Section 2. Plan Area and Basin Setting

Santa Margarita Basin
Groundwater Sustainability Plan

Appendix 2D
Santa Margarita Basin Groundwater Model
Updates and Simulations for Groundwater Sustainability Planning

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

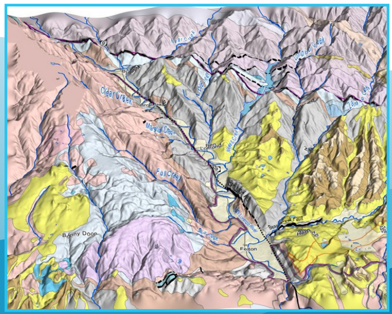
Public Review Draft

July 16, 2021

Santa Margarita Basin Groundwater Model Updates and Simulations for Groundwater Sustainability Planning

Prepared for:

SANTA MARGARITA
Groundwater Agency



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July 16, 2021

Santa Margarita Basin Groundwater Model Updates and Simulations for Groundwater Sustainability Planning

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ACRONYMS & ABBREVIATIONS

AFY................acre-feet per year
amsl................above mean sea level
bgs..................below ground surface
cfs...................cubic feet per second
DEM...............digital elevation model
DRN...............drain (MODFLOW6)
DWR..............Department of Water Resources
EKI.................EKI Environment & Water
ET...................evapotranspiration
ft/d..................feet per day
ft2/d................square feet per day
GHB...............general head boundary (MODFLOW6)
GSP................Groundwater Sustainability Plan
GWV..............Groundwater Vistas
HFB................horizontal flow barrier (MODFLOW6)
IRWMP..........Integrated Regional Water Management Plan
KJ...................Kennedy/Jenks Consultants
M&A..............Montgomery & Associates
MHA..............Mount Hermon Association
MVR..............mover (MODFLOW6)
PET................potential evapotranspiration
PRISM............Parameter-elevation Regressions on Independent Slopes Model
RIV.................river (MODFLOW6)
RMP...............representative monitoring point
RPE................reference point elevations
SLR................San Lorenzo River
SFR................streamflow routing (MODFLOW6)
SGMA............Sustainable Groundwater Management Act
SMGB............Santa Margarita Groundwater Basin
SLVWD.........San Lorenzo Valley Water District
SMGWA........Santa Margarita Groundwater Agency
SVWD............Scotts Valley Water District
UWMP...........Urban Water Management Plan
USGS.............U.S. Geological Survey
WY.................water year
WRI................Water Resources Inc
WUF...............water use factors

1 EXECUTIVE SUMMARY

1.1 Introduction

Santa Margarita Groundwater Agency (SMGWA) was formed under the Sustainable Groundwater Management Act (SGMA) and oversees development of a Groundwater Sustainability Plan (GSP). The Santa Margarita Groundwater Basin (SMGB or Basin) model is intended to support GSP development. ETIC originally developed the SMGB model in 2006, Kennedy/Jenks Consultants updated the model in 2015, and Hydrometrics Water Resources Inc (WRI) updated the model further in 2016 and 2017. Montgomery & Associates (M&A) has updated the model to be a suitable tool for quantifying water budgets and simulating future simulations based on different projects and management actions to support the GSP.

1.2 Results

The updates to the SMGB model include improvements to structure and inputs. Updates to the model such as temporal refinement to monthly stress periods and extension of the domain to cover SMGB provide the framework needed to run predictive future simulations based on projected climate change and pumping datasets. Future model inputs are developed based on different projects and management actions and are evaluated based on sustainability indicators.

Model calibration results indicate slight improvements from previous models for both groundwater and surface water. Groundwater level hydrographs of targets generally calibrate well to long-term trends and can be used to develop sustainable management criteria by accounting for the magnitude of calibration error as well as projecting the expected benefits of projects and management actions. Surface water flows generally calibrate well, but the model does not simulate some observed base flows. Model simulation of stream discharge and seepage can be improved with additional data from new streamflow gauging sites and accretion studies.

2 INTRODUCTION

2.1 Purpose of Model Update and Improvements

The SMGB model is intended to be used to support GSP development through the following:

- Quantifying historical, current, and future water budgets
- Projecting sustainability indicators
- Evaluating effects from projects and management actions

Future monthly climate and pumping projections are used as inputs for the predictive model. The model had to be updated such that it can efficiently incorporate estimates of future conditions based on climate projections and potential projects and management actions. The model has also been expanded to cover the modified Santa Margarita Basin as required by SGMA (Figure 1). Model update needs for supporting GSP development was guided by EKI Environment & Water (EKI) model review (EKI, 2018) of the existing SMGB that was updated for the Scotts Valley Water District (SVWD) Annual Report in 2016. The following are EKI model review recommendations along with the corresponding sections in this report that address them:

1. Expand model to agree with SMGB boundaries (Section 5.2.1).
2. Preserve model cell dimensions or layering (Section 5.2).
3. Revise water transmitting parameters (Sections 5.2.4 and 6.2.2).
4. Refine recharge estimates (Sections 5.1.3 and 5.1.4).
5. Modify or remove ET package (Section 5.1.5).
6. Perform quality checks on data (Section 5).
7. Extend historic simulation by adding 2017-2018 data (Section 5.1.1).
8. Update calibration (Section 5.2.4).
9. Change from quarterly to monthly stress periods (Section 5.1.1).
10. Include downscaled climate change in projected hydrology (Section 7.1).

2.2 Santa Margarita Basin Model History

The original version of the SMGB model was developed in 2006 by ETIC (ETIC, 2006) as part of the Prop 84 Planning Grant via Santa Cruz Integrated Regional Water Management Plan (IRWMP). The ETIC model was developed to provide a quantitative tool to assess regional groundwater conditions for the SMGB and was updated in 2015 by Kennedy/Jenks Consultants with updated geological interpretations (KJ model). Minor updates to extend the temporal data of the KJ model was carried out by HydroMetrics WRI in 2016-2017. In 2018, the SMGWA-commissioned EKI to evaluate the KJ model on its ability to support GSP development. EKI's report provided recommended updates to the model hydrogeologic framework, recharge, evapotranspiration (ET), and model calibration as shown in Section 2.1. This report documents the most recent model updates and improvements to the KJ model as part of developing the SMGB GSP.

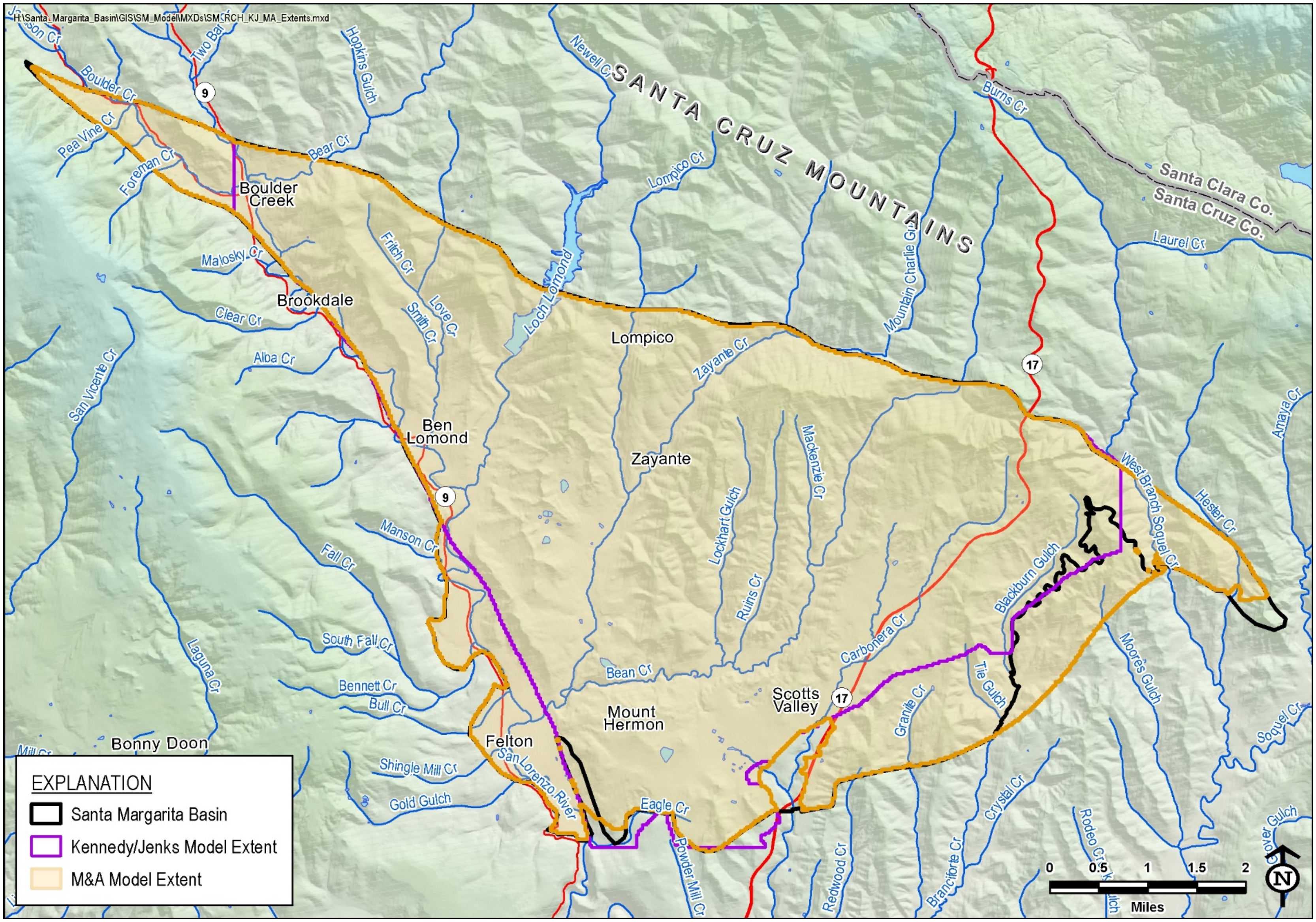


Figure 1. Santa Margarita Basin Compared to Kennedy/Jenks Model Extent and M&A Model Extent

