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# WY 2022 Annual Report

Castac Lake Valley Groundwater Basin

Prepared by:

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for

Castac Basin Groundwater Sustainability Agency

March 2023



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**Abbreviations**

AF	acre-feet
AFY	acre feet per year
CCR	California Code of Regulations
CWC	California Water Code
DWR	California Department of Water Resources
ft	feet
ft bgs	feet below ground surface
ft msl	feet above mean sea level (i.e., NAVD 88)
GDE	Groundwater Dependent Ecosystem
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWE	Groundwater Elevation
IM-5, 10, or 15	Interim Milestone at 5, 10, or 15 years after GSP adoption
KMWC	Krista Mutual Water Company
LCWD	Lebec County Water District
MAF	Million Acre-Feet
MO	Measurable Objective
MT	Minimum Threshold
NAVD 88	North American Vertical Datum of 1988
P&MA	Projects and Management Actions
RMW	Representative Monitoring Well
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
TCWD	Tejon-Castac Water District
TRC	Tejon Ranch Company
TMV	Tejon Mountain Village
USGS	United States Geological Survey
WY	Water Year



## 1. Executive Summary

The Castac Lake Valley Groundwater Basin (referred to herein as “the Basin”), California Department of Water Resources (DWR) Basin No. 5-029, is classified as a “very low priority” basin (DWR, 2019). To address the long-term reliability of groundwater within the Basin, the Castac Basin Groundwater Sustainability Agency (GSA) developed a Groundwater Sustainability Plan (GSP), which was adopted by the Castac Basin GSA Board on 22 September 2020 and submitted to DWR on 4 November 2020.

This Water Year (WY) 2022 Annual Report for the Basin has been prepared in compliance with California Code of Regulations (CCR) 23 § 356.2. WY 2022 includes the period from 1 October 2021 through 30 September 2022.

The Castac Basin GSA is the exclusive GSA for the Basin, and its Board of Directors is comprised of two representatives from Tejon-Castac Water District (TCWD), two representatives from Lebec County Water District (LCWD), and two non-voting representatives, one from Kern County, and one from Krista Mutual Water Company (KMWC), respectively.

The Basin is located in at the southern end of Kern County, as shown on Figure 1. The Basin contains one principal aquifer, generally made up of unconsolidated clastic sediments layered in two interconnected hydrostratigraphic “zones”.

Groundwater elevation contours are shown on Figure 2 for Fall 2021 (dry season) and on Figure 3 for Spring 2022 (wet season). Water level contours did not vary greatly from dry to wet season in WY 2022. Generally, piezometric gradients are shallower in the upper Castac Lake area of the Basin, and steeper in the lower Grapevine Canyon area of the Basin.

The Basin currently has three Representative Monitoring Wells (RMWs); TRC-MW16D in the upper Basin, TRC-MW18D in the central basin near Castac Lake, and TRC-MW23D in the lower Basin (Grapevine Canyon). Hydrographs showing water level data and Sustainable Management Criteria (SMCs) for each of these wells are shown on Figures 4, 5, and 6, respectively. Groundwater levels in all RMWs continue to remain above their Measurable Objectives (MOs), although TRC-MW23D is currently very close to the MO with fluctuations which dip below the MO.

Groundwater use in the Basin during WY 2022 is summarized in Table 1. Consumptive use typically consisted of municipal and minimum agricultural pumping from several supply wells, however, there was no agricultural pumping in WY 2022. Total pumpage was approximately 338 acre-feet (AF), of which 100% was for the municipal sector. Reporting supply wells in the Basin are shown on Figure 7.



Groundwater was the sole source of municipal and agricultural water in the Basin during WY 2022; no perennial surface water or imported water currently is available. Castac Lake is an ephemeral lake, and was dry for most of WY 2022.

Changes in groundwater storage were estimated using the Castac Basin Groundwater Flow Model (Basin model), a three-dimensional numerical groundwater flow model based on the USGS MODFLOW-NWT platform (Niswonger et al, 2011), which was prepared as a tool to analyze Basin water budget information as part of the GSP. Modeled groundwater levels correlate closely with measured water levels in Basin wells (Figure 8), thus the Basin model is sufficiently accurate for reporting purposes. A map of groundwater storage change in the Basin as calculated by the Basin model is shown on Figure 9. Generally, the Basin shows a loss in groundwater storage over the water year. Figure 10 shows water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater storage for the Basin from WY 2015 to WY 2022.<sup>1</sup>

As described above, and in Table 1, groundwater levels in the RMWs remain at or above MOs, thus, they also remain above Minimum Thresholds and Interim Milestones, as defined by SGMA. Table 2 summarizes the water levels in RMWs, and their various SMCs.

The GSP outlined six Projects and Management Actions (P&MAs) for the Basin, of which four are ongoing or have been initiated. Implementation has not yet begun for the two other P&MAs. A brief description of each P&MA and its implementation status is listed in Section 8.2.

## 2. General Information

### § 356.2 (a)

*Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

*(a) General information, including an executive summary and a location map depicting the basin covered by the report.*

On 16 September 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) - the primary purpose of which is to achieve and/or maintain sustainability within the state's high and medium priority groundwater basins. The Castac Lake Valley Groundwater Basin (referred to herein as "the Basin"), California Department of Water Resources (DWR) Basin No. 5-029, is classified as a "very low priority" basin (DWR, 2019). The SGMA Legislation does not require but "encourages and authorizes" very low priority basins to be managed under Groundwater Sustainability Plans (GSPs; California Code of Regulations [CCR]

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<sup>1</sup> For WY 2022, the Basin model was updated with more accurate pumping data, modified general-head boundary conditions, and revised recharge inputs. Historical water-budget data shown on Figure 10 reflect current, updated model estimates, which are similar but not identical to previously estimated water budgets shown on Figure 10 of the WY 2021 Annual Report.

## WY 2022 Annual Report Castac Lake Valley Groundwater Basin



23 § 10720.7(b)). To address the long-term reliability of groundwater within the Basin, the Castac Basin Groundwater Sustainability Agency (GSA) developed a GSP, which was adopted by the Castac Basin GSA Board on 22 September 2020 and submitted to DWR on 4 November 2020.

This Water Year (WY) 2022 Annual Report for the Basin has been prepared in compliance with CCR 23 § 356.2. WY 2022 includes the period from 1 October 2021 through 30 September 2022. This Annual Report also contains available and appropriate historical information back to 1 January 2015, as it is the effective date of SGMA and required by CCR 23 §356.2 (b), in order to provide information and data to facilitate an understanding of Basin conditions through the current reporting year.

The Castac Basin GSA is the exclusive GSA for the Basin, and its Board of Directors is comprised of two representatives from Tejon-Castac Water District (TCWD), two representatives from Lebec County Water District (LCWD), and two non-voting representatives, one from Kern County, and one from Krista Mutual Water Company (KMWC), respectively.

The Basin is located at the southern end of Kern County in the Tehachapi and San Emigdio Mountains (Figure 1), near the intersection of the San Andreas and Garlock faults. The Basin is divided into three general areas: the Castac Lake area near the lakebed, the Dryfield Canyon area extending northeast from the lake, and the Grapevine Canyon area extending northwest from the lake.

Available hydrogeologic information indicates that the Basin is bounded by very low-permeability igneous and metamorphic rocks, except the upgradient southwest side which is bounded by the Cuddy Canyon Valley Basin (DWR Basin No. 5-082). The Basin contains one principal aquifer, generally made up of unconsolidated clastic sediments layered in two hydrostratigraphic “zones” (i.e., the Shallow and Deep Aquifer zones). Based on water level data, results of aquifer pumping tests, and water quality data, these zones appear to be hydraulically connected. The total depth of alluvium in the Basin is estimated to vary from approximately 95 feet below ground surface (ft bgs) near the southern margin of the Basin, to approximately 350 ft bgs near the center of the Basin.

Sources of water to the Basin groundwater system include recharge from precipitation, intermittent surface inflow from Cuddy Creek and other minor drainages, subsurface groundwater inflows from the up-gradient Cuddy Canyon Valley Basin, return flows from irrigation and septic tanks, and Castac Lake seepage when water is present in the lake (Castac Lake commonly contains no surface water in dry years).

Outflows from the Basin include groundwater pumping; evapotranspiration by trees, brush, and other plants including groundwater dependent ecosystems (GDEs) located mostly near and immediately downgradient of the lake; inflow seepage of groundwater to Castac Lake (during wetter years); and subsurface outflow to Grapevine Creek.



### 3. Groundwater Elevation Data

§ 356.2 (b) (1)

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

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

(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:

(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.

(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.

#### 3.1. Groundwater Elevation Contour Maps

Groundwater elevations in the Basin generally mimic topography, and groundwater flow in the Basin follows a pattern roughly similar to the surface water drainage. The Basin generally drains to the northwest, with Grapevine Creek gaining much of the outflow at the topographically lowest northwest end.

