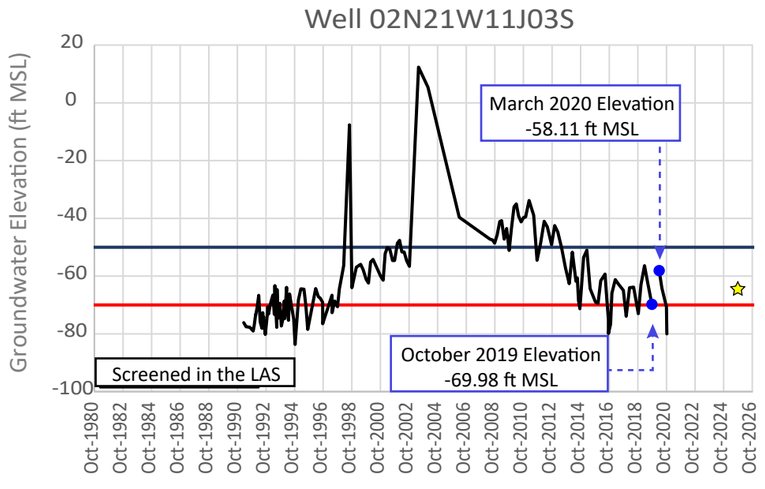
FIGURE 2-10

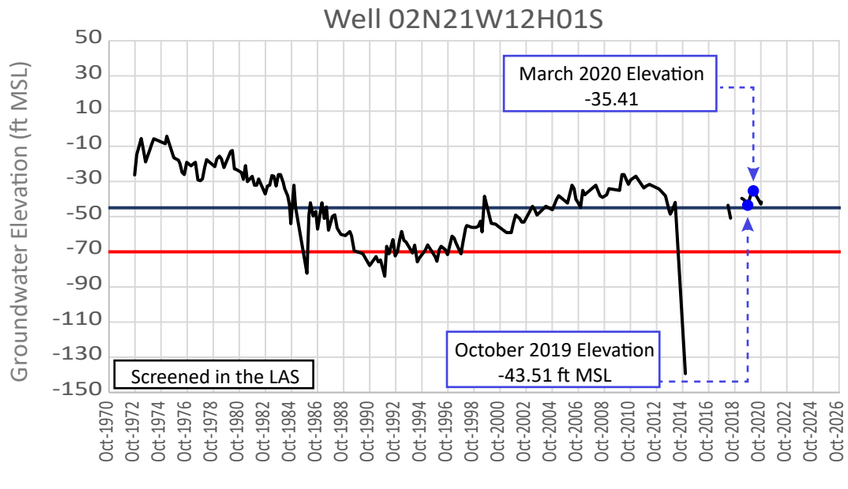
Groundwater Elevation Contours in the Grimes Canyon Aquifer, February 23 to April 4, 2020









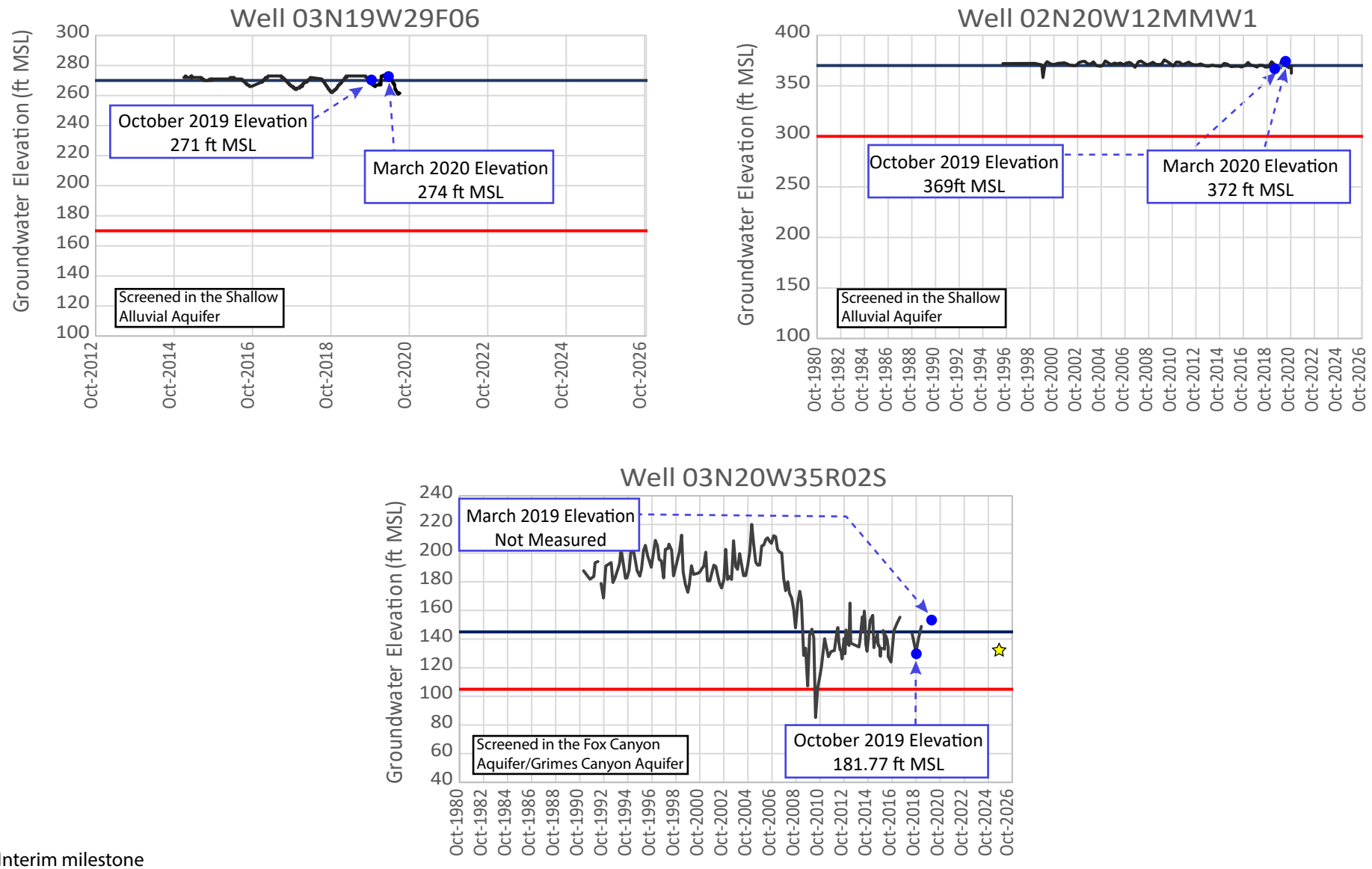


Groundwater Elevation | Minimum Threshold | Measurable Objective | 2025 Interim Milestone for dry climate conditions

Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

FIGURE 2-11

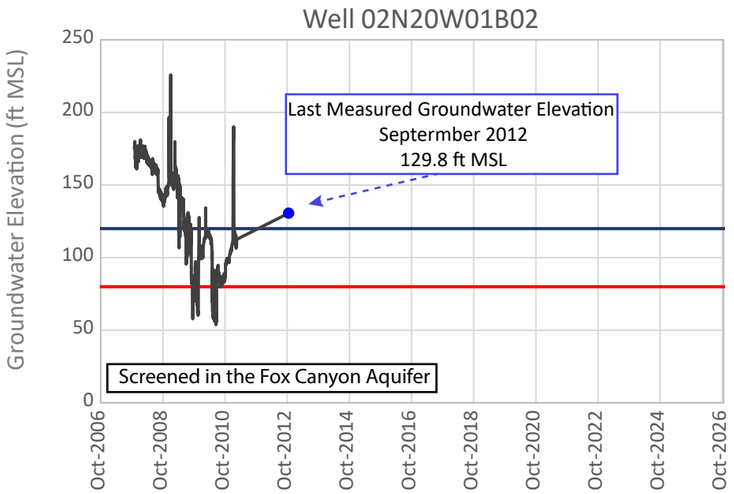
Groundwater Elevation Hydrographs for Representative Wells in the WLPMA

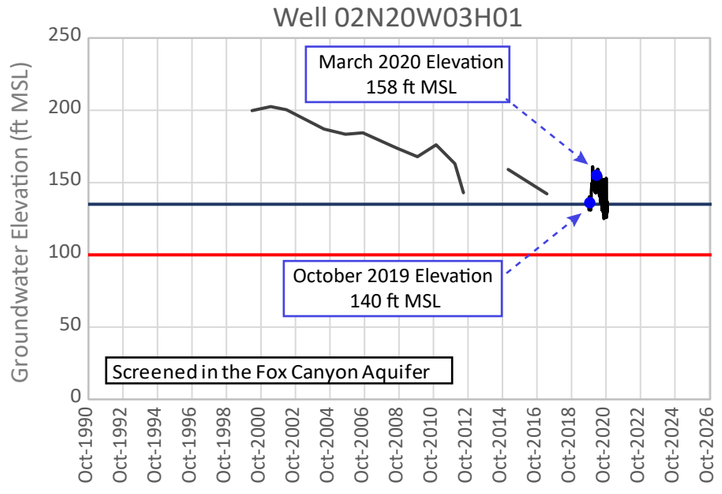


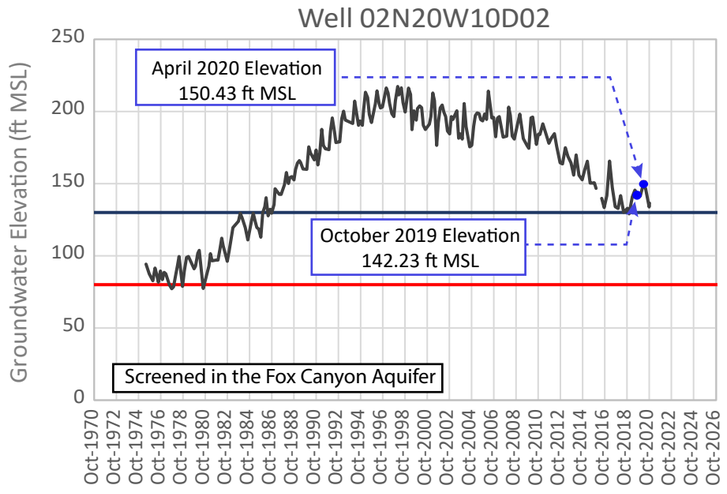
Note:
2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

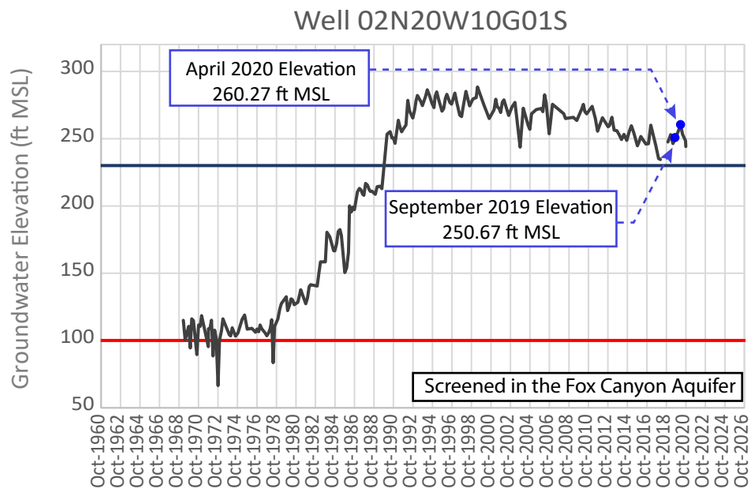
FIGURE 2-12a

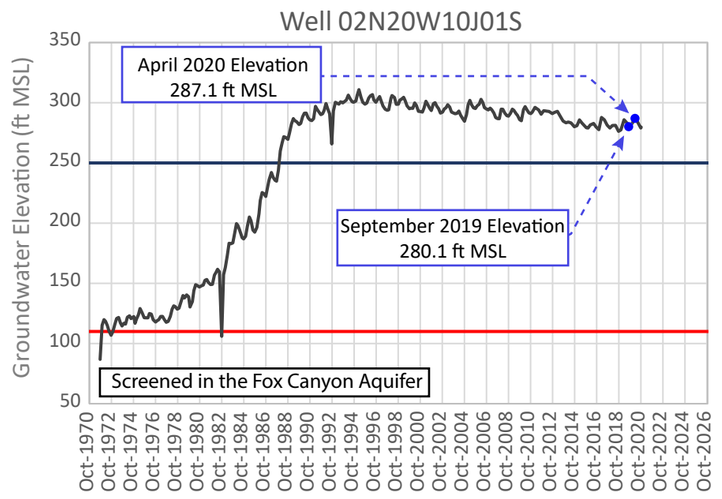
Groundwater Elevation Hydrographs for Representative Wells Screened in the East Las Posas Management Area