3 CONCEPTUAL MODEL UPDATES

General conceptual model details can be found in the KJ model report (Kennedy/Jenks, 2015) and Section 2 of the GSP. Additional conceptual model updates include:

- Extension of existing spatial domain to include substantial extent of SMGB representing hydrogeologic boundaries described in basin boundary modification report (HydroMetrics WRI, 2016) and inclusion of Felton area alluvium
- Conversion of general head boundaries to no-flow boundaries along the model boundary at Santa Cruz Mid-County Basin to represent hydrogeologic boundary based on granitic high described in basin boundary modification report (HydroMetrics WRI, 2016)
- Removal of ET prior to recharge and runoff calculations from precipitation
- Removal of the simulation of ET by MODFLOW as recommended by EKI

Section 5.1 and 5.2 of this report elaborate further on how conceptual model updates are implemented.

4 NUMERICAL MODEL AND CODE

The SMGB model was updated from MODFLOW-NWT to MODFLOW6 (Langevin and others, 2017). MODFLOW6 is the most recent core MODFLOW code developed by the United States Geological Survey (USGS). MODFLOW6 allows for the following improvements to model implementation:

- Multiple input files of the same model flow package to organize input development and output processing
- Pass-through cells to efficiently simulate geological pinch-outs
- Routing of flow from one model flow package to another via Mover (MVR) package

MODFLOW6 is the most frequently updated and supported version by the USGS and allows flexibility for future model updates.

5 MODEL UPDATES AND IMPROVEMENTS

Model updates primarily involve changes to model inputs and model structure. Model inputs include period extension and refinement, pumping data, recharge and runoff, and ET. Structural updates include domain expansion, pinch-outs, stream network, and vertical hydraulic conductivity. This section addresses EKI recommendation 6 to perform quality checks on data as referenced in Section 2.1 in this report.

5.1 Model Input Updates

5.1.1 Model Period Extension

Model period was extended through Water Year (WY) 2018 and was discretized into monthly stress periods for a total of 409 stress periods to capture effects of seasonality and to match climate projection datasets. These changes address EKI recommendations 7 and 9 for extending the historical simulation and to change from quarterly to monthly stress periods as referenced in Section 2.1 of this report.

5.1.2 Pumping Volumes

5.1.2.1 Public Water Supply Agencies

San Lorenzo Valley Water District (SLVWD), SVWD, and Mount Hermon Association (MHA) meter extraction from their wells. Data were provided by the agencies as monthly volumes.

5.1.2.2 Small Water Systems

Since 2015, small water systems are required to report their monthly groundwater extraction to the County of Santa Cruz. These data are used in the model where available. Where data are not available, the same monthly volumes used in the KJ model were applied.

5.1.2.3 Private Residential

The location of private residential pumping was determined from County parcel data assigned as residential that has a building structure built on it, and that falls outside of the water service areas of SLVWD, SVWD, and MHA. The County’s well permit data for domestic wells were compared with those selected parcels to ensure the locations of known wells aligned with those areas identified by the parcel selection method.

The volume of private residential pumping is based on annual water use factors (WUF) developed based on small water system metered use per connection. The annual WUF is distributed to each month by the seasonal distribution of SVWD’s residential potable water demand. The range in WUF per home is from 0.46 acre-feet per year (AFY) in WY1985 to 0.23 AFY in WY2015 at the end of the recent drought.

An additional factor for changing population is applied to the data normalized to 2018 County of Santa Cruz unincorporated population sourced from the California Department of Finance (2019) population estimates. The range in the factor is from 0.89 in WY1985 at the start of the model to 1 in WY2018 at the end of the model.

Total private residential pumping over the model period averages 309 AFY. The KJ model cited an average of 282 AFY pumped by private wells from 1976 – 2012. This estimate only includes wells in the central and southern portion of the Basin and did not include wells to the north, or in the expanded portions of the modified Basin boundary.

5.1.2.4 Other Pumping

Other uses of pumped groundwater include sand quarries dust suppression and sand washing, environmental remediation, industrial, pond-filling, and landscape irrigation. Of these uses, only extraction for environmental remediation was metered. Pump and treat remediation were deactivated at the Scotts Valley Dry Cleaners in August 2015 and at the Watkins-Johnson Superfund site in July 2016. Groundwater pumping by these remediation systems was reported to the United States Environmental Protection Agency. Discharge reports were accessed through the State Water Resources Control Board GeoTracker database and used to update the volumes included in the KJ model and for the extended period.

Estimates for groundwater pumped for sand quarries, pond-filling, and landscape irrigation included in the KJ model were duplicated for the extended model period. Additional information regarding water use and pumping can be found in GSP Section 2.

5.1.3 Recharge and Runoff

The KJ model (2015) used isohyetal rainfall zones from Johnson (2009) to distribute quarterly precipitation totals from SVWD and SLVWD rain gauges to calculate recharge and runoff. The M&A model uses monthly spatial mean precipitation data from Parameter-elevation Regressions on Independent Slopes Model (PRISM) Climate Group (PRISM, 2004).

The KJ model used reference ET (ET_o) based on data for Santa Cruz County from Snyder et al 1992 and CIMIS (1998, 2005). The M&A model uses ET_o through 2000 provided by the Hydrologic Model developed by Balance Hydrologics (City of Santa Cruz, 2021). PRISM mean temperature data is used to extend the ET_o data through 2018 with the Blaney-Criddle (1962) method using adjusted factors from the Santa Cruz Water Balance Model. PRISM allows for calculation of recharge and runoff using ET_o consistent with climate change data sets. The KJ model used ET_o as a model input scaled by a crop factor to simulate ET over riparian areas while the M&A model uses ET_o as a part of recharge and runoff calculations.

The KJ model partitioned precipitation to recharge and runoff in the KJ model (2015) based on coefficients determined by land use and geology; remaining water after calculation of recharge and runoff was assumed to be lost without consideration of reference ET. Precipitation distribution has been updated to be affected by reference ET and therefore temperature with Equation (1) for each watershed:

$$P_{eff} = P - ET_o = R + RO \qquad (1)$$

P_{eff} = effective precipitation

P = precipitation

ET_o = reference evapotranspiration calculated from temperature using Blaney-Criddle (1962)

R = recharge

RO = runoff

P_{eff} is then distributed to recharge-runoff zones within each watershed in the basin. Watershed averages for precipitation and temperature for ET_o in each recharge-runoff zone is calculated directly from PRISM datasets. KJ model (2015) had 125 zones delineated by rainfall isohyetals, land use, and geology. The number of zones is updated with watershed boundaries that encompass the basin boundary for the M&A model. Watershed boundaries are refined by land use and geology for a total of 420 zones.

The max precipitation filter used by KJ model (2015) is still applied to P_{eff} as 50% of P_{eff} in excess of 6.67 inches (20 inches per quarter) added to 6.67 inches as shown in Equation (2):

$$P_{eff_{filtered}} = \begin{cases} P_{eff}, & P_{eff} \leq 6.67 \\ 6.67 + \dfrac{(P_{eff} - 6.67)}{2}, & P_{eff} > 6.67 \end{cases} \qquad (2)$$

A portion of $P_{eff\_filtered}$ is distributed as runoff to the streams based on an area-weighted average of runoff coefficients within each watershed.

The second portion of P_{eff} applies the KJ model (2015) 3-quarter recharge lag of 60% from the current quarter, 30% from previous quarter, and 10% of the 2nd preceding quarter. Recharge lag for the M&A model is converted to monthly terms of 20% of each month in the current quarter, 10% of each month in the previous quarter, and 3.33% of each month in the 2nd preceding quarter as shown in Equation (3):

$$P_{eff_{filtered_{lag}}} = 0.2 * \sum_{i=0}^{2} P_{eff_{filtered}}(month - i) + 0.1 * \sum_{j=3}^{5} P_{eff_{filtered}}(month - j) + 0.033 * \sum_{k=6}^{8} P_{eff_{filtered}}(month - k) \quad (3)$$

$P_{eff\_filtered\_lag}$ is distributed as recharge in each zone in the watershed weighted by zone area, recharge coefficients, and percent of watershed that is inside the basin boundary; recharge outside the basin boundary is assumed to not contribute inside the basin. Recharge and runoff coefficients from the KJ model (2015) were retained. Figure 2 shows the average annual recharge for each geology within the basin.