Figures 2 and 3 map groundwater elevation contours for data collected in Fall 2021, and Spring 2022, respectively. The changes in contours and posted groundwater elevations in monitoring wells indicate seasonal high and low groundwater conditions for WY 2022.

Figure 2 illustrates the WY 2022 “dry” season (Fall 2021) piezometric surface in the Basin, which ranged from approximately 3,550 feet above mean sea level (ft msl) in the upper Dryfield Canyon portion of the Basin to approximately 3,150 ft msl in the northern basin outflow, a vertical drop of approximately 400 feet over approximately 6 miles (i.e., on average about 67 feet per mile).

Figure 3 illustrates the WY 2022 “wet” season (Spring 2022) piezometric surface in the Basin. Water level contours shown are very similar to the Fall 2021 contours, with minor observed piezometric head changes of at most a few feet in all wells, but no large changes in the groundwater contours or flow conditions.

Figures 2 and 3 show that in WY 2022, most of the piezometric head change (the steepest groundwater gradient) is in the Grapevine area of the Basin, and it appears to be mostly independent of the season.





### 3.2. Groundwater Hydrographs

Long-term hydrographs showing historical data from 1 January 2015 to WY 2022 for Representative Monitoring Wells (RMWs) are shown on Figures 4 through 6. Trends are calculated from 2017 through 2022. Overall, the 5-year hydrographic trends based on the RMW water levels from 2017 to 2022 range from -1.0 feet per year in the upper Basin to -1.7 feet per year in the central Basin, however, during WY 2022, groundwater levels increased approximately 0.9 feet in upper Basin well RMW TRC-MW16D, decreased approximately 0.2 feet in mid-Basin well TRC-MW18D, and decreased approximately 2.7 feet in lower Basin RMW TRC-MW23D in the Grapevine area, as shown in Table 3 in Section 8.1.<sup>2</sup>

The GSA established Sustainable Management Criteria (SMCs) including Measurable Objectives (MOs) and Minimum Thresholds (MTs) for groundwater levels at the three RMWs, based on historical trends observed over the 10-year period between DWR Water Years 2008 and 2018; these are depicted graphically on the hydrographs, and are summarized in Table 2. Water levels in MW16D and MW18D continue to remain above their MOs (and their MTs) over the reporting period. Water levels in MW23D are between the MO and MT over the reporting period.

## 4. Groundwater Extraction Data

### § 356.2 (b) (2)

*Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

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

*(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.*

Table 1 shows the WY 2022 groundwater extraction data by water use sector. Figure 7 shows the general locations of supply wells with annual groundwater extraction for wells with available data. Total pumpage was approximately 338 acre-feet (AF), of which 100% was for the municipal sector.

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<sup>2</sup> Change in groundwater elevation is calculated by comparing the end of WY 2022 groundwater elevation with the end of WY 2021 groundwater elevation.



**Table 1. Summary of Groundwater Extraction Data by Sector<sup>(a)</sup>**

Water Year	Pumping, Municipal (AF) <sup>(b)</sup>	Pumping, Agricultural (AF) <sup>(b)</sup>	Pumping, Total (AF) <sup>(b)</sup>
2021	333.7	0	333.7
2022	337.5	0	337.5

**Note:**

(a) Pumping records based on summation of data from metered supply wells provided by Castac Basin municipal suppliers and agricultural entities in response to requests by the GSA. Note that estimates of pumping from the Tejon MS well or the Lebec State Historical Park well are not available for WY 2022 and are not included here.

(b) AF = Acre-feet

Groundwater for irrigation has historically been extracted from agricultural wells TRC-PW88A and TRC-PW90, although no pumping occurred in either of these wells for WY 2022. Groundwater for municipal use in developed areas is extracted from wells operated by KMWC, LCWD, and Tejon Ranch Company (TRC). Additional operators are Tejon Middle School, and Fort Tejon Historical State Park. Municipal production wells include Krista MWC PW, LCWD-Lebec PW, LCWD-State PW, TRC-PW60, TRC-PW80, TRC-PW81, Fort Tejon Well, and Tejon MS Well. Currently, WY 2022 production data are not available from the public water systems at Tejon Middle School and Fort Tejon State Park. Although other domestic wells exist within the Basin, these are assumed to be de minimis users (i.e., less than 2 acre-feet per year; AFY) and therefore are not estimated herein.

Water year total and monthly groundwater pumping data for the Basin are derived from available reported flowmeter readings between October 2021 and September 2022. In response to requests for information, KMWC and LCWD provided monthly pumping records for their production wells. TRC provided totalizing flowmeter readings reported once for the year. An average monthly rate was estimated for each well, based on an estimated seasonally adjusted rate based on prior reported metering data<sup>3</sup>.

Pumping measurements shown on Figure 7 are similar to data from WY 2021. Groundwater use data generally are reported by AF, with a precision of 0.001 AF, however some municipal water suppliers report in gallons, with a precision of 1.0 gallon.

<sup>3</sup> For wells TRC Hartley, 56A, 80, 88A and 90, a repeat of the WY 2021 pumping timeseries was assumed.



## 5. Surface Water Supply

§ 356.2 (b) (3)

*Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

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

*(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.*

Surface water inflows and outflows to and from the Basin are natural sources, including precipitation and streamflow. In WY 2022, imported surface water was not used as a water supply, nor was it used to supply water for any Projects and Management Actions (P&MAs). Imported surface water is not currently used within the Basin.

## 6. Total Water Use

§ 356.2 (b) (4)

*Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:*

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

*(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.*

As described above, surface water was not used as a supply source in WY 2022 in the Basin. Therefore, total water use is equal to that of total estimated groundwater extraction, and total water use by water use sector is shown in Table 1. Methods of measurement for groundwater extraction data are summarized in Section 4, above.



## 7. Change in Groundwater Storage

§ 356.2 (b) (4)

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

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

(4) Change in groundwater in storage shall include the following:

(A) Change in groundwater in storage maps for each principal aquifer in the basin.

(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

Changes in groundwater storage were estimated using the Castac Basin Groundwater Flow Model (Basin model), a three-dimensional numerical groundwater flow model based on the U.S. Geological Survey public-domain software platform MODFLOW-NWT (Niswonger et al, 2011). The Basin model was prepared to analyze water budget information for the Basin as part of the GSP.

For WY 2022, the Basin model was extended to include pumping data, general-head boundary conditions, and recharge inputs through the WY. Historical water-budget data shown on Figure 10 reflect current, updated model estimates.

As a check on model output, water level elevations in wells predicted by the model for the end of WY 2022 (September 2022) were compared to September 2022 water level elevations measured in wells. The modeled heads correlated closely with the measured data, as shown on Figure 8. A linear regression of modeled vs. observed data has a linear correlation coefficient ( $R^2$ ) of 0.99, as shown on the scatterplot, indicating that the model can be used to accurately simulate water levels in the Basin, and thus it also can be used to estimate changes in Basin groundwater storage.

Figure 9 is a map of model-estimated changes in groundwater storage within the Basin from WY 2021 to WY 2022. The model calculates the change in groundwater storage based on the change in water level and the calibrated storage properties of each model cell.

Based on the modeled groundwater storage system, groundwater storage in the Basin continued to decline, but the magnitude of the storage change was less than the previous water year. Figure 9 shows that most of the central Basin area experienced a relatively small groundwater storage decrease in WY 2022 (less than 0.2 AF decline), with upper Dryfield Canyon and side drainages of



the Grapevine portion of the Basin experiencing relatively small groundwater storage increases in WY 2022 (less than 0.2 AF increase).

Figure 10 shows annual groundwater storage changes as well as the cumulative change in storage for the basin since WY 2015. Climatic conditions were very dry during WY 2022, which is classified as a “Critical” year, according to the following criteria<sup>4</sup>:

**Table 2. USGS HU8 Hydrologic Unit Water Year Type Classification**

Index	Water Year Type	Classification Basis: USGS HU8 Hydrologic Unit 30-Year Nonstationary Threshold Ranking
W	Wet	21 < rank
AN	Above Normal	15 < rank ≤ 21
BN	Below Normal	9 < rank ≤ 15
D	Dry	4 < rank ≤ 9
C	Critical	rank ≤ 4

Groundwater storage in the Basin declined approximately 210 AF for WY 2022 (i.e., approximately 0.23% of the total estimated basin storage of 93,000 AF), with a cumulative decline of approximately -2,900 AF since 2015 (Figure 10).

<sup>4</sup> Water Year Type classification for USGS Middle Kern - Upper Tehachapi - Grapevine Hydrologic Unit 18030003. Annual precipitation data in the hydrologic unit (HU) from the past 30 years are ranked in ascending order, and the current year’s classification is based on its position within the overall 30-year record.