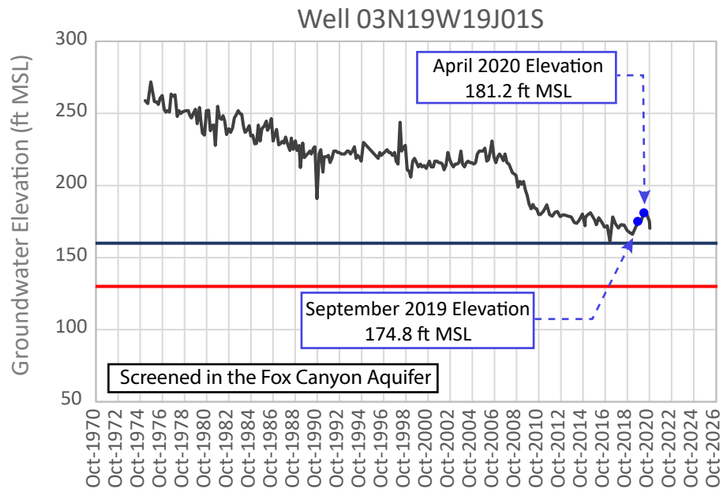










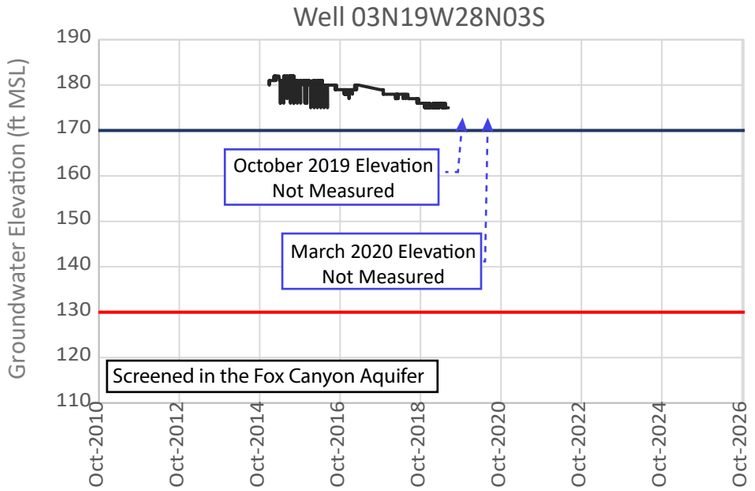


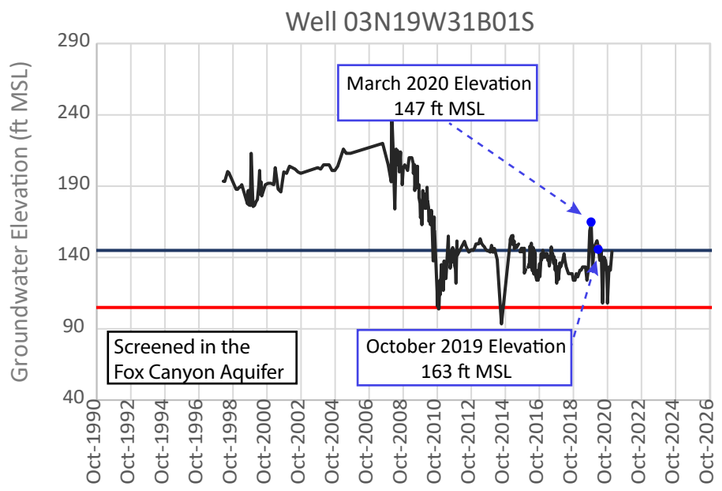
Groundwater Elevation — Minimum Threshold — Measurable Objective — Measurement not collected between September 29 and October 31, 2019 or February 23 and April 4, 2020

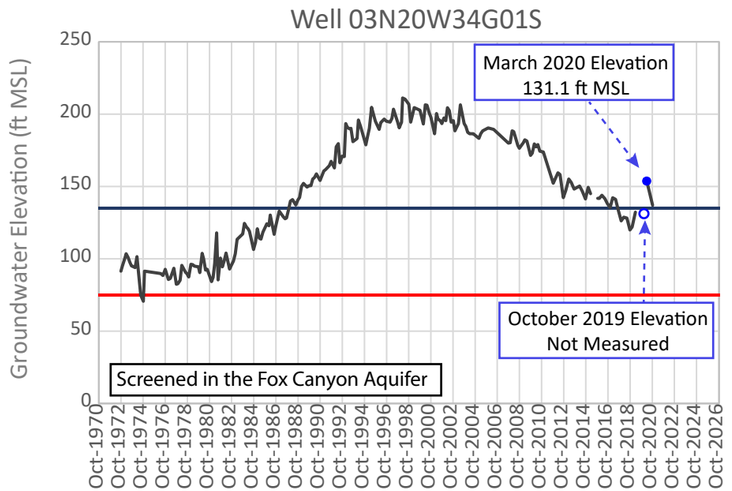
Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum threshold

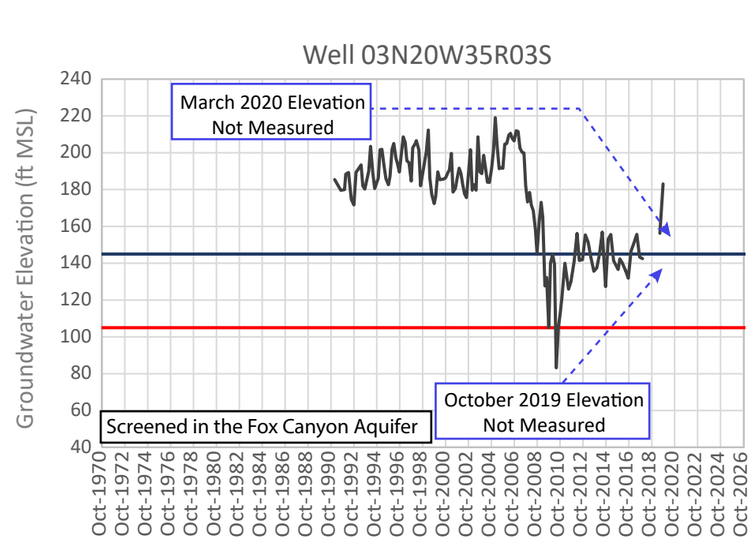
FIGURE 2-12b

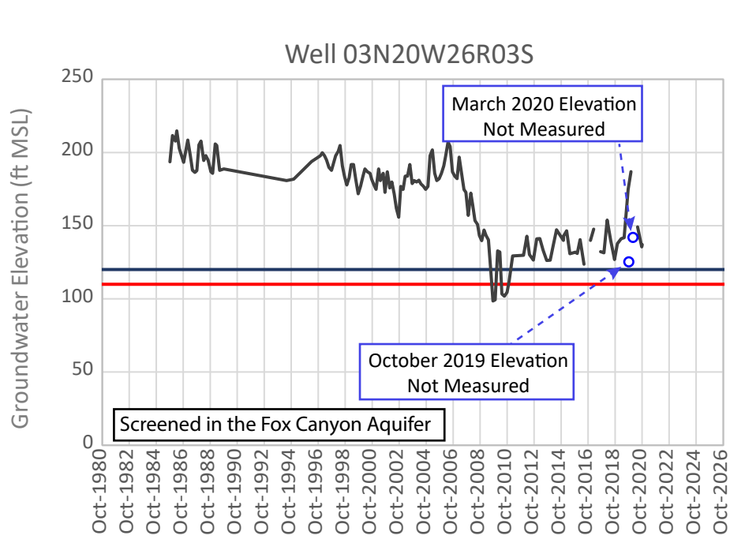
Groundwater Elevation Hydrographs for Representative Wells in the East Las Posas Management Area