Recharge updates described this section addresses EKI recommendation 4 as referenced in Section 2.1 in this report. Incorporating reference ET facilitates simulation of the effects of warmer temperatures projected to occur with climate change.

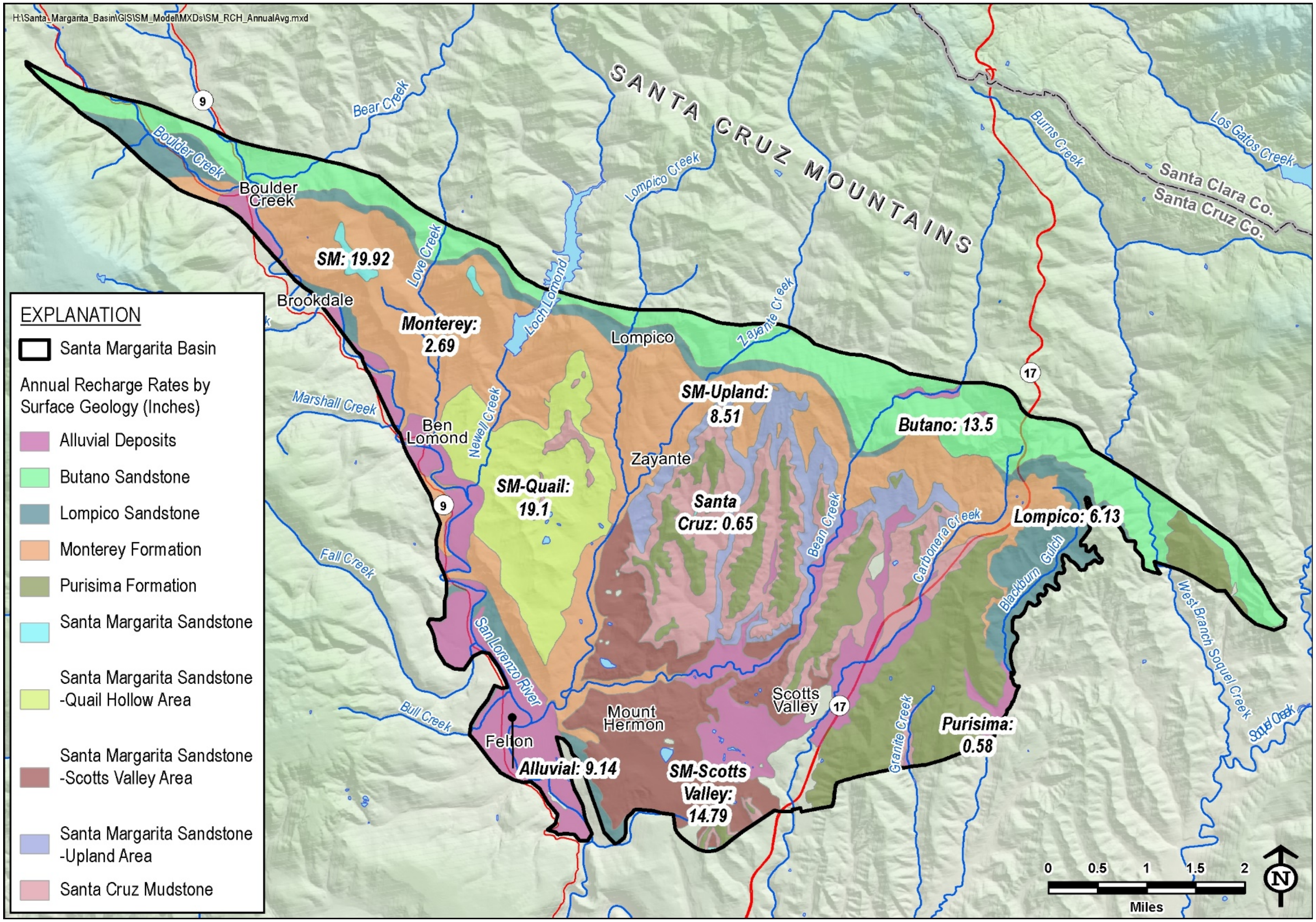


Figure 2. Average Annual Recharge by Surface Geology

5.1.4 Return Flow Recharge

Private well owner return flows comprise return flows generated from septic systems and outdoor irrigation. Figure 3 shows the assumptions made to determine the amount of return flow that recharges groundwater in the model.

Steady-state recharge from return flows in the Scotts Valley area are increased to account for septic system return flows occurring prior to sewering the City of Scotts Valley in the mid-1980s. Residential parcels are assumed to have septic systems and associated septic return flows for the steady-state period using the same assumptions as for private well owners shown in Figure 3.

Updated septic return flows for the M&A model (1,115 AFY average) is higher than in the KJ model (658 AFY average) due to the higher percentage of residential use that becomes return flow as well as the larger overall model area. Return flow averages over the model period are summarized in Table 1.

Table 1. Average Return Flow Recharge Over Model Period

Return Flow Component	Average Over Model Period, Acre-Feet per Year (Water Year 1985 – 2018)
Septic	1,115
Private Residential Landscape Irrigation	4
Landscape Irrigation in SLVWD, SVWD and MHA	26
Landscape Irrigation in Small Water Systems	13
Water System Losses	216
Sewer Losses	30

Return flow recharge updates described in this section addresses EKI recommendation 4 referenced in Section 2.1 in this report.

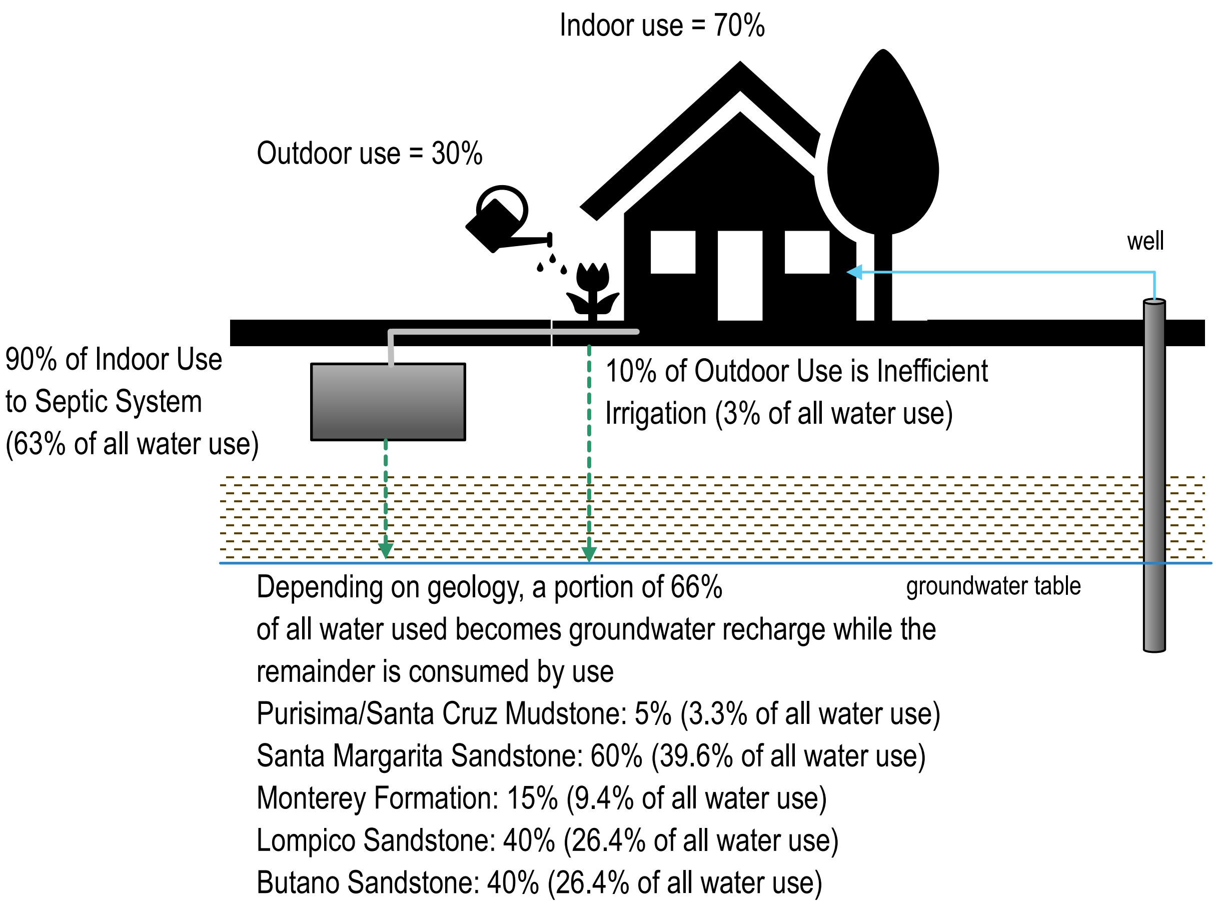


Figure 3. Private Well Owner Return Flow Assumptions

5.1.5 Evapotranspiration

The simulation of ET by MODFLOW is removed in the M&A model because it is factored in the recharge-runoff calculations. Removal of simulated ET addresses EKI recommendation 5 to remove or modify ET package as referenced in Section 2.1 in this report, Purpose of Model Update and Improvements.