## 8. Plan Implementation

§ 356.2 (b) (4)

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

### 8.1. Progress Towards Interim Milestones for Chronic Lowering of Groundwater Levels

Table 3 summarizes groundwater level elevations in the three RMWs, estimated annual change in groundwater level elevations, and interim milestones for water levels established in the Castac Basin GSP.

**Table 3. Groundwater Elevations and Relevant Sustainable Management Criteria**

Well Name	Fall 2021 GWE (ft msl)	Spring 2022 GWE (ft msl)	1-Year GWE Change <sup>(1)</sup> (ft)	MO (ft msl)	MT (ft msl)	IM-5 (ft msl)	IM-10 (ft msl)	IM-15 (ft msl)
TRC-MW16D <sup>(2)</sup> (upper Basin)	3496.75	3496.78	-0.4	3,420	3,345	3,420	3,383	3,401
TRC-MW18D (mid-Basin)	3463.14	3463.82	-0.2	3,411	3,357	3,411	3,384	3,397
TRC-MW23D (lower-Basin)	3356.18	3360.14	-2.4	3,356	3,348	3,356	3,352	3,354

**Abbreviations:**

ft msl	= feet above mean sea level	MO	= measurable objective
GWE	= groundwater elevation	MT	= minimum threshold
IM	= interim milestone	WY	= water year

**Notes:**

- (1) Approximate year-over-year GWE change is estimated by comparing available data from the end of WY 2022 GWE to data from the end of WY 2021 GWE (September values when available). A monthly average GWE value is used if multiple measurements are recorded in a given month.
- (2) The datalogging pressure transducer in TRC-MW-16D failed. The unit was replaced but some WY2022 data after 16 Aug 2022 were lost.



Fall measurements for WY 2022 were collected in October 2021, and spring measurements were collected in March 2022. Multiple measurements in a given month were averaged. Groundwater levels in the three RMWs in the Basin were similar to previous water levels reported in the GSP, and changes were relatively minor from Fall 2021 to Spring 2022. All of the wells have water levels above their respective MOs, except TRC-MW23D which is fluctuating around its MO, so none indicate the presence of Undesirable Results with respect to groundwater levels in the Basin.

## 8.2. Implementation of Projects and Management Actions (P&MAs)

The Castac Basin GSP outlined six P&MAs. A brief description and progress towards implementation of these is provided below.

- P&MA #1 Aquifer Replenishment Project consists of importing surface water through TCWD's Bear Trap turnout on the California Aqueduct to maintain Castac Lake initially at a lake depth of eight to ten feet (stage of 3,493 to 3,495 feet above mean sea level). P&MA #1 is in a preliminary planning stage, and work is ongoing.
- P&MA #2 - Cuddy Creek Bank Modifications Project would entail modifying the bank of Cuddy Creek to retain floodwaters for a longer stretch of creek, thereby increasing the likelihood for groundwater recharge, subject to constraints of permitting and (as required by SGMA) in accordance with applicable water rights. P&MA #2 has not yet been initiated.
- P&MA #3 - KMWC Emergency Interconnect with LCWD is an infrastructure project which connects the Lebec County Water District (LCWD) and Krista Mutual Water Company (KMWC) distribution systems so that KMWC can use groundwater pumped from LCWD wells if KMWC is unable to use their existing public supply well. This project is currently in the feasibility study phase.
- P&MA #4 - Wastewater Reclamation will combine future, highly treated reclaimed water produced from the Tejon Mountain Village (TMV) development with imported surface water (as needed) to maintain Castac Lake levels and meet some landscape irrigation demands. P&MA #4 has not yet been initiated.
- P&MA #5 - Frazier Mountain High School Water Project aims to improve the drinking water quality delivered to Frazier Mountain High School, which has high uranium concentrations, by serving the high school with groundwater pumped from a planned new LCWD well located within the Basin. P&MA #5 is in the preliminary planning stage.
- P&MA #6 - Well Metering and Data Collection entails installing meters on supply wells within the Basin and regularly collecting pumping data from those wells. Improved

## WY 2022 Annual Report Castac Lake Valley Groundwater Basin



estimates of groundwater extraction in the Basin will aid in quantifying any relationships between groundwater use, groundwater levels, and groundwater quality, as well as provide the necessary information for annual reporting required under CCR § 356.2(b)(2). P&MA #6 is ongoing; most supply wells are metered. During WY 2022, the GSA successfully spoke with representatives of each public water system in which pumping data is not currently available (Tejon Middle School and Fort Tejon State Park). Representatives were willing to share future meter readings with the GSA.

The Castac Basin GSA practices stakeholder engagement through the GSA website (<https://www.castacgsa.org/>), public meetings and workshops presented in person prior to the current global COVID-19 pandemic, and presented online while health-protective restrictions are in force. During the reporting period, Castac Basin GSA held two public meetings on 29 March 2022 and 15 September 2022. The GSA will continue to meet semi-annually in 2023.





## REFERENCES AND TECHNICAL STUDIES

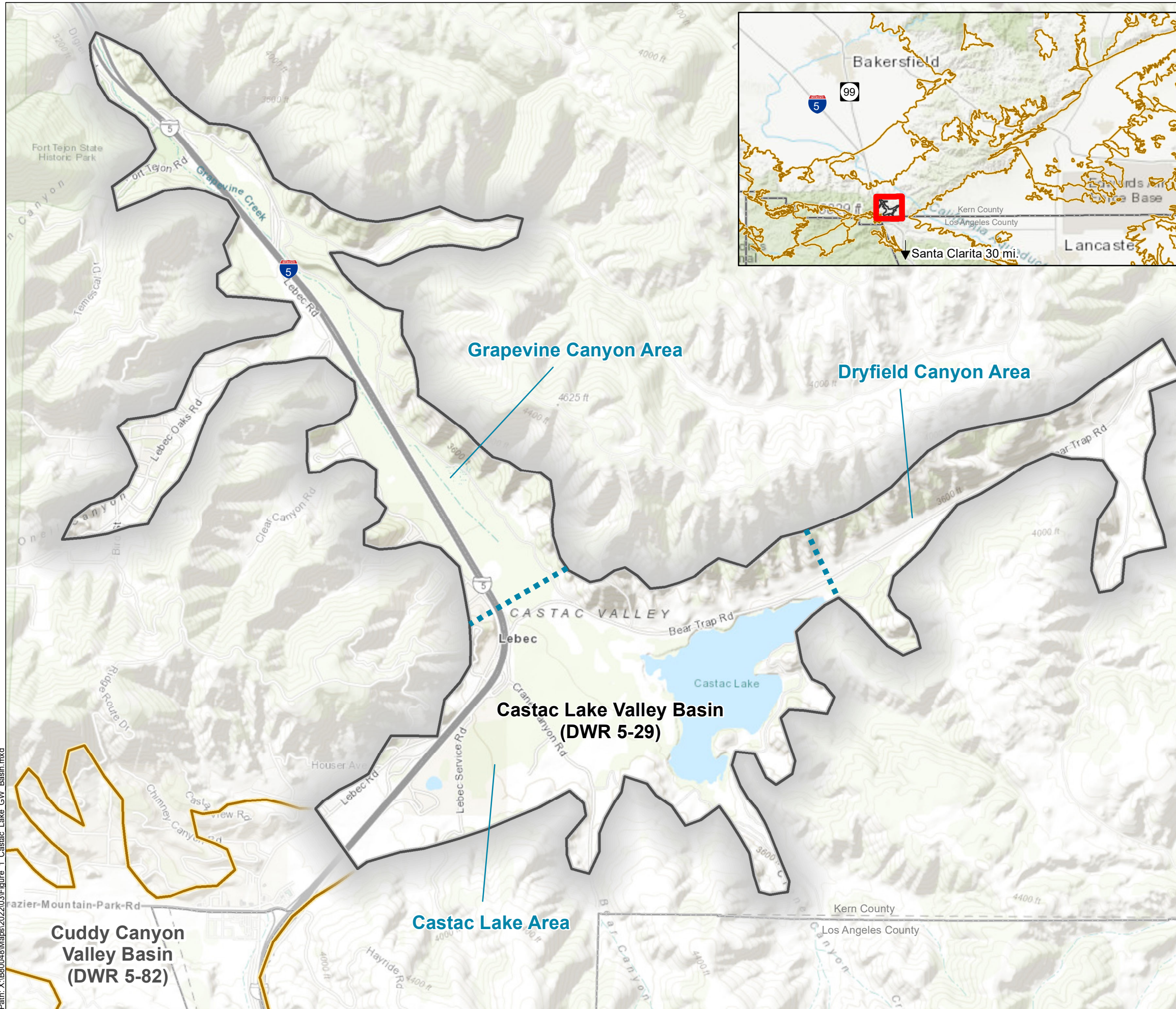
Castac Basin GSA, 2020, *Groundwater Sustainability Plan, Castac Lake Valley Basin*. September 2020, 534 pp.