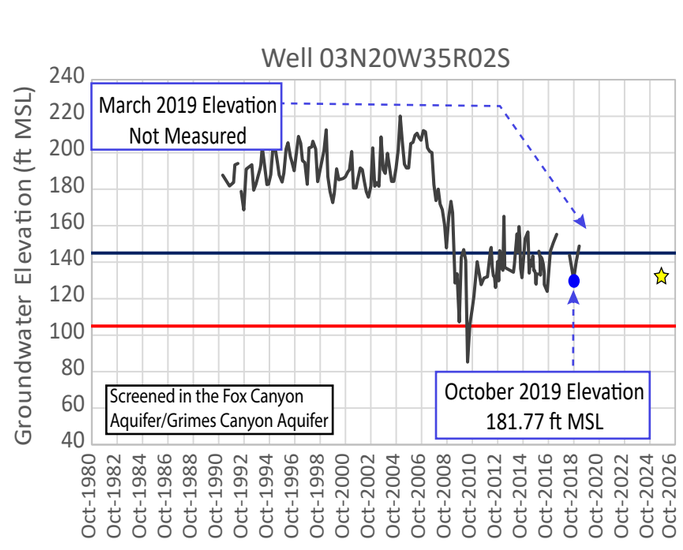












Groundwater Elevation | Minimum Threshold | Measurable Objective | 2025 Interim Milestone for dry climate conditions | Measurement not collected between September 29 and October 31, 2019 or February 23 and April 4, 2020

Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

FIGURE 2-12c

Groundwater Elevation Hydrographs for Representative Wells in the East Las Posas Management Area

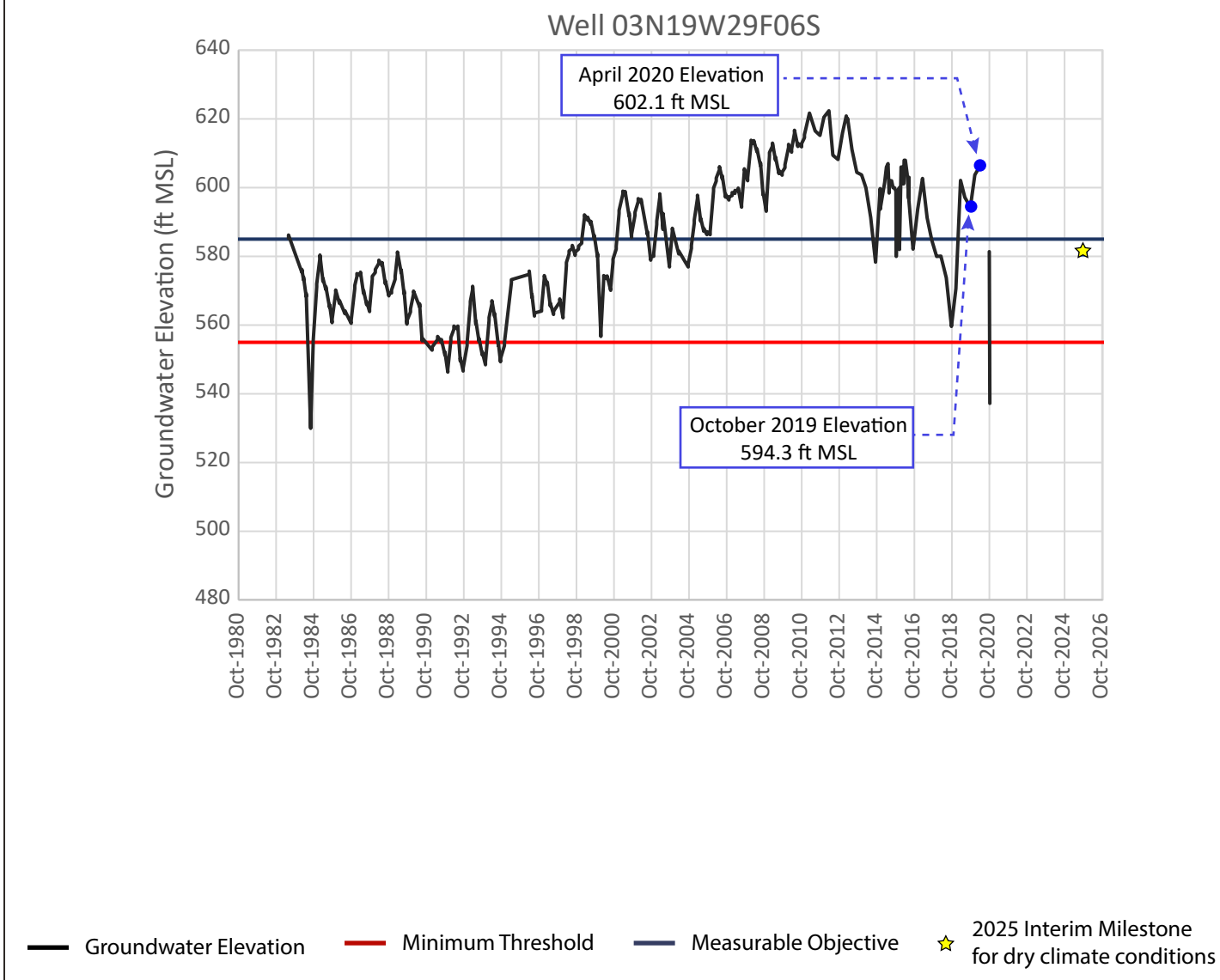
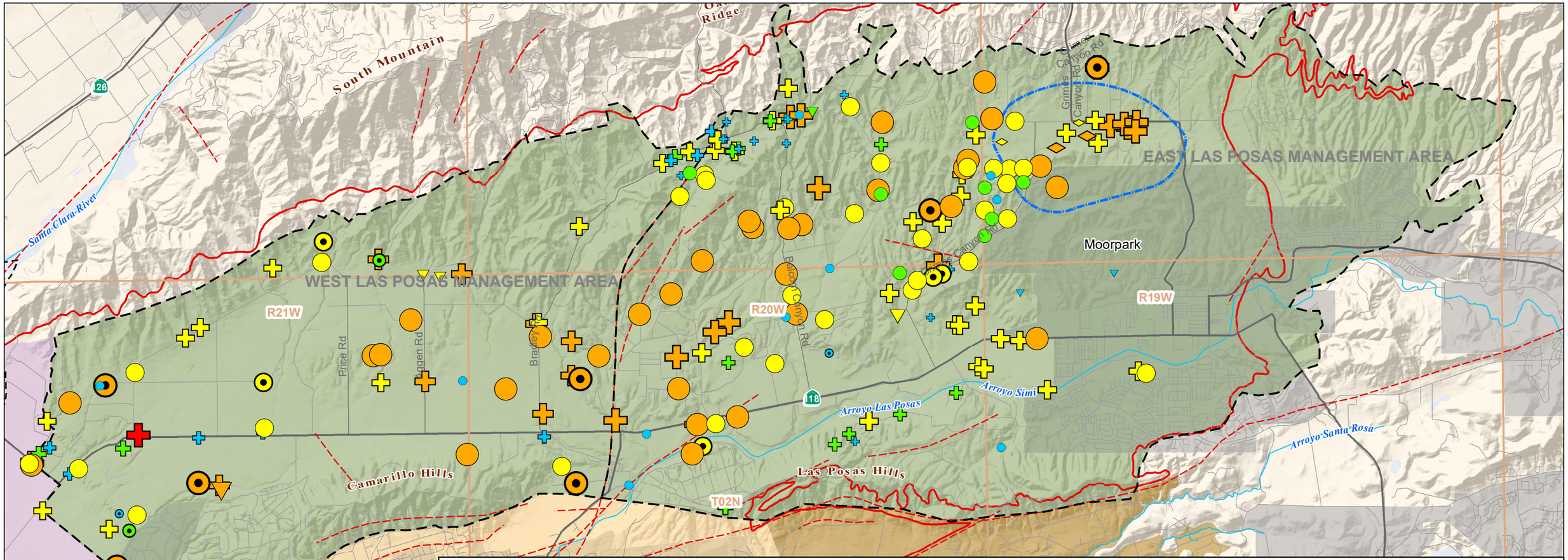