The existing model layer structure and cell dimensions are both preserved in the M&A model which addresses EKI recommendation 2 as referenced in Section 2.1 in this report.

5.2 Model Structural Improvements

5.2.1 Model Domain Extension

The model domain is extended to include the Bulletin 118 Department of Water Resources (DWR) basin boundary for the SMGB (DWR, 2018) using a 3D geologic model prepared in Leapfrog Geo (Seequent, 2020). Leapfrog is used to define how lithologic contact surfaces between the hydrogeologic units are defined as numerical model layers in the extended areas. The areas where the numerical model is extended are shown in Figure 4 and described as:

- Northwest extension in the Boulder Creek area where the Zayante and Ben-Lomond faults described in the basin boundary modification report (HydroMetrics WRI, 2016) converge
- Southwest extension to include alluvium associated in the Felton area, west of Ben Lomond Fault, included with the SMGB as part of the basin boundary modification approval by DWR
- South extension to a granitic bedrock high defining part of the shared boundary with the Santa Cruz Mid-County Basin boundary, as described in the basin boundary modification request to DWR (HydroMetrics WRI, 2016)
- East extension: south of the Zayante fault to include the West Branch of Soquel Creek that intersects the Butano aquifer of the Santa Margarita Basin

This addresses EKI recommendation 1 to expand model domain to agree with SMGB boundaries as referenced in Section 2.1 in this report.

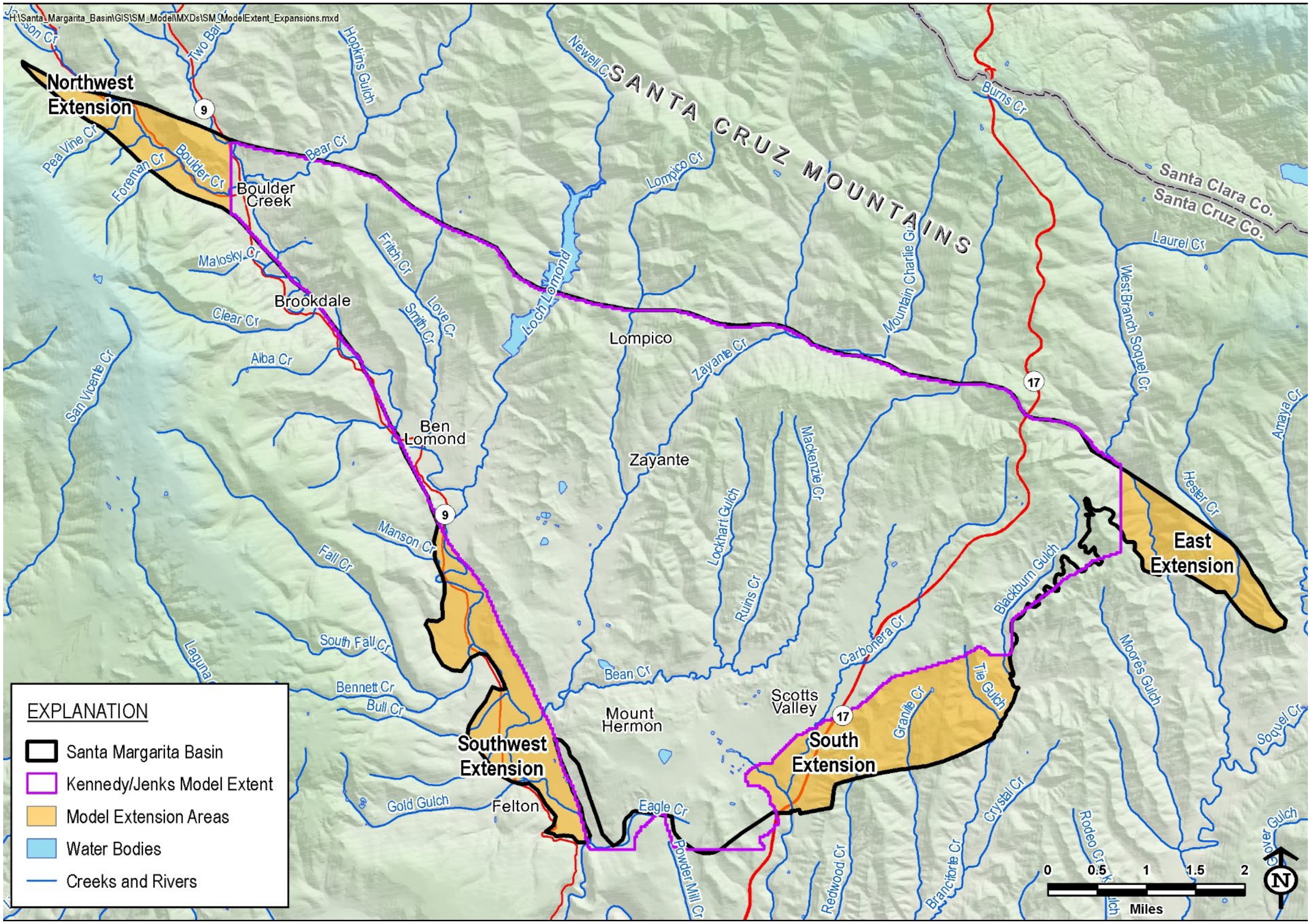


Figure 4. Model Domain Extension Areas

The M&A model extended areas are defined using hydrogeologic cross sections from the SLVWD Water Supply Master Plan (Johnson, 2009), KJ model report (2015), surface geology, selected well lithologic logs, and granitic bedrock derived from a residual gravity elevation map (Roberts et al., 2004). Land surface elevations are extended using a Lidar-generated digital elevation model (DEM) (USGS, 2012a and 2012b).

A summary of hydrogeologic units represented by the model layers in the extension areas follows along with the specific data sources used to define model layer elevations:

- **Northwest extension**: The geologic unit contact surfaces are extended using SLVWD Section C-C', and DEM.
- **Southwest extension**: The Felton area alluvium west of Ben Lomond Fault in the Felton area is a distinct geologic unit deposited on top of the Lompico aquifer Sandstone (Figure 5). Alluvium thicknesses estimated from lithologic logs near Felton vary from about 160 feet near Bean Creek, to about 100-125 feet near San Lorenzo River, and it pinches out to the west where the Lompico aquifer sandstone outcrops. Model layer elevations are based on Johnson (2009) cross sections A-A' and D-D', the extended DEM, surface geology maps, and lithologic logs from eight wells located west of Ben Lomond Fault. Alluvium is incorporated as part of layer 1 in the model and has its own set of hydraulic properties because it is not a part of the Santa Margarita aquifer.
- **South extension**: The geologic unit contact surfaces are extended using lithologic logs of wells in the extension area, granite bedrock elevation contour map, and DEM.
- **East extension**: The geologic unit contact surfaces are extended using granitic bedrock contours derived from a residual gravity elevation map (Roberts et al., 2004), and Johnson (2009) section A-A'.

With only 2 exceptions, the updated model layers within the existing KJ model domain are consistent with the KJ model. The resulting lithologic contacts match the existing bottom elevations of the KJ model layers. One exception occurs for model Layer 7 near the Santa Cruz Mid-County Basin boundary, where the bottom elevations of KJ model Layer 7 (Lower Butano aquifer-granitic bedrock contact) is merged with data from granitic bedrock contours derived from a residual gravity elevation map (Roberts et al., 2004) that covers the south and southeast edges of the model. A second exception occurs where bottom of Layer 7 matches this bedrock contour map that extends above the bottom layers of the KJ model near Mount Hermon. General head boundaries that used to run along the Mid-County Basin boundary were also switched to no-flow boundaries based on historically stable water levels in the area and the conceptualization of the granitic high representing a flow divide between the 2 basins.