DWR, 2019, *Sustainable Groundwater Management Act 2019, Basin Prioritization Process and Results*. April 2019, 64 pp.

Niswonger, R.G., Panday, S., and Ibaraki, M., 2011, *MODFLOW-NWT, A Newton formulation for MODFLOW-2005*. U.S. Geological Survey Techniques and Methods 6-A37, 44 p.

## APPENDICES

Appendix A. Annual Report Submittal Checklist



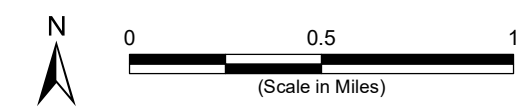
**Legend**

- Castac Lake Valley Groundwater Basin
- Other Groundwater Basin
- County Boundary
- Boundary Between Castac Lake Valley Groundwater Basin Subareas

**Abbreviations**  
 CGS = California Geological Survey  
 DWR = California Department of Water Resources

**Notes**  
 1. All locations are approximate.

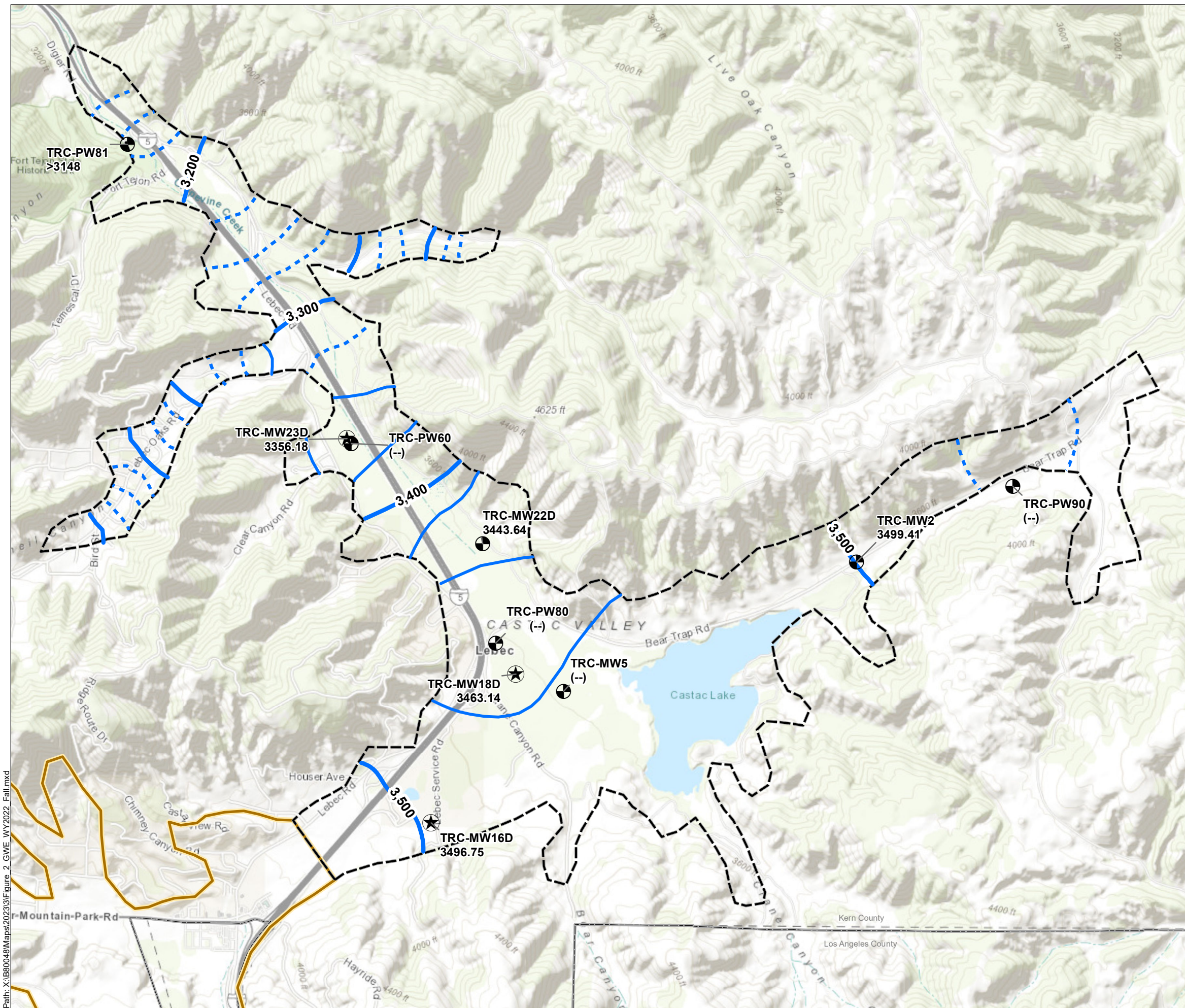
**Sources**  
 1. DWR groundwater basins are based on the boundaries defined in California's Groundwater Bulletin 118 - Final Prioritization, dated February 2019.  
 2. Basemap is ESRI's ArcGIS Online world topographic map, obtained 9 March 2022.



**Castac Lake Valley Groundwater Basin**

Tejon-Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00  
**Figure 1**

Path: X:\B80048\Maps\202203\Figure 1 Castac Lake GW Basin.mxd



**Legend**

**Monitoring Wells**

- ★ Representative Monitoring Well
- Other Wells

**Groundwater Elevation Contour (ft msl)**

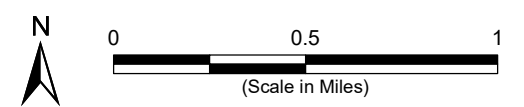
- (Dashed where uncertain)
- Castac Lake Valley Groundwater Basin
- Other Groundwater Basin
- County Boundary

**Abbreviations**

DWR= California Department of Water Resources  
 ft msl = feet above mean sea level (NAVD88)  
 NAVD88 = North American Vertical Datum 1988

- Notes**
1. All locations are approximate.
  2. Contour interval: 25 feet.
  3. Groundwater elevation contours were estimated where data are sparse. Dashed lines indicate greater uncertainty.
  4. Groundwater elevation measurements collected between 1 October 2021 - 31 December 2021.
  5. Water year 2022 is October 2021 through September 2022.
  6. Data posted next to each well show water elevation in feet relative to NAVD 1988. A double dash (--) indicates no data are available for that well.
  7. TRC-PW81 was flowing during measurement collection.

- Sources**
1. Groundwater basin boundaries from DWR Bulletin 118 Interim Update 2016.
  2. Basemap is ESRI's ArcGIS Online world topographic map, obtained 15 March 2023.