FIGURE 2-13

Groundwater Elevation Hydrographs for Representative Wells Screened in the Epworth Gravels Aquifer



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Epworth Gravels Management Area
- Las Posas Management Areas
- Faults (Ventura County 2016)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

2020 Extraction (acre-feet)

- 0 - 2; 16 AF total
- >2 - 10; 140 AF total
- >10 - 100; 3,646 AF total
- >100 - 1000; 19,963 AF total
- >1000; 1,371 AF total

Aquifer designation

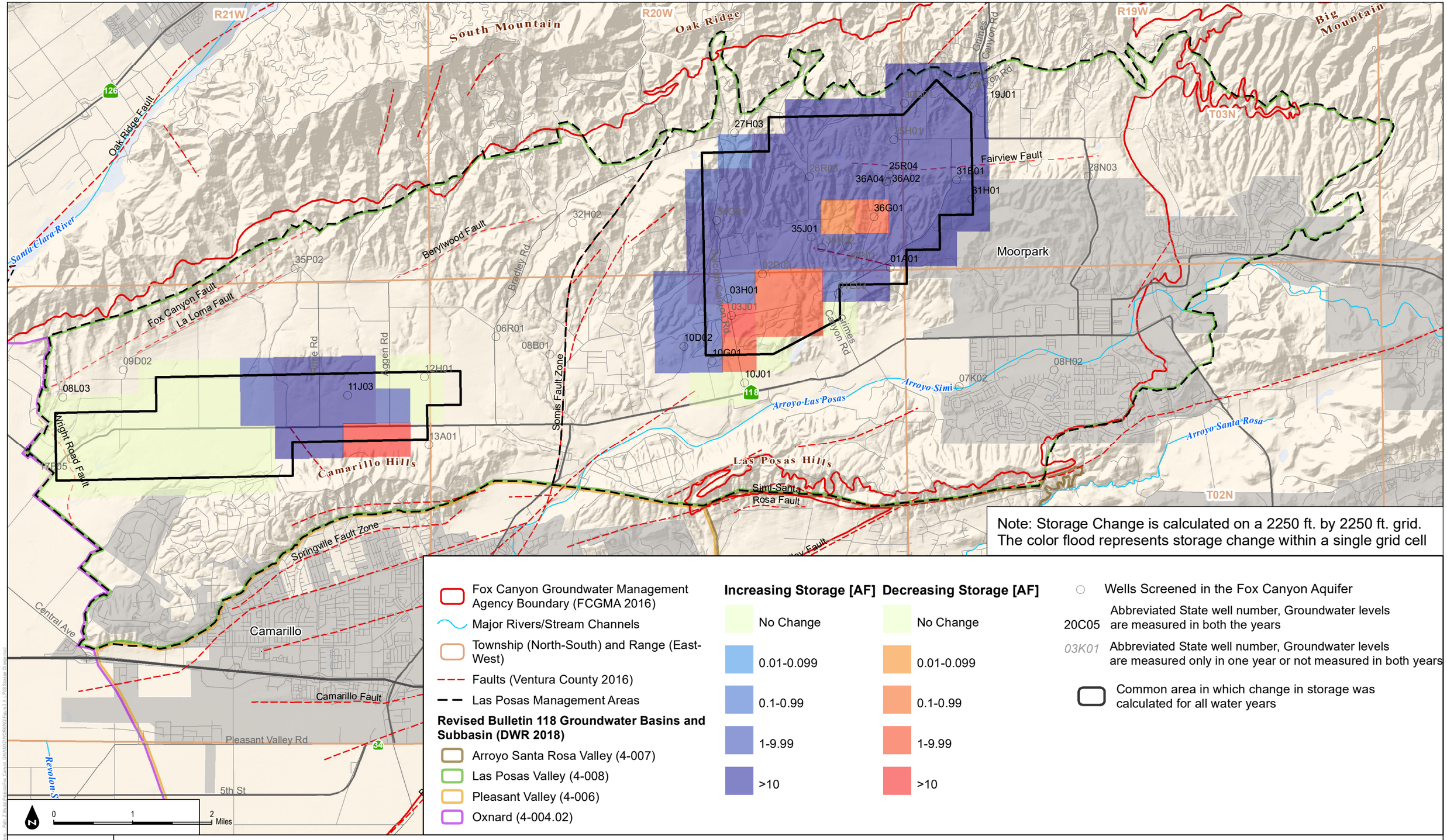
- Wells screened in the Epworth Gravels aquifer
- Wells screened in the Upper San Pedro aquifer
- Wells screened in the Fox Canyon aquifer
- Wells screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS
- Wells with undetermined screened aquifers

Notes:
1) The shape of each well symbol corresponds to the aquifer system(s) in which it is screened (see adjacent)
2) The color of each well symbol corresponds to the pumping in the well for calendar year 2016
3) Aquifer designation information for individual wells was provided by FCGMA, CMWD, and UWCD.