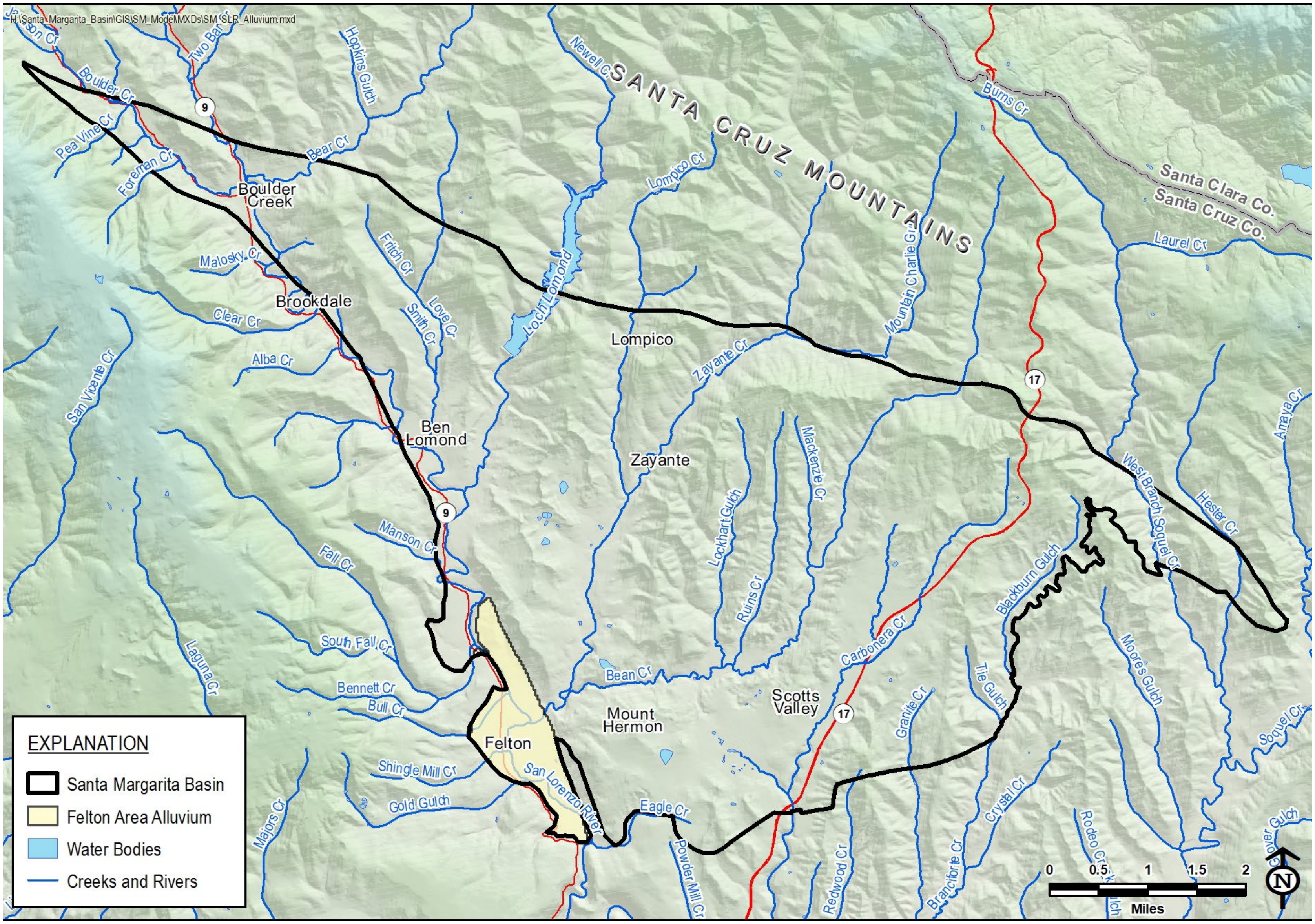


Figure 5. Felton Area Alluvium

5.2.2 Model Pinch-Out Implementation

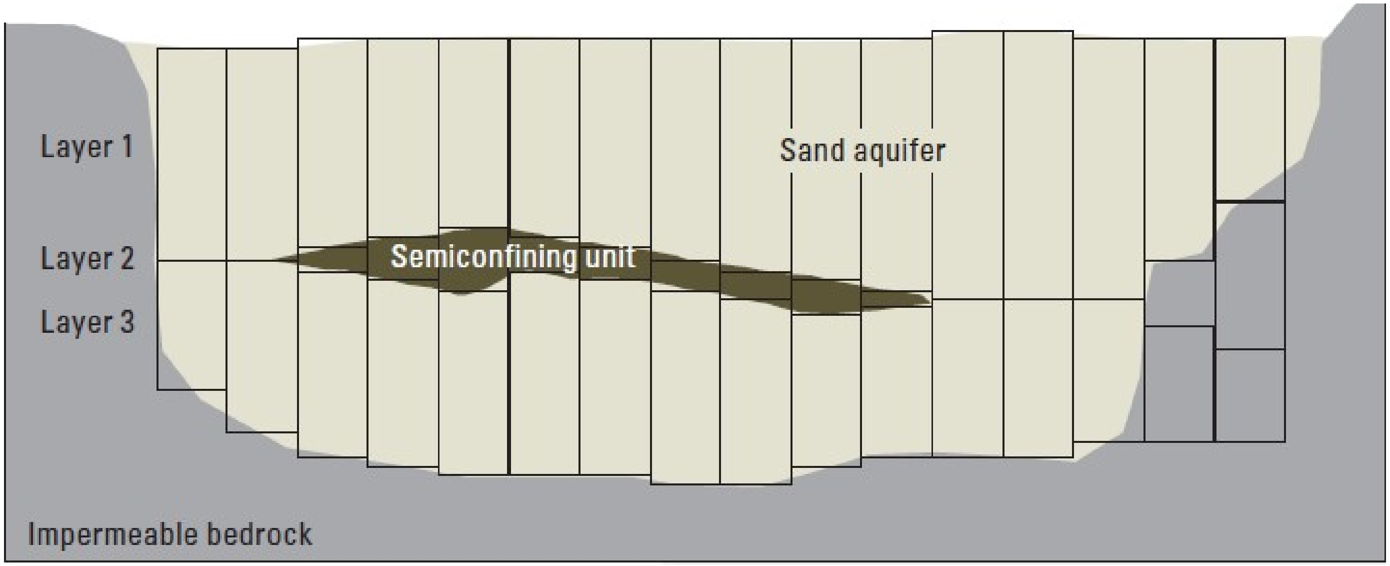
Pinch-outs were previously implemented using the horizontal flow barrier (HFB) package. MODFLOW6 introduces the ability to assign pass-through cells which routes flow between the over- and underlying cells of the pass-through cell (Figure 6). The HFB package has been removed and pass-through cells are assigned to the same areas of pinch-outs in each layer as the KJ model. Figure 7 and Figure 8 summarize pinch-out area delineations for Monterey Formation and Butano aquifer. Pass-through cells allow for quicker model performance as no extra cells are simulated to account for pinch-outs.

5.2.3 Stream Network Updates

The stream network properties of the Streamflow Routing (SFR) package are preserved within the KJ model domain. Additional stream segments are added to model extension areas. The San Lorenzo River (SLR) was represented in the KJ model using the River (RIV) package but is now added to the SFR package in the M&A model due to availability of calibration data for seepage and streamflow. The RIV package for Loch Lomond Reservoir is preserved due to limited calibration data. General Head Boundary (GHB) cells are no longer used along SMGB basin boundaries. GHB cells that represent springs and seeps are preserved to simulate flow into Butano aquifer. Springs and seeps represented by the Drain (DRN) package in the existing model are retained. Figure 9 shows the updated stream network.

New segments are assigned bottom elevations at the first and last reach via LiDAR. New segment stages are set 2 feet above bottom elevation. Conductance values are calibrated, but initial values for stream width, length, and streambed thickness are set to 10, 100, and 1 ft, respectively. Roughness coefficients are maintained at 0.035 for all segments. Initial stream conductivities from previous model are maintained and range from 0.005 to 15 ft/day. Stream conductivity for new segments is initialized to 5 ft/day.

MODFLOW6 includes the MVR package which allows the routing of water between different water flow packages. The updated DRN package is linked to the SFR with the MVR package to route flows from springs and seeps to the stream network. MVR package is set up to route DRN flows with monthly factors representing percentage of flow to be routed that vary based on location and water year type. Monthly factors applied to model cells representing springs and seeps listed in Table 2 are shown in relation to the stream network on Figure 10.