**DRAFT**

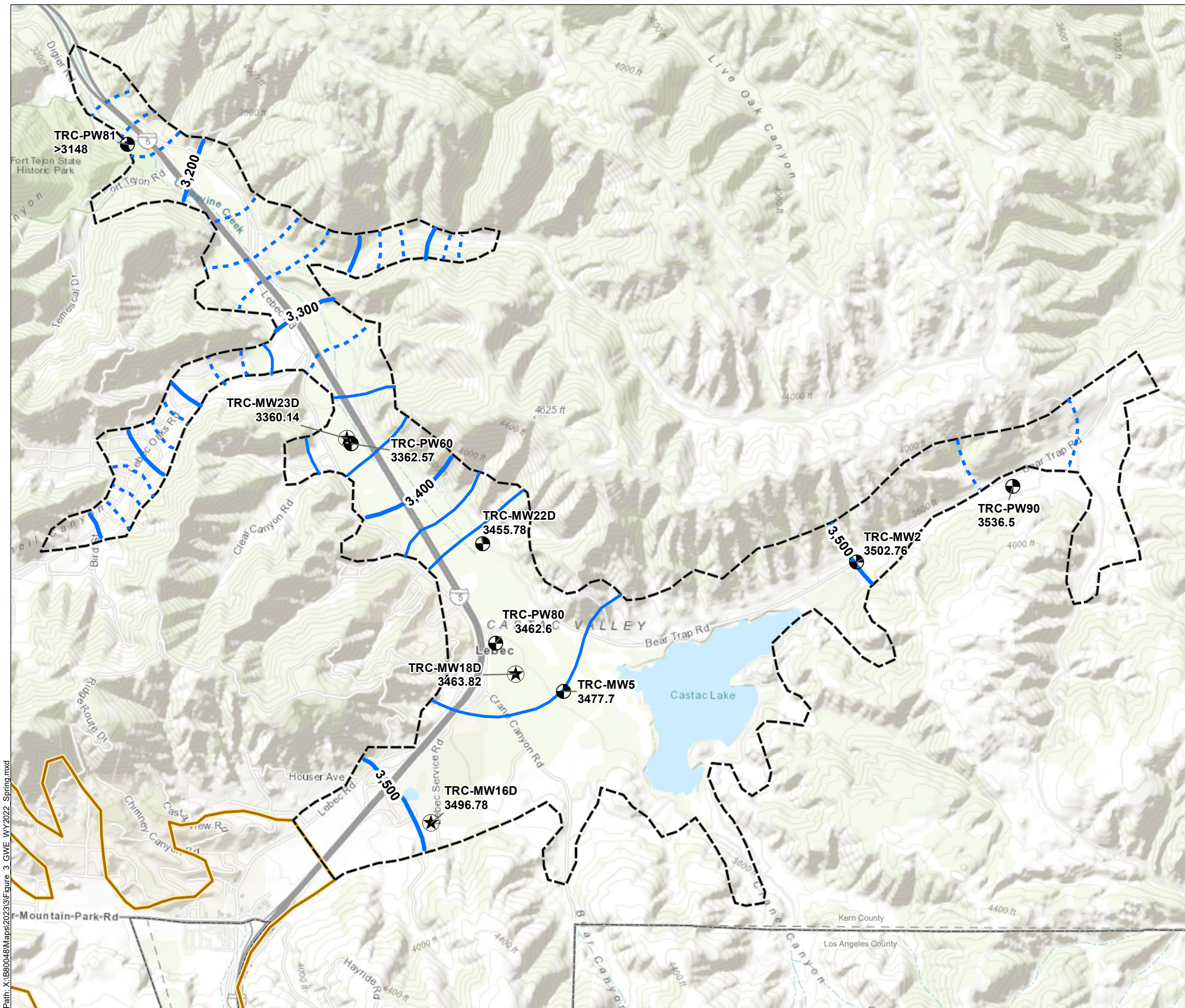
**Groundwater Elevation  
Fall 2021**

Tejon Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00

**eki** environment & water

**Figure 2**

Path: X:\B80048\Maps\2023\3\Figure 2\_GWE\_WY2022\_Fall.mxd



**Legend**

**Monitoring Wells**

- ★ Representative Monitoring Well
- Other Wells

**Groundwater Elevation Contour (ft msl)**

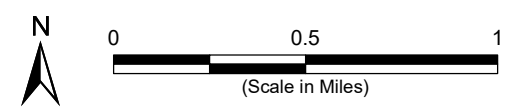
- (Dashed where uncertain)
- Castac Lake Valley Groundwater Basin
- Other Groundwater Basin
- County Boundary

**Abbreviations**

DWR= California Department of Water Resources  
 ft msl = feet above mean sea level (NAVD88)  
 NAVD88 = North American Vertical Datum 1988

- Notes**
1. All locations are approximate.
  2. Contour interval: 25 feet.
  3. Groundwater elevation contours were estimated where data are sparse. Dashed lines indicate greater uncertainty.
  4. Groundwater elevation measurements collected between 1 January 2022 - 30 April 2022.
  5. Water year 2022 is October 2021 through September 2022.
  6. Data posted next to each well show water elevation in feet relative to NAVD 1988. A double dash (--) indicates no data are available for that well.
  7. TRC-PW81 was flowing during measurement collection.

- Sources**
1. Groundwater basin boundaries from DWR Bulletin 118 Interim Update 2016.
  2. Basemap is ESRI's ArcGIS Online world topographic map, obtained 15 March 2023.