SOURCE: DWR, FCGMA, VCWPD, UWCD, CMWD

FIGURE 2-14

Groundwater Production (Acre-feet) in the Las Posas Valley Basin between January 1, 2020 and December 31, 2020



Note: Storage Change is calculated on a 2250 ft. by 2250 ft. grid. The color flood represents storage change within a single grid cell

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Ventura County 2016)
- Las Posas Management Areas

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Increasing Storage [AF]	Decreasing Storage [AF]
No Change	No Change
0.01-0.099	0.01-0.099
0.1-0.99	0.1-0.99
1-9.99	1-9.99
>10	>10

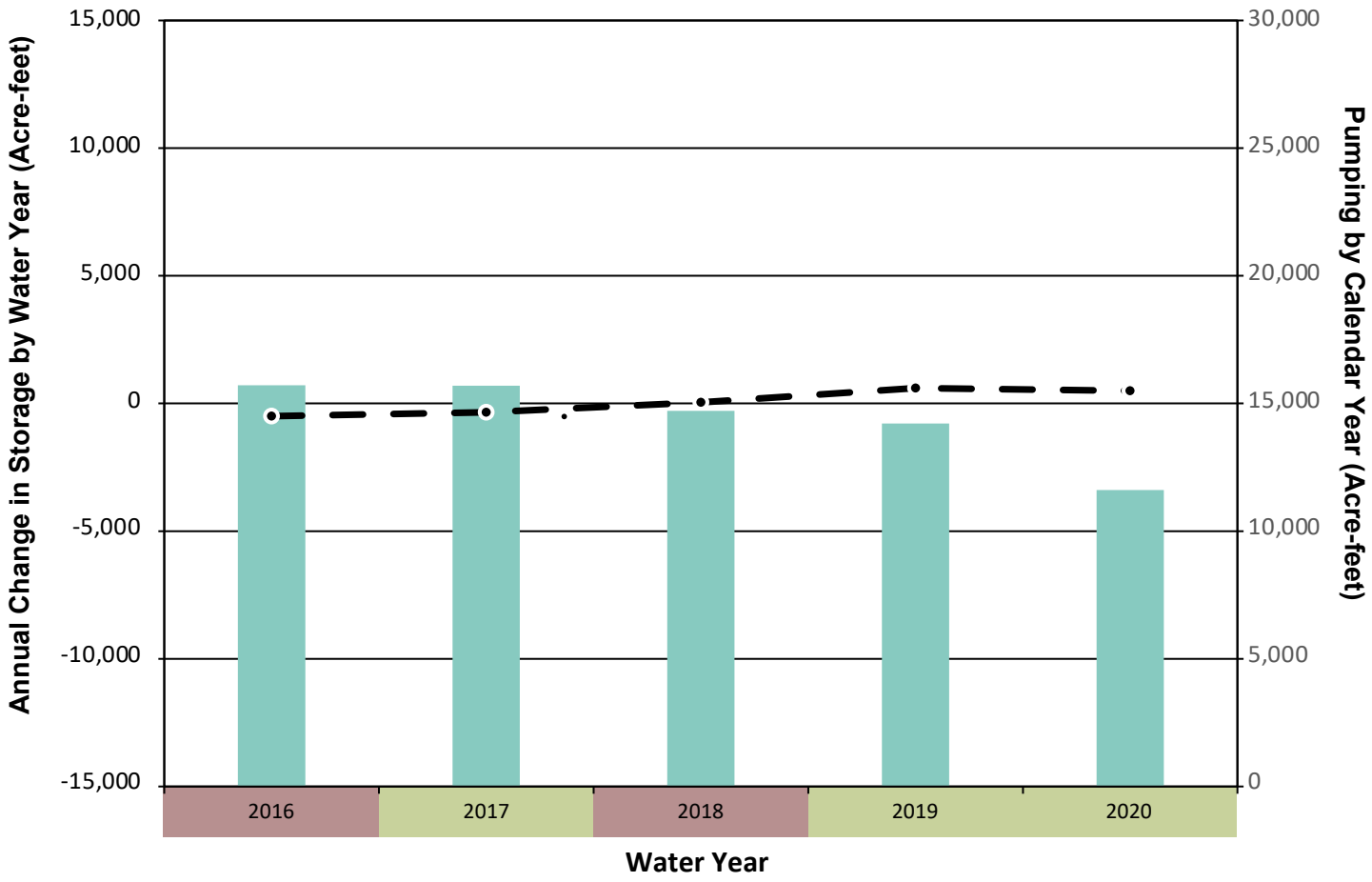
- Wells Screened in the Fox Canyon Aquifer
- 20C05 — Abbreviated State well number, Groundwater levels are measured in both the years
- *03K01* — Abbreviated State well number, Groundwater levels are measured only in one year or not measured in both years
- Common area in which change in storage was calculated for all water years