Layer 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Layer 2	–1	–1	1	1	1	1	1	1	1	1	1	–1	–1	–1	0	0
Layer 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0

EXPLANATION

IDOMAIN codes

>0 Included cell
=0 Excluded cell
<0 Excluded pass-through cell

Source: Figure 3-3 in Documentation for the MODFLOW6 Groundwater Flow Model (Langevin et al., 2017)

Figure 6. Pass-through Cell Representation in MODFLOW6

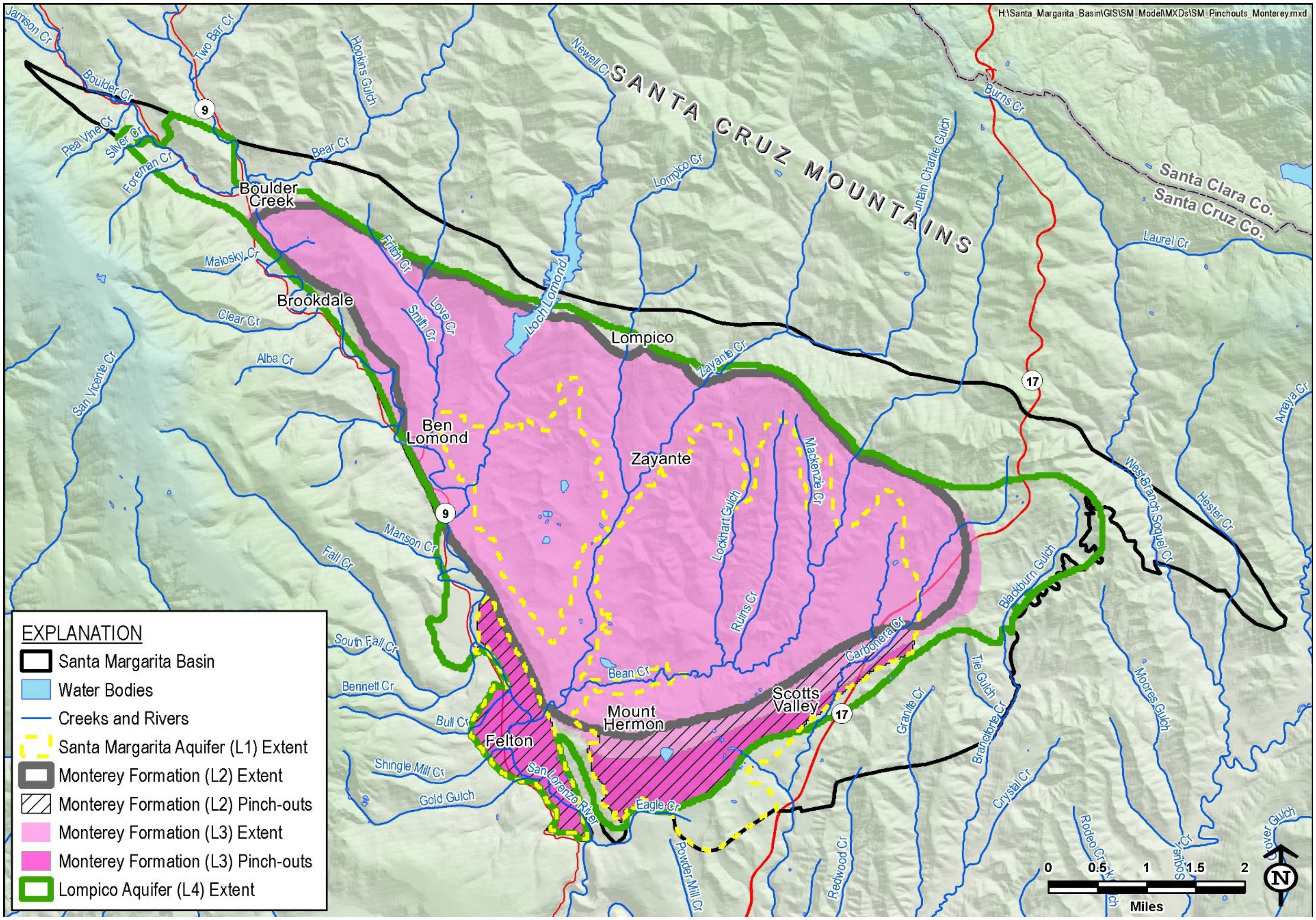


Figure 7. Pinch-out Area Delineation for Monterey Formation

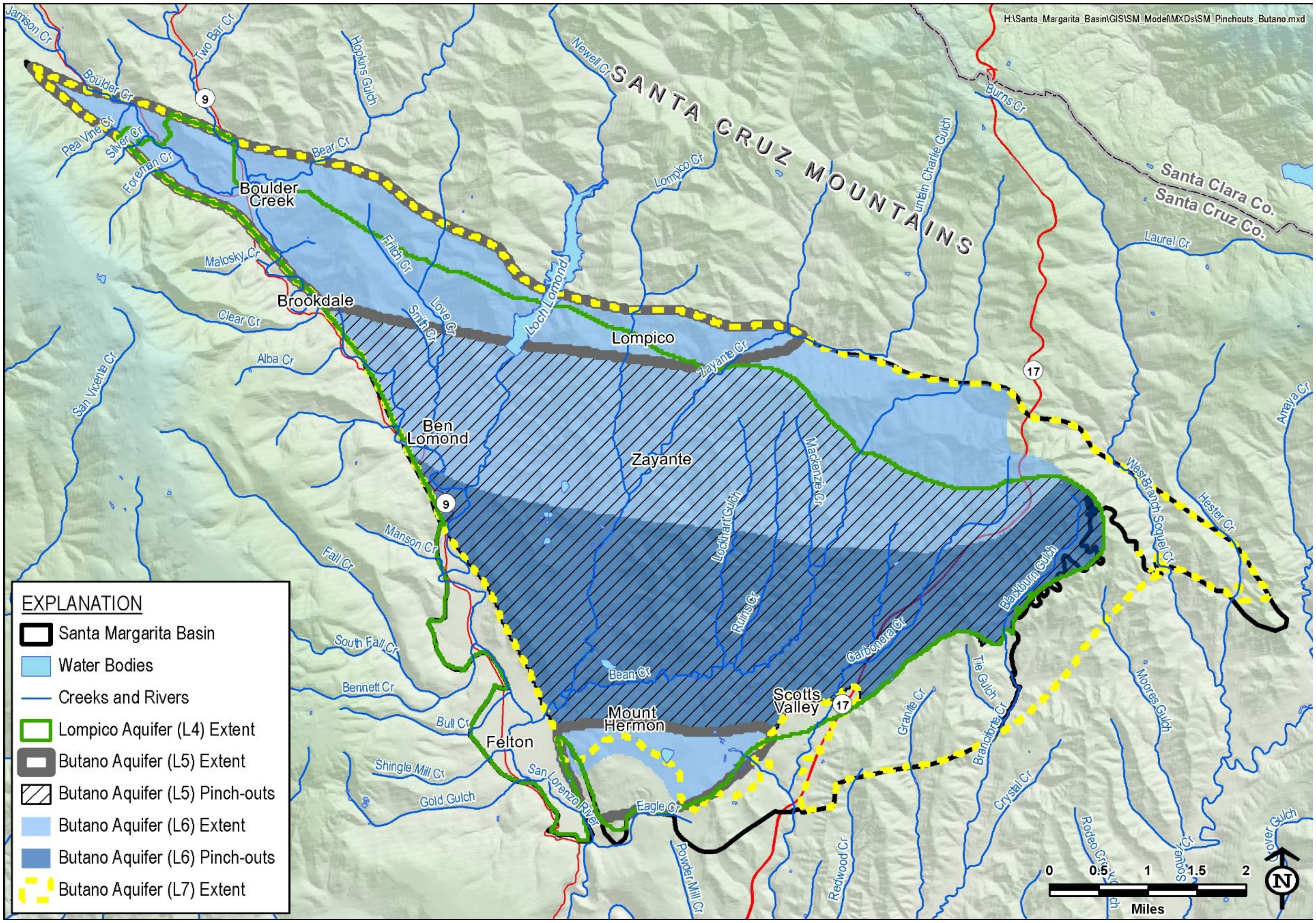


Figure 8. Pinch-out Area Delineation for Butano Aquifer

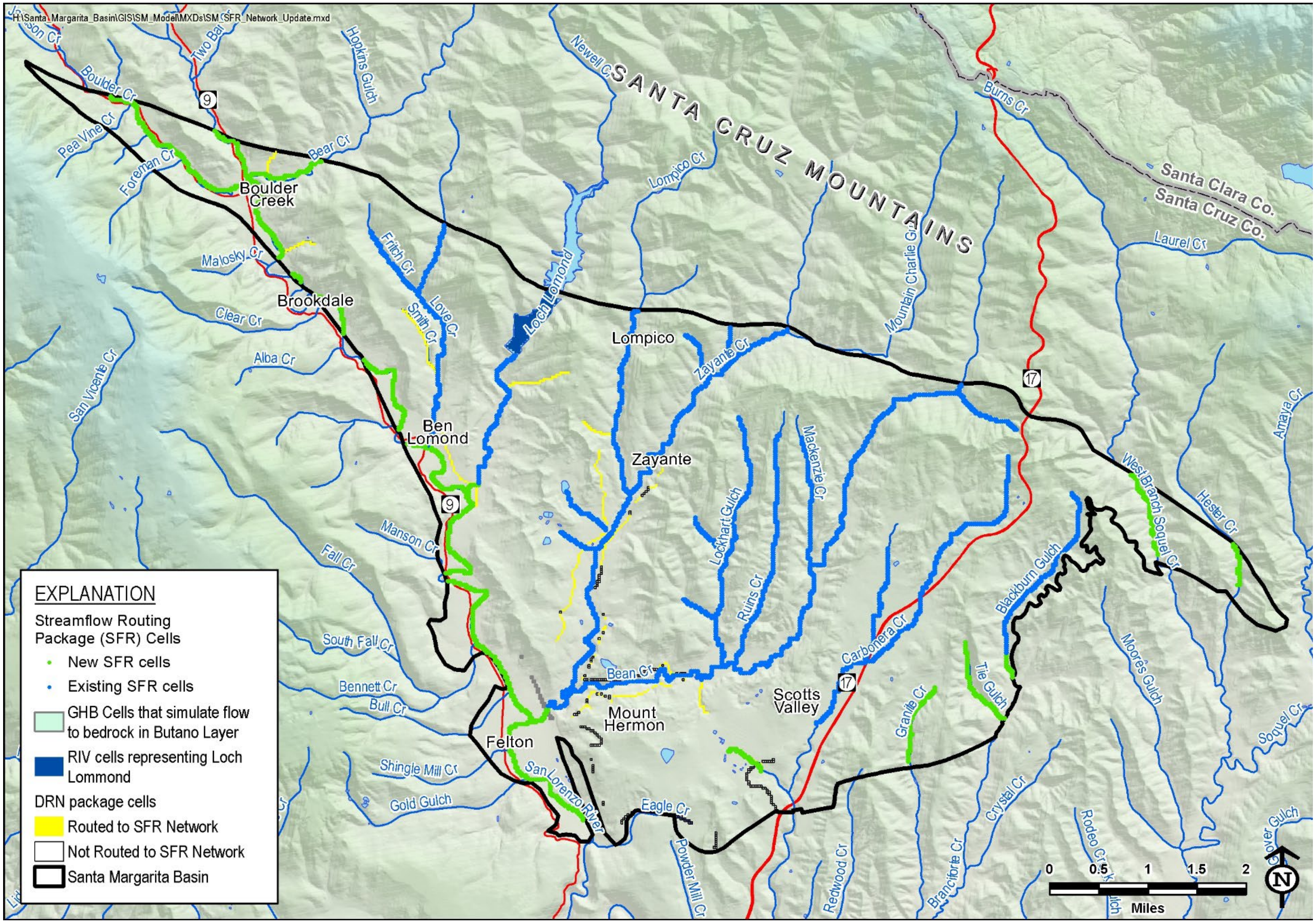


Figure 9. Updated Stream Network

Table 2. DRN Cell Factors

Cluster	Water Year Type	May	Jun	Jul	Aug	Sep	Oct	Nov - Apr
Spring Creek Gulch	Wet	0.80	0.80	0.75	0.75	0.75	0.75	1.00
	Normal	0.75	0.75	0.75	0.70	0.70	0.70	1.00
	Dry	0.75	0.70	0.65	0.55	0.40	0.40	1.00
	Critically Dry	0.65	0.60	0.50	0.40	0.30	0.30	1.00
Quail Hollow \ (San Lorenzo River side)	Wet	0.90	0.85	0.75	0.70	0.65	0.65	1.00
	Normal	0.85	0.85	0.75	0.70	0.60	0.60	1.00
	Dry	0.80	0.75	0.70	0.60	0.50	0.50	1.00
	Critically Dry	0.70	0.65	0.55	0.45	0.40	0.40	1.00
Quail Hollow (Zayante Creek side)	Wet	0.90	0.80	0.70	0.60	0.50	0.50	1.00
	Normal	0.85	0.75	0.60	0.50	0.35	0.35	1.00
	Dry	0.75	0.65	0.55	0.40	0.30	0.30	1.00
	Critically Dry	0.65	0.55	0.45	0.30	0.20	0.20	1.00
Canham-Glenwood	Wet	0.95	0.90	0.75	0.65	0.65	0.65	1.00