**DRAFT**

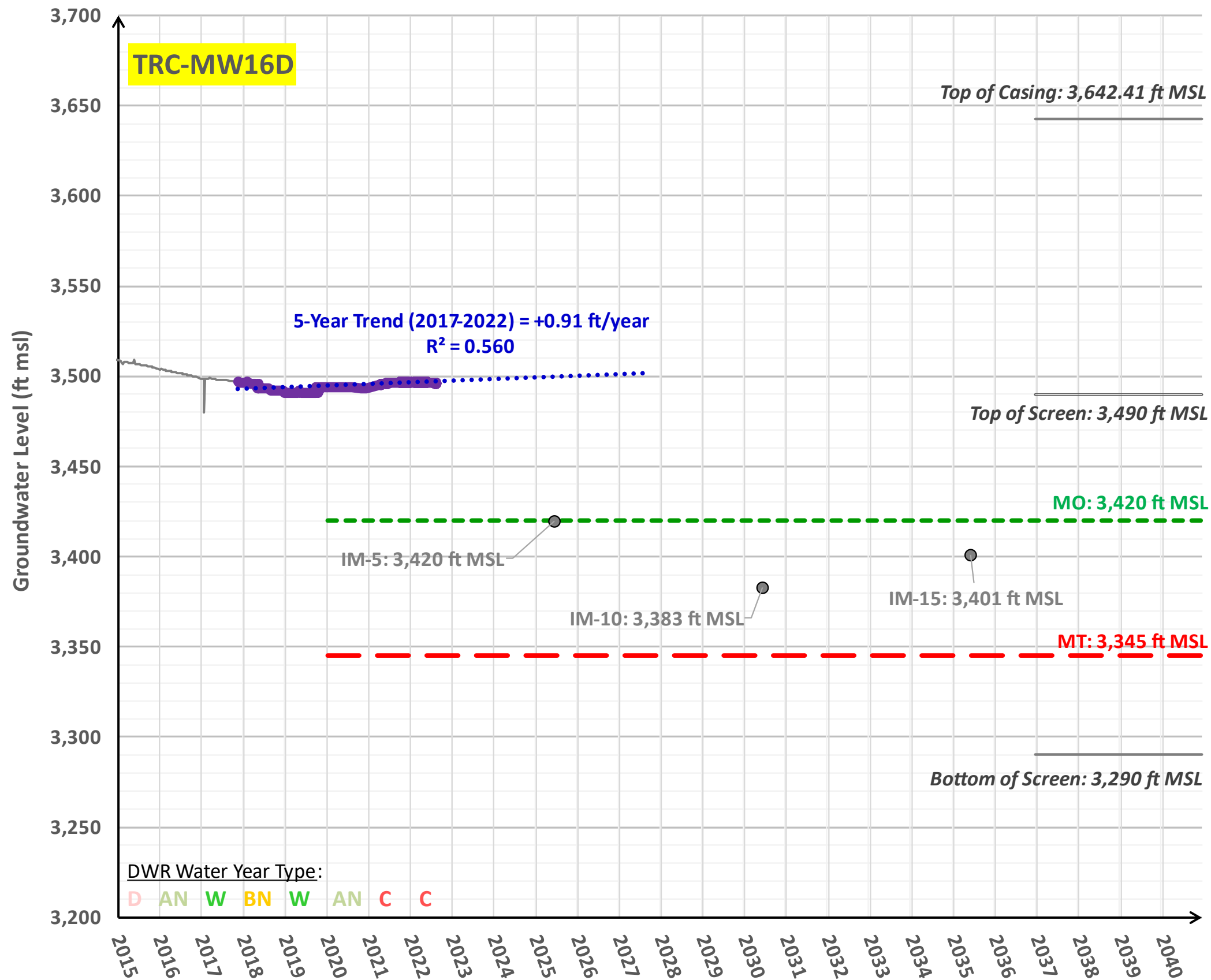
**Groundwater Elevation  
Spring 2022**

Tejon Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00

**eki** environment & water

**Figure 3**

Path: X:\B80048\Maps\2023\3\Figure\_3\_GWE\_WY2022\_Spring.mxd



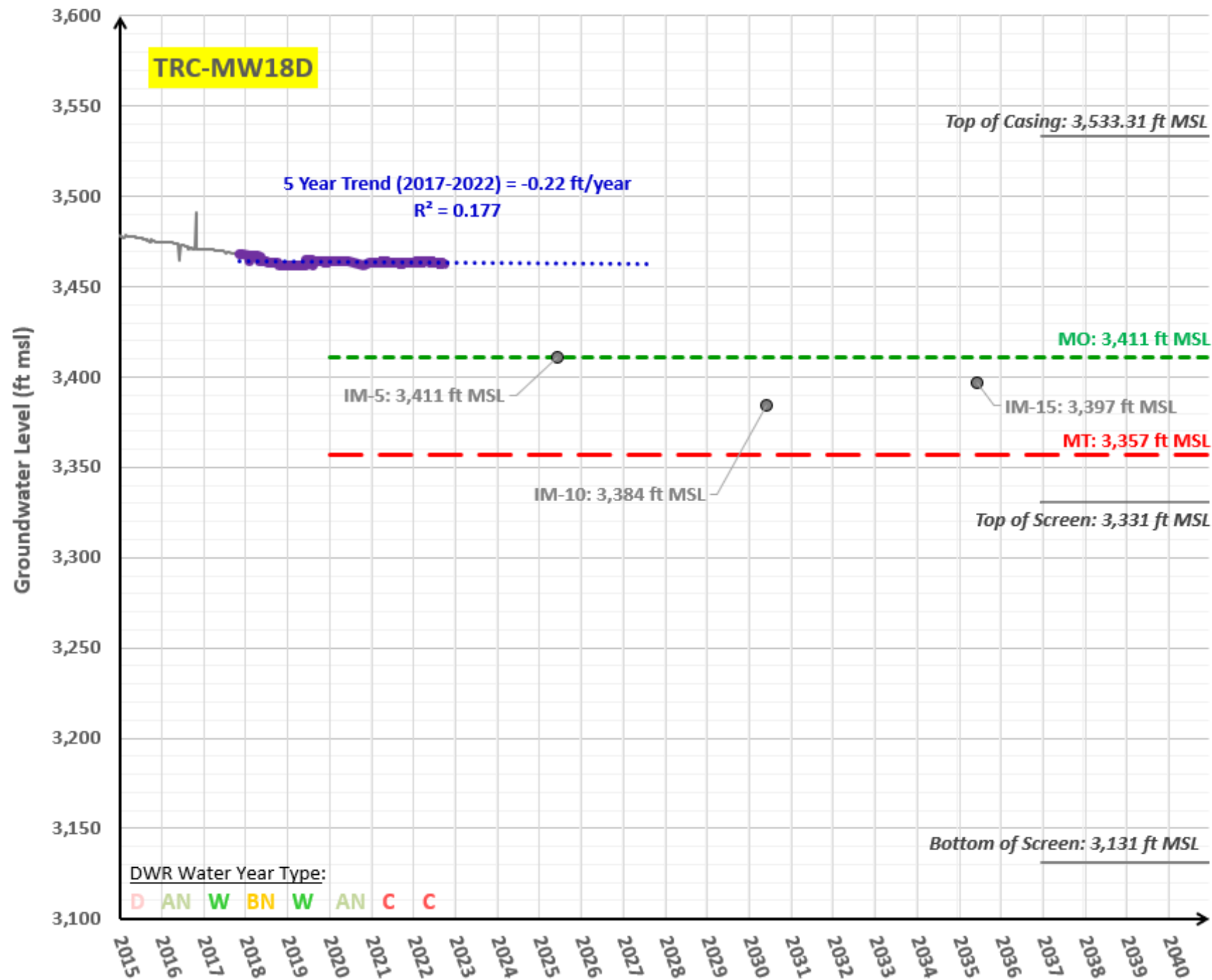
**Notes:**

1. Well located in southeast (upper) part of the Basin.
2. Water Year Type classification based on USGS Middle Kern - Upper Tehachapi - Grapevine Hydrologic Unit 18030003.

Index	WY Type
W	Wet
AN	Above Normal
BN	Below Normal
D	Dry
C	Critical

**Hydrograph:  
Representative  
Monitoring Well  
TRC-MW16D**

**DRAFT**



**Notes:**

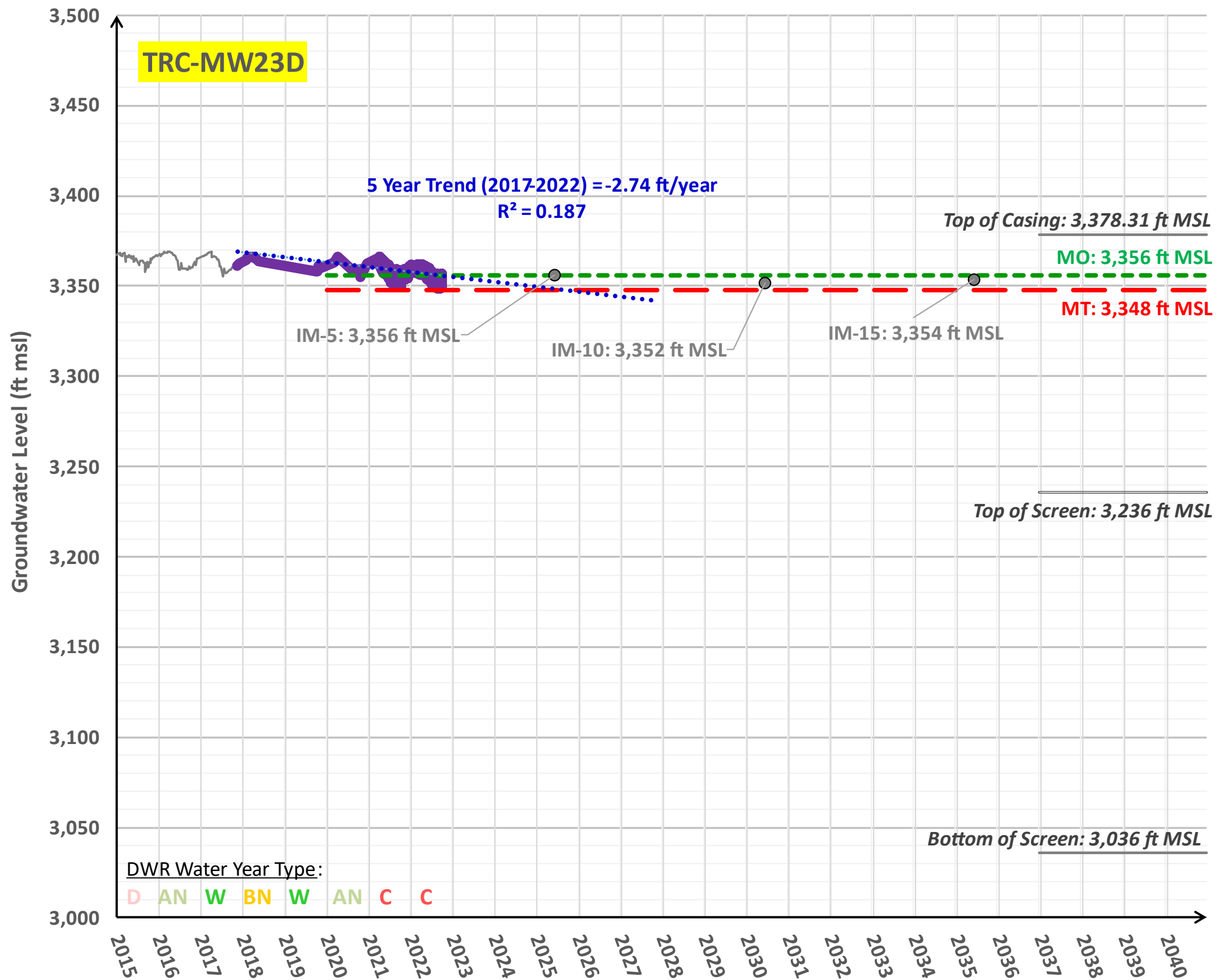
1. Well located in central part of the Basin near Castac Lake.
2. Water Year Type classification based on USGS Middle Kern - Upper Tehachapi - Grapevine Hydrologic Unit 18030003.