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-15

Change in Storage in the Fox Canyon Aquifer: Spring 2019 to Spring 2020

DUDEK

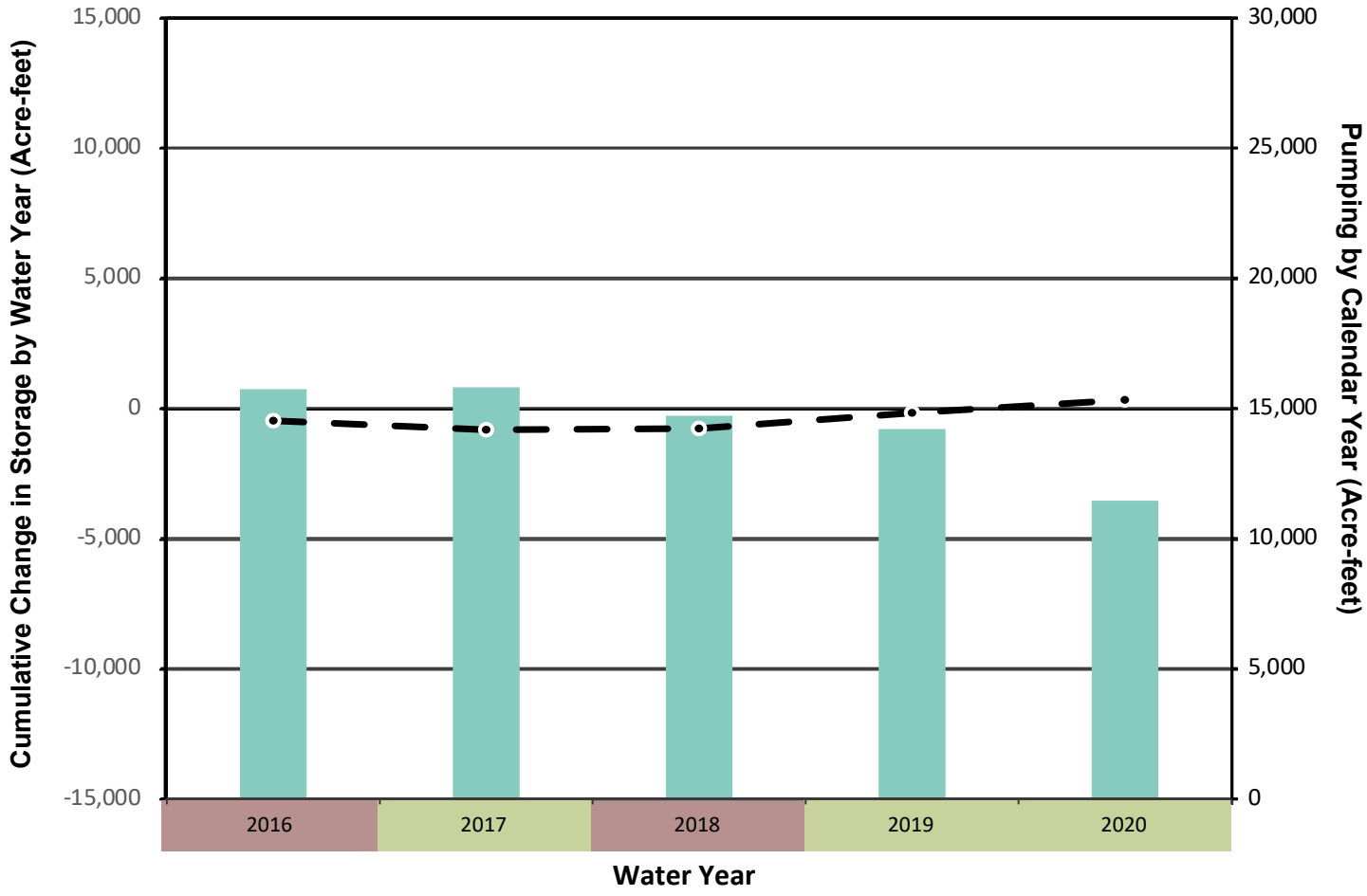


Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the UWCD model. Storage change is only calculated for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2020.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

FIGURE 2-16

Water Year Type, Groundwater Use, and Annual Change in Storage in the West Las Posas Management Area



Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the UWCD model. Storage change is only calculated for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2020.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

Change in Storage

Pumping

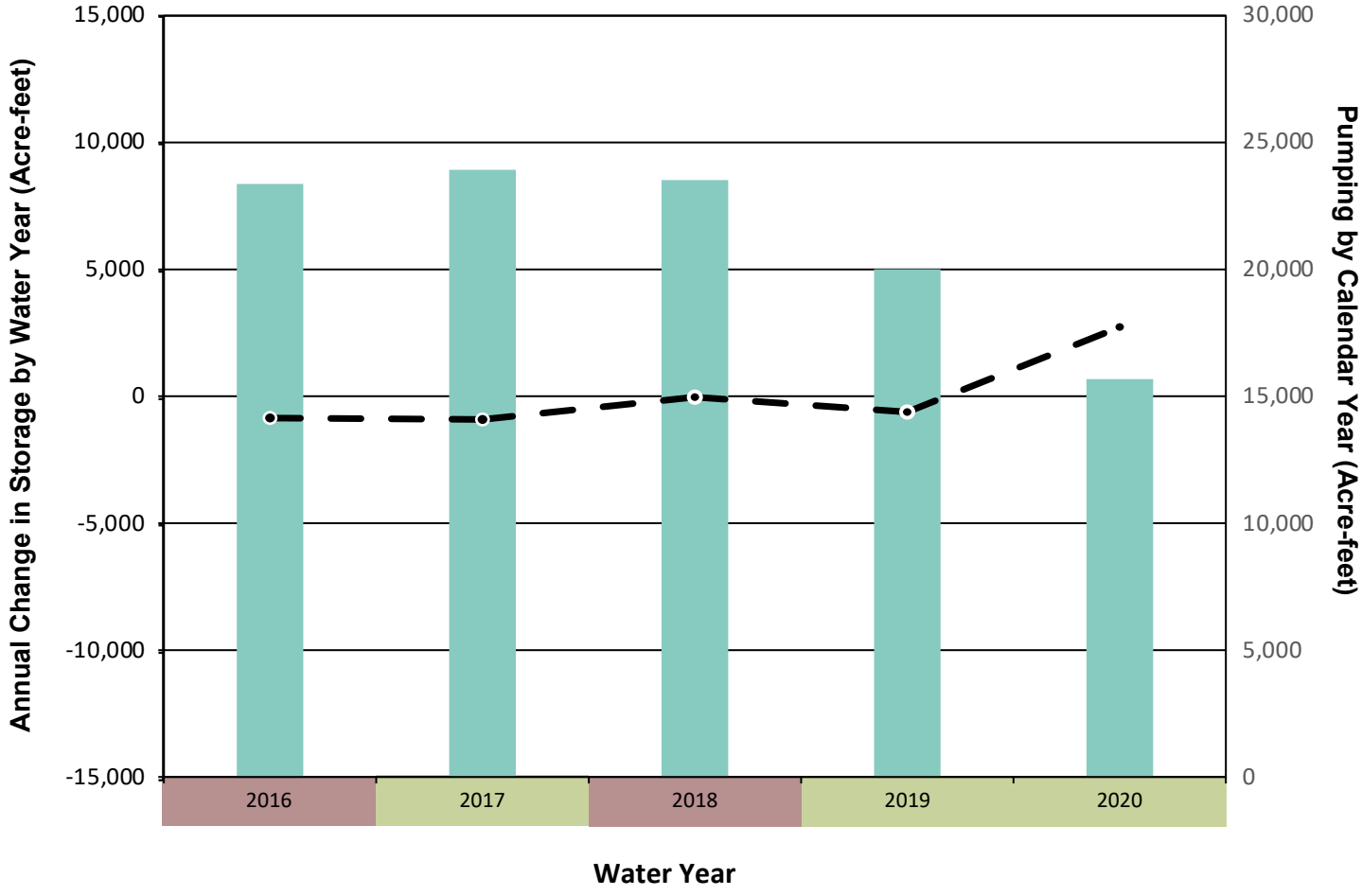
Fox Canyon aquifer

Water Year Type

Wet | Above Normal | Below Normal | Dry | Critical

FIGURE 2-17

Water Year Type, Groundwater Use, and Cumulative Change in Storage in the West Las Posas Management Area



Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the CMWD model. Storage change is calculated for only for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2020.

2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).