	Normal	0.90	0.80	0.65	0.60	0.55	0.55	1.00
	Dry	0.80	0.65	0.60	0.45	0.35	0.35	1.00
	Critically Dry	0.65	0.60	0.55	0.35	0.20	0.20	1.00
Mid-Zayante Creek	Wet	0.95	0.90	0.85	0.80	0.80	0.80	1.00
	Normal	0.95	0.90	0.85	0.80	0.80	0.80	1.00
	Dry	0.90	0.85	0.80	0.80	0.75	0.75	1.00
	Critically Dry	0.75	0.75	0.65	0.65	0.65	0.65	1.00
Mt Hermon-Bean Creek	Wet	0.95	0.90	0.85	0.85	0.75	0.75	1.00
	Normal	0.95	0.90	0.85	0.80	0.75	0.75	1.00
	Dry	0.90	0.90	0.85	0.80	0.75	0.75	1.00
	Critically Dry	0.85	0.85	0.80	0.80	0.75	0.75	1.00
Manana-Shadow Oaks	Wet	0.95	0.90	0.85	0.85	0.75	0.75	1.00
	Normal	0.95	0.90	0.85	0.80	0.75	0.75	1.00
	Dry	0.90	0.90	0.85	0.80	0.75	0.75	1.00
	Critically Dry	0.85	0.85	0.80	0.80	0.75	0.75	1.00
Skypark	Wet	0.85	0.80	0.75	0.70	0.70	0.70	1.00
	Normal	0.75	0.75	0.70	0.65	0.65	0.65	1.00
	Dry	0.75	0.70	0.70	0.65	0.65	0.65	1.00
	Critically Dry	0.70	0.60	0.60	0.55	0.55	0.55	1.00

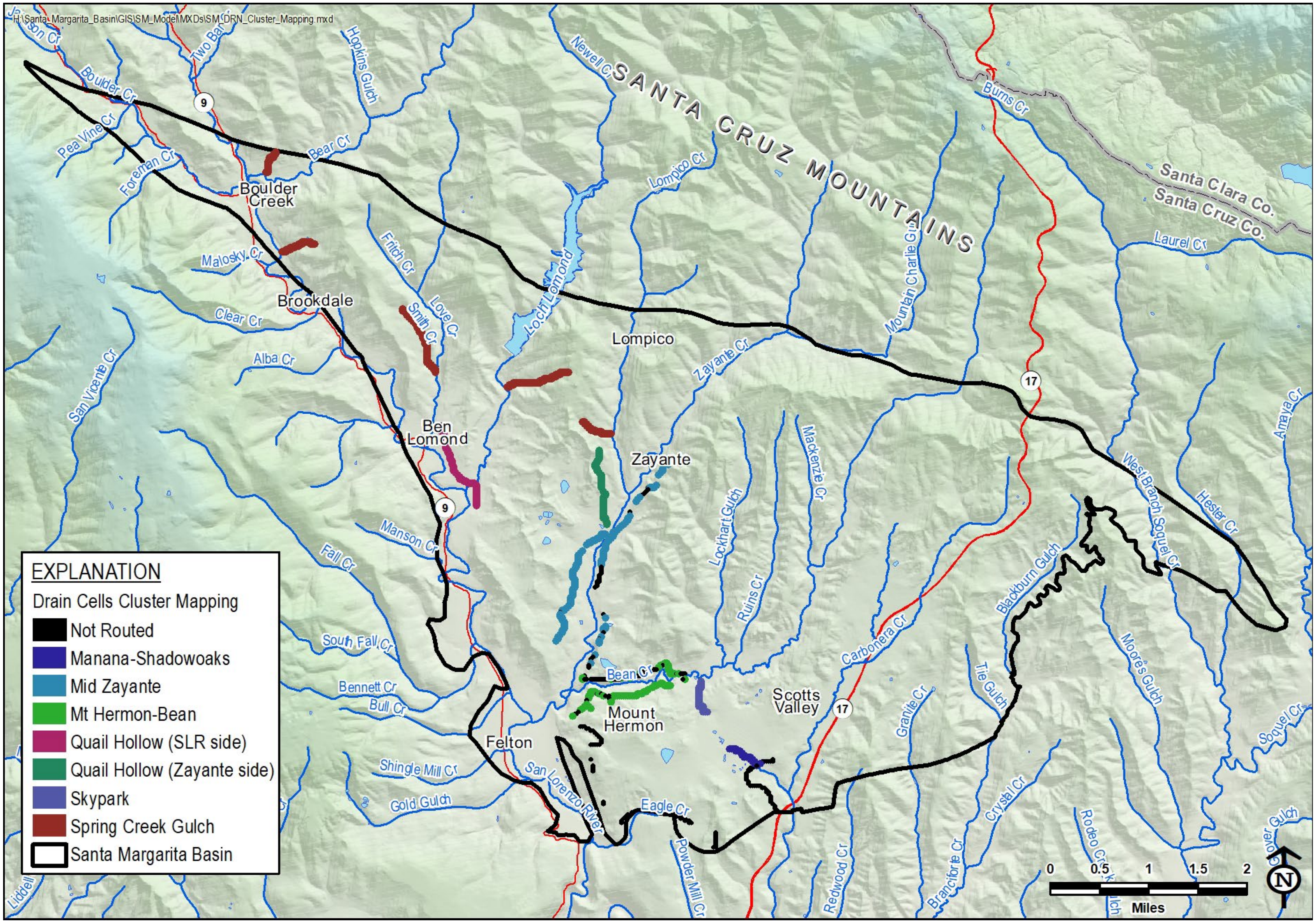


Figure 10. Drain Cluster Locations

5.2.4 Hydraulic Conductivity Updates

The KJ model implemented vertical hydraulic conductivity as part of the leakance property in Groundwater Vistas (GWV) with slightly different property zones than horizontal hydraulic conductivity. The updated SMGB model implements vertical hydraulic conductivity using anisotropy so a relationship between horizontal and vertical conductivity can be maintained over the same zones. This allowed for more efficient calibration during parameter estimation.