Index	WY Type
W	Wet
AN	Above Normal
BN	Below Normal
D	Dry
C	Critical

**Hydrograph:  
Representative  
Monitoring Well  
TRC-MW18D**

**DRAFT**

Tejon-Castac Water District  
Kern County, California  
March 2023  
B80048.00



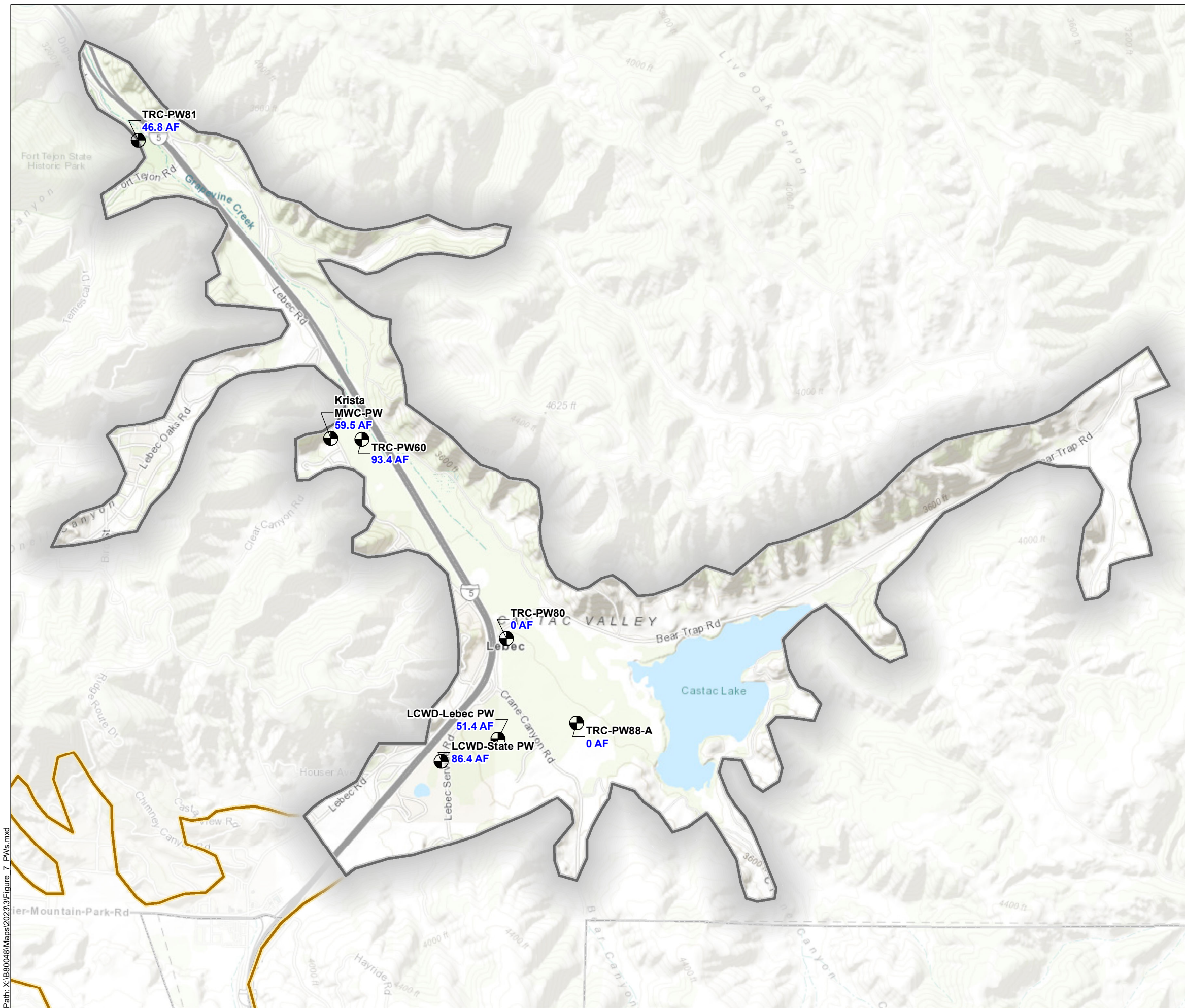
**Notes:**

1. Well located in lower part of the Basin near Grapevine Canyon.
2. Water Year Type classification based on USGS Middle Kern - Upper Tehachapi - Grapevine Hydrologic Unit 18030003.

Index	WY Type
W	Wet
AN	Above Normal
BN	Below Normal
D	Dry
C	Critical

**Hydrograph:  
Representative  
Monitoring Well  
TRC-MW23D**

**DRAFT**



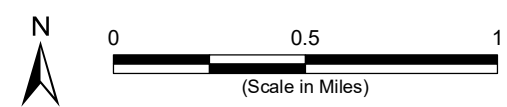
- Legend**
- Water Supply Well
  - Castac Lake Valley Groundwater Basin
  - Other Groundwater Basin
  - County Boundary

**1.1 AF** Annual Pumping from Water Supply Well (acre-feet)

**Abbreviations**  
 AF = acre-feet  
 DWR= California Department of Water Resources  
 NA = Data not available

**Notes**  
 1. All locations are approximate.  
 2. Water year 2022 is October 2021 through September 2022.

**Sources**  
 1. Groundwater basin boundaries from DWR Bulletin 118 Interim Update 2016.  
 2. Basemap is ESRI's ArcGIS Online world topographic map, obtained 14 March 2023.



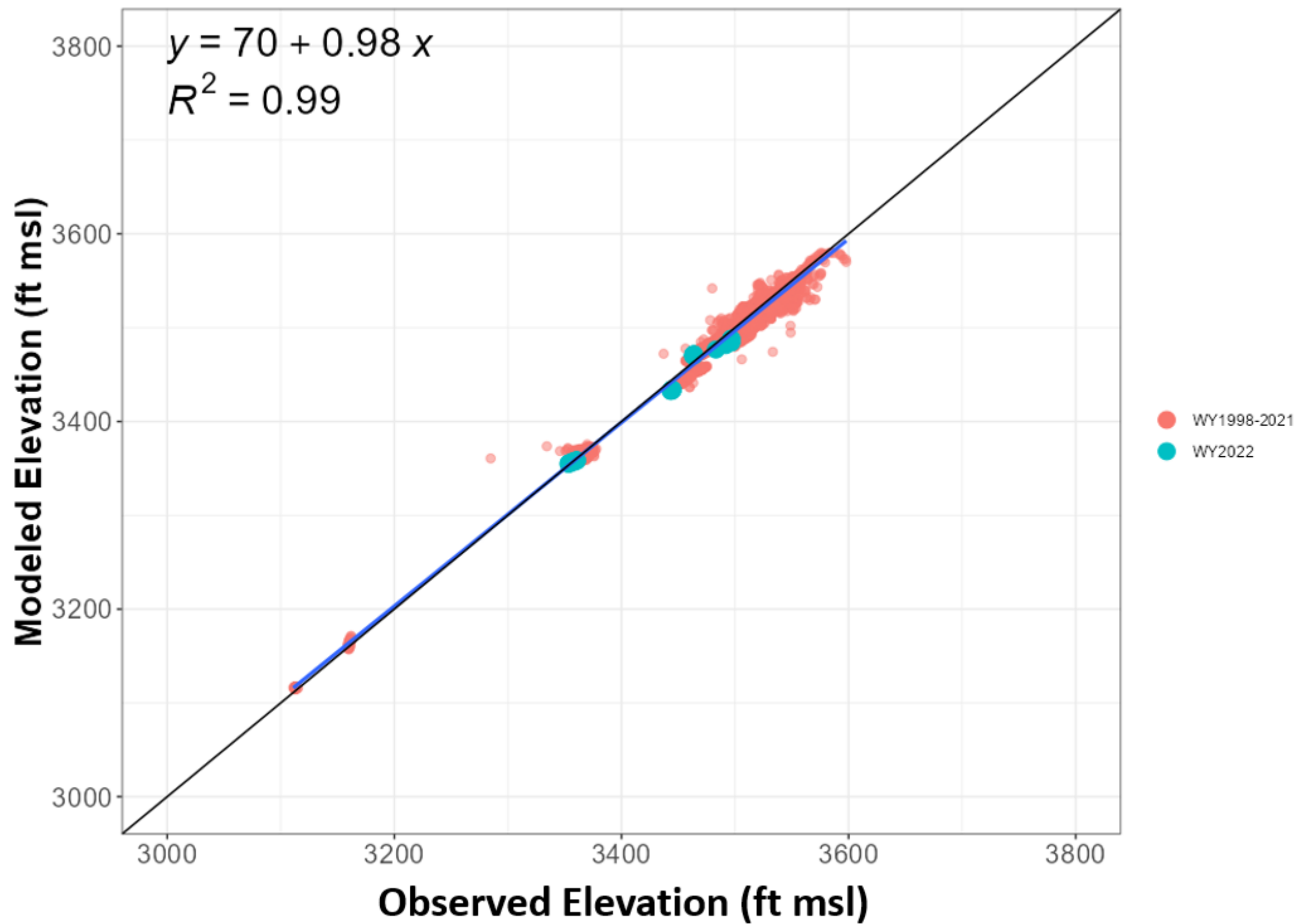
**Location and Groundwater Production of Supply Wells, WY 2022**

**DRAFT**  
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Tejon Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00  
**Figure 7**

Path: X:\B80048\Maps\2023\3\Figure 7 PWs.mxd





**Abbreviations:**

ft msl = feet above mean sea level  
 WY = Water Year

**Notes:**

1. Modeled water level elevations from the Castac Basin 3-D numerical flow model.
2. Observed water level elevations were measured in Basin wells in Water Year 2022.