3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

Change in Storage

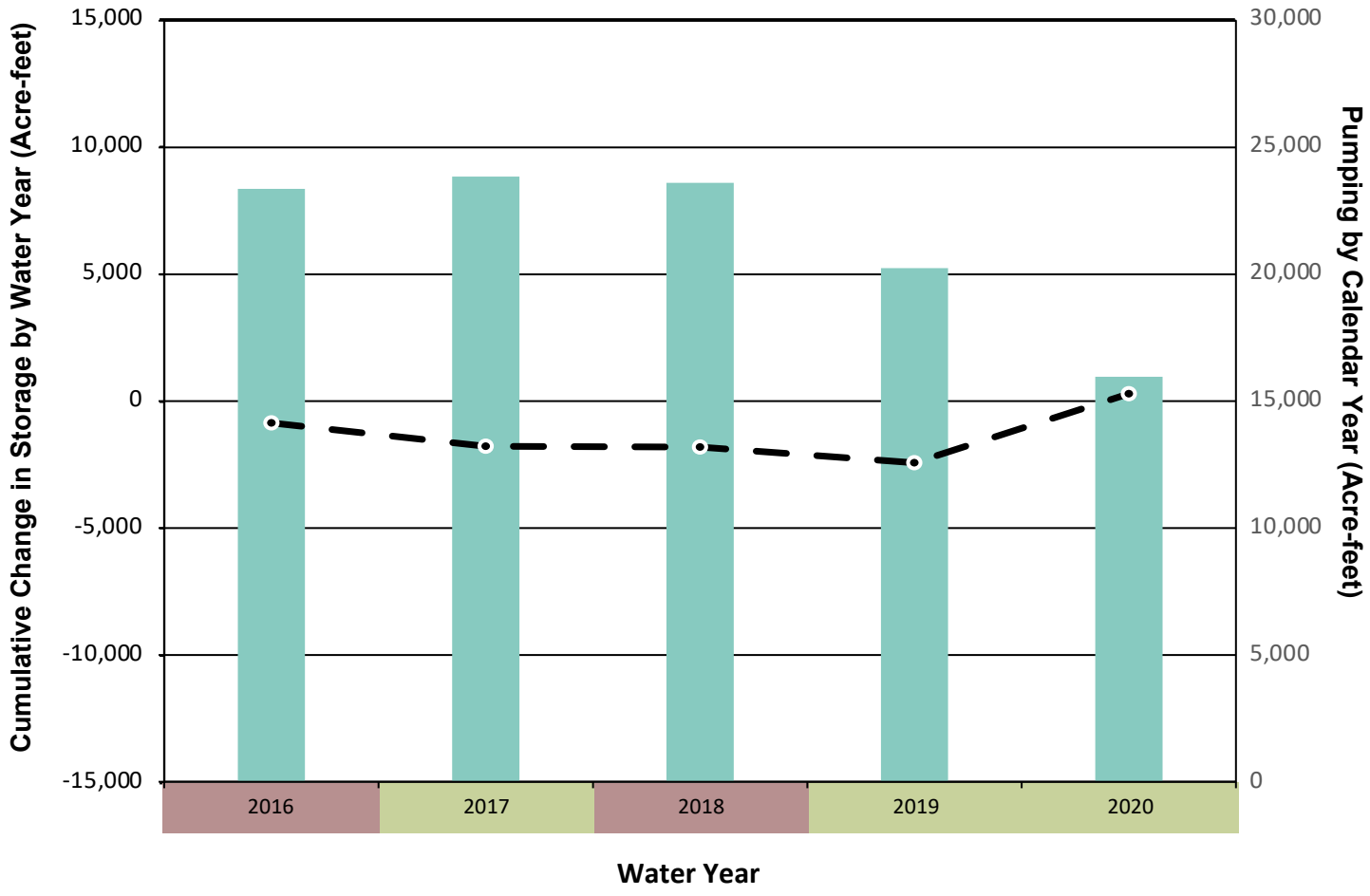
Pumping — Fox Canyon aquifer

Water Year Type

Wet | Above Normal | Below Normal | Dry | Critical

FIGURE 2-18

Water Year Type, Groundwater Use, and Annual Change in Storage in the East Las Posas Management Area



Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the CMWD model. Storage change is calculated for only for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2020.

2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).

3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

Change in Storage

Pumping — Fox Canyon aquifer

Water Year Type

Wet | Above Normal | Below Normal | Dry | Critical

FIGURE 2-19

Water Year Type, Groundwater Use, and Cumulative Change in Storage in the East Las Posas Management Area

Appendix A: Corrections to the Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report

Table A: Corrections to 2020 Annual Report			
Component of the 2020 Annual Report	**Item**	**Error or comment on 2020 Annual Report Representation**	**Updated Data**
Section 2.1.1.3: Upper San Pedro Formation			
	1a	Groundwater elevations measured at 03N20W35R04S were reported as Not Measured in fall 2018 and spring 2019 in the 2019 Annual Report. This data was provided by CMWD to support preparation of the 2019 Annual Report and missed during preparation of the groundwater elevation maps for the Upper San Pedro.	Groundwater at 03N20W35R04S was measured at an elevation of 265 ft msl in Fall 2018 and at an elevation of 266 ft msl in spring 2019.
Table 2-4: Total Imported Water Supplies in the LPVB			
	2a	Data characterizing imported water to the LPVB supplied by Camrosa Water District (CWD) was not available during prepartion of the 2020 Annual Report for PVB. Consequently, reported imported water supplies were approximately 3% lower than import water supplies to the LPVB.	CWD provided imported water supply data for incorporation into the 2021 Annual Report. Data provided by CWD tabulates deliveries between calendar years 1985 and 2020. Table 2-4 was updated to incorporate CWD data for water years 2016 through 2020.

Table 2-4: Total Water Available in the LPVB			
	3a	Data characterizing imported water to the LPVB supplied by Camrosa Water District (CWD) was not available during prepartion of the 2020 Annual Report for PVB. Consequently, reported imported water supplies were approximately 3% lower than import water supplies to the LPVB.	CWD provided imported water supply data for incorporation into the 2021 Annual Report. Data provided by CWD tabulates deliveries between calendar years 1985 and 2020. Table 2-6 was updated to incorporate CWD data for water years 2016 through 2020.
Table 2-6a and Table 2-6b: Annual and Cumulative Change in Storage (Acre-Feet) in the Fox Canyon Aquifer in the LPVB			
	4a	The change in storage calculations for the Fox Canyon aquifer in WLPMA contained an error that was the result of mapping draft groundwater elevation contours onto the storage change calculation grid. The groundwater elevation contours used to compute change in storage in the WLPMA differed from the groundwater elevation contours published in the 2020 Annual Report.	Change in groundwater storage for water years 2016, 2017, 2018, and 2019 were recomputed as part of the 2021 Annual Report preparation using the groundwater elevation contours published with the 2020 Annual Report. The updated change in storage calculated are described in section 2.6.1.