**Modeled versus Observed  
 Water Level Elevations  
 in Wells**

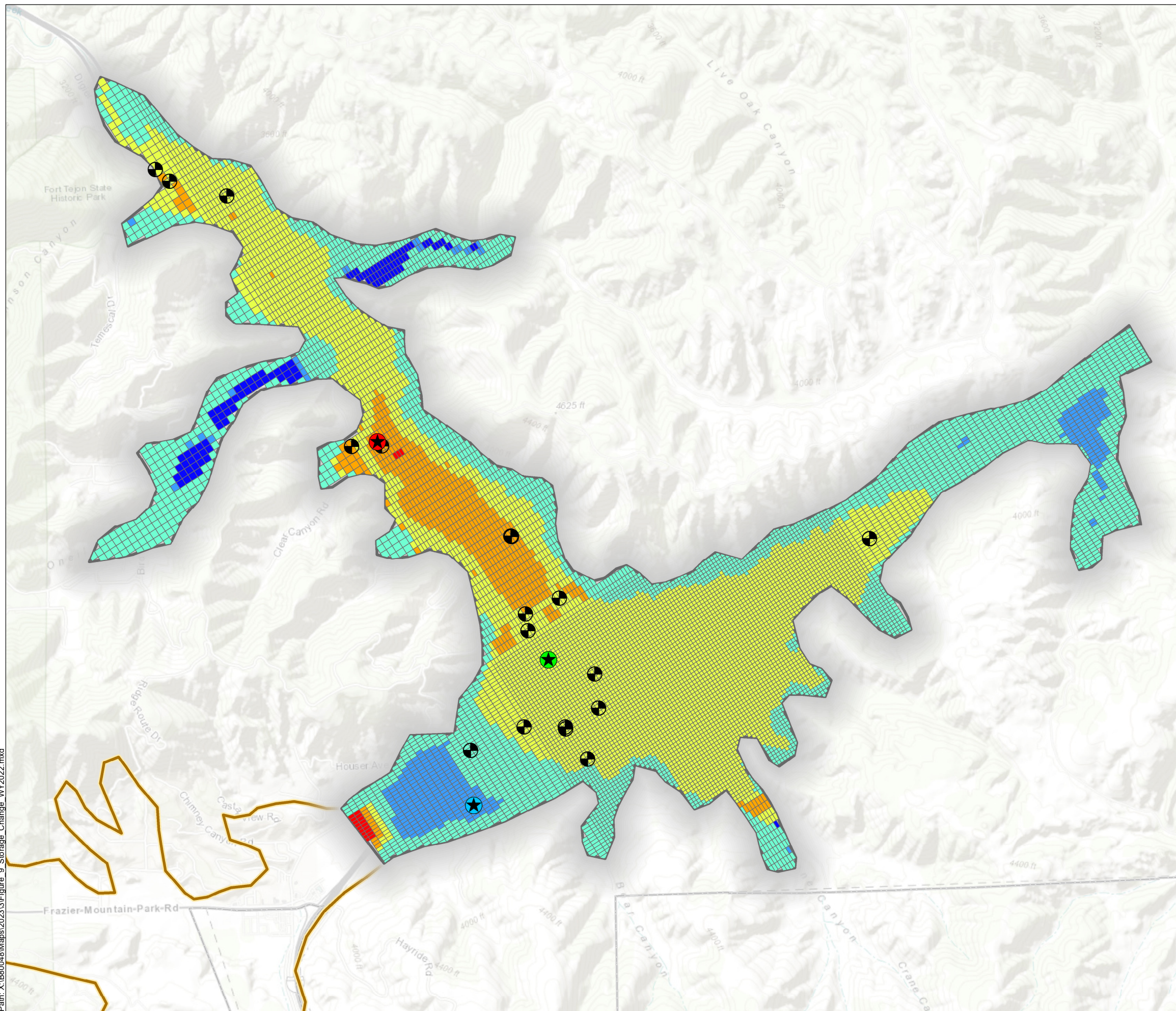
**DRAFT**

Tejon-Castac Water  
 District  
 Kern County, California  
 March 2023  
 B80048.00



**Figure 8**

Path: X:\B80048\Maps\2023\3\Figure 9 Storage Change WY2022.mxd



**Legend**

- Castac Lake Valley Groundwater Basin
- Other Groundwater Basin
- County Boundary

**RMWs**

- TRC-MW16D
- TRC-MW18D
- TRC-MW23D

**Monitoring Wells**

- Representative Monitoring Well
- Other Wells

**Changes in Groundwater Storage (AF)**

- <-0.2
- 0.2 - 0.1
- 0.1 - 0
- 0 - 0.1
- 0.1 - 0.2
- >0.2

**Abbreviations**

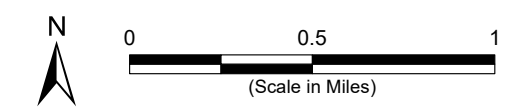
AF = acre-feet

**Notes**

1. All locations are approximate.
2. Storage spatial distribution is derived from the Castac groundwater model.
3. Water year 2022 is October 2021 through September 2022.

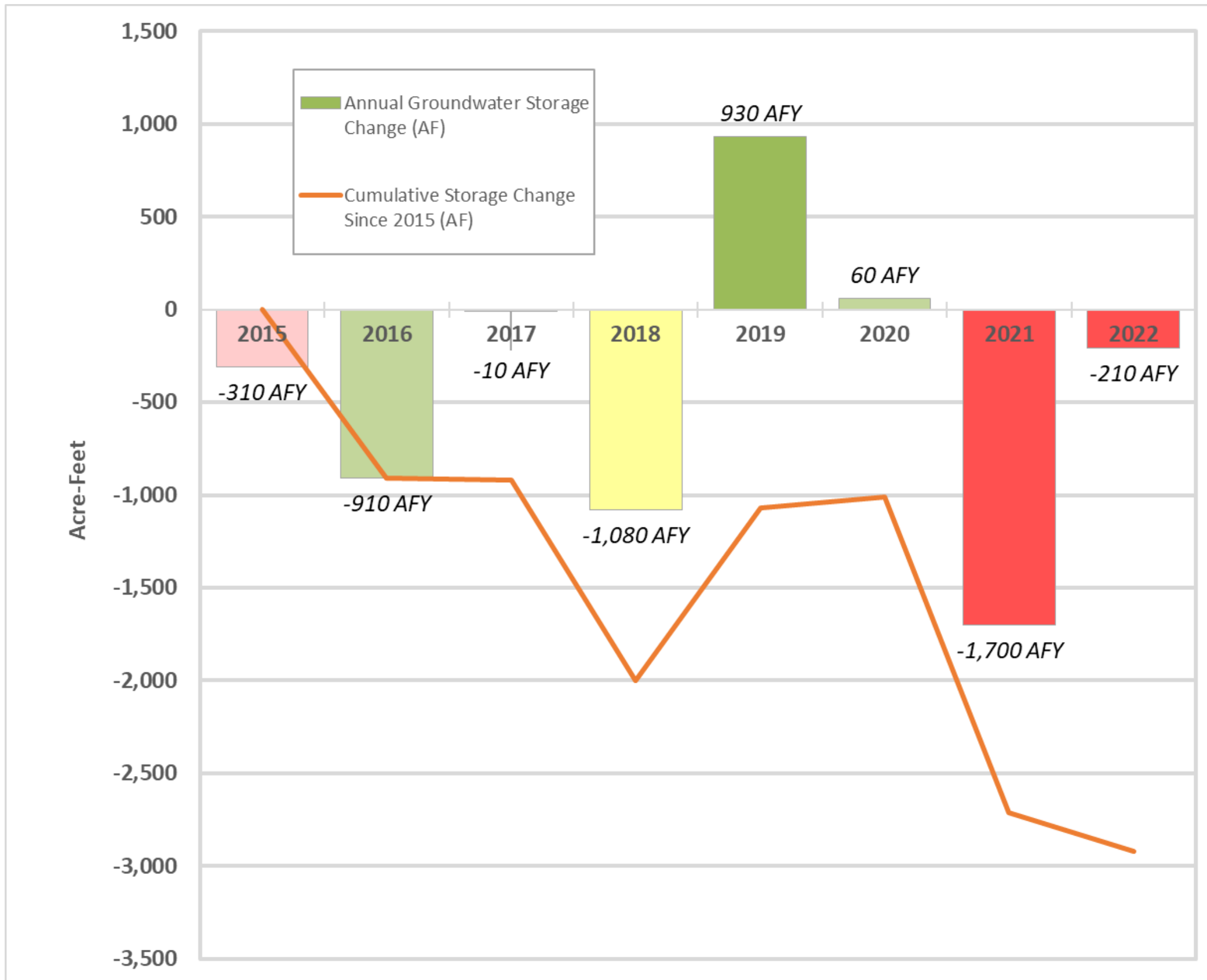
**Sources**

1. Groundwater basin boundaries from DWR Bulletin 118 Interim Update 2016.
2. Basemap is ESRI's ArcGIS Online world topographic map, obtained 13 March 2023.



**DRAFT** Model Estimated  
**Changes in Groundwater Storage**  
**Water Year 2022**

Tejon Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00  
**Figure 9**



**Abbreviations:**

AFY = acre-feet per year  
 DWR = California Department of Water Resources

**Notes:**

1. Water Year is defined as the October of the previous year through September of the current year.
2. Groundwater Storage change estimated using the Castac Basin groundwater flow model.
3. Updated estimates of historical annual groundwater storage changes are shown here, based on updates performed on the Basin model for WY 2022.
4. Water Year Type classification based on USGS Middle Kern - Upper Tehachapi - Grapevine Hydrologic Unit 18030003.

Index	WY Type
W	Wet
AN	Above Normal
BN	Below Normal
D	Dry
C	Critical

**Annual Change in Groundwater Storage and DWR Water Year Type**

**DRAFT**

Tejon-Castac Water District  
 Kern County, California  
 March 2023  
 B80048.00



**Figure 10**