Hydraulic property zone values from the KJ model (2015) calibration were preserved as initial values. Hydraulic properties for the extended areas (Figure 4) are as follows:

- **Northwest extension**: Lompico aquifer and Butano aquifer hydraulic property zones are extended from the existing domain.
- **Southwest extension**: Lompico aquifer hydraulic property zones are extended from the existing domain and an additional hydraulic conductivity zone is added to represent the alluvium (Figure 5) since it is a layer that separates creeks with Lompico aquifer and it is not part of the Santa Margarita aquifer.
- **South extension**: Butano aquifer hydraulic properties are extended from existing domain.
- **East extension**: Butano aquifer hydraulic properties are extended from the existing domain.

The hydraulic property updates described address EKI recommendation 3 to revise water transmitting parameters as referenced in Section 2.1 in this report.

6 MODEL CALIBRATION

Model calibration is split into surface water and groundwater calibration. Additional datasets for model calibration include monthly groundwater levels, daily streamflow measurements, and accretion studies. PEST++ (2020) software suite was used along with manual trial and error to perform parameter estimation using calibration data. Methods and results described in this section address EKI recommendations 3 and 8 to revise water transmitting parameters and to update calibration as referenced in Section 2.1 in this report.

The level of calibration is appropriate for use of the model in estimating water budgets in the GSP and evaluating expected sustainability benefits of projects and management actions. Further refinement may be needed to support more detailed planning of projects and management actions. The calibration presented here is potentially non-unique; other combinations of parameter values may equivalently match calibration data. We also recommend evaluating predictive uncertainty when using the model for more detailed planning of projects and management actions.

6.1 Calibration Methods

6.1.1 Surface Water Calibration

Stream conductance is the primary parameter that is estimated for surface water calibration. Daily streamflow data throughout the model period from WY1985 through WY2018 was collected from the following locations:

- SLVWD: Boulder Creek and Lompico Creek
- Santa Cruz County: Bean Creek near Mount Hermon Camp and Zayante Creek at Woodwardia
- USGS: Bean Creek near Mount Hermon Road, Zayante Creek, Carbonera Creek, and San Lorenzo River at Big Trees

Streamflow data is aggregated into average monthly streamflow in cubic feet per second (cfs) and used as calibration targets for simulated outflows for a total of 978 streamflow targets.

Stream seepage gains and losses are processed from accretion studies by Balance Hydrologics for Bean Creek in June 2010 and San Lorenzo River in September 2017. A total of 17 seepage calibration targets are compared to the simulated stream groundwater discharge. The stream network is discretized into 26 conductance zones that are estimated in PEST using the described streamflow and seepage data. Figure 11 shows the stream gauge locations, accretion study points, and conductance zones used for surface water calibration.

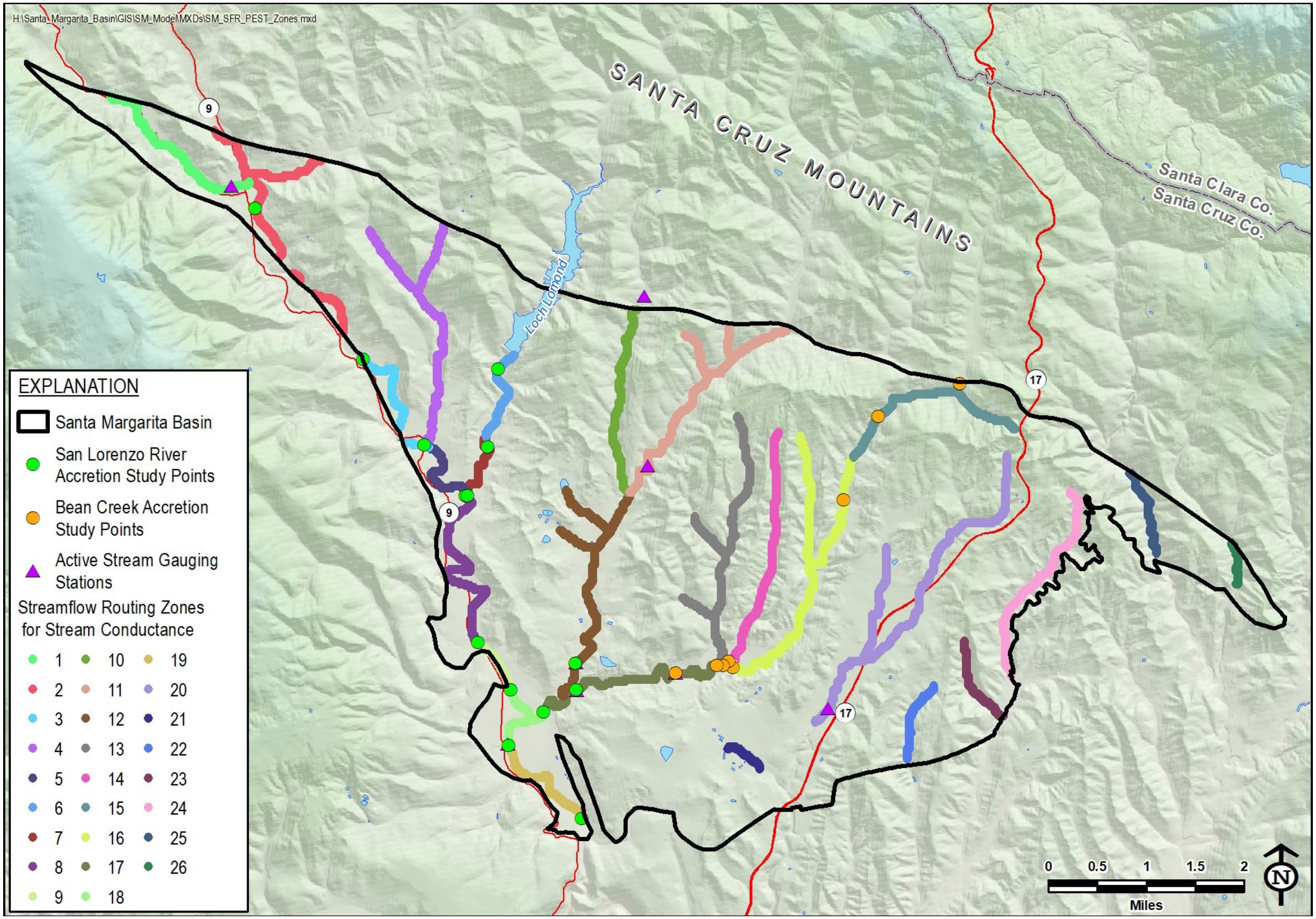


Figure 11. Streamflow Routing Network in Updated Model including Parameter Zones and Locations of Stream Gauges Used for Calibration

6.1.2 Groundwater Calibration

Groundwater level data for the whole model period from WY1985 through WY2018 is sourced from the database provided by SVWD and has been processed as average monthly groundwater levels for a total of 59 target wells with 5621 targets. Target wells are selected based on spatial distribution, and consistency and period of record of groundwater level measurement. Groundwater elevation targets are used to calibrate horizontal (Kx) and vertical hydraulic conductivity (Kz) and specific yield (Sy) and specific storage (Ss). There are 69 zones each for Kx and Kz and 23 zones for both Sy and Ss across all 7 layers of the model. PEST++ adjusted all parameters zones to achieve best fit to all groundwater level targets with calibration also informed by manual trial and error runs.

6.2 Calibration Results

6.2.1 Surface Water Calibration Results

Table 3 lists the final parameter values for stream conductance for each zone shown in Figure 11.

Table 3. Calibrated Streamflow Conductance

Stream Conductance Zone	Stream Conductance (ft²/day)	Stream Conductance Zone	Stream Conductance (ft²/day)
1	11.70	14	0.01
2	3.34	15	0.04
3	2.24	16	7.70
4	0.27	17	0.01
5	1.33	18	1.21
6	0.73	19	3.65
7	1.99	20	0.07
8	6.85	21	3.52
9	14.98	22	0.16
10	0.25	23	0.13
11	0.47	24	42.33
12	8.46	25	2.20
13	0.01	26	2.18

Streamflow calibration shows a good fit for Zayante Creek at Woodwardia (Figure 15), Bean Creek at Mount Hermon Camp (Figure 17), Carbonera Creek (Figure 18), and San Lorenzo River at Big Trees (Figure 19). Lompico Creek (Figure 13) indicates that the model simulates streamflow above 0.4 cfs. Base flows is underestimated for Boulder Creek (Figure 12) and is overestimated within 1 cfs for Zayante Creek (Figure 14) and Bean Creek near Mt Hermon Rd. (Figure 16).

Model calibration for streamflow is sufficient because baseflows trends are simulated within 1 cfs on all gauges except for Boulder Creek (Figure 12). The model can be used to estimate surface water components of the water budget and provide the best available estimate of streamflow depletion from pumping. Additional streamflow data from new gauges in areas of interest would help improve model calibration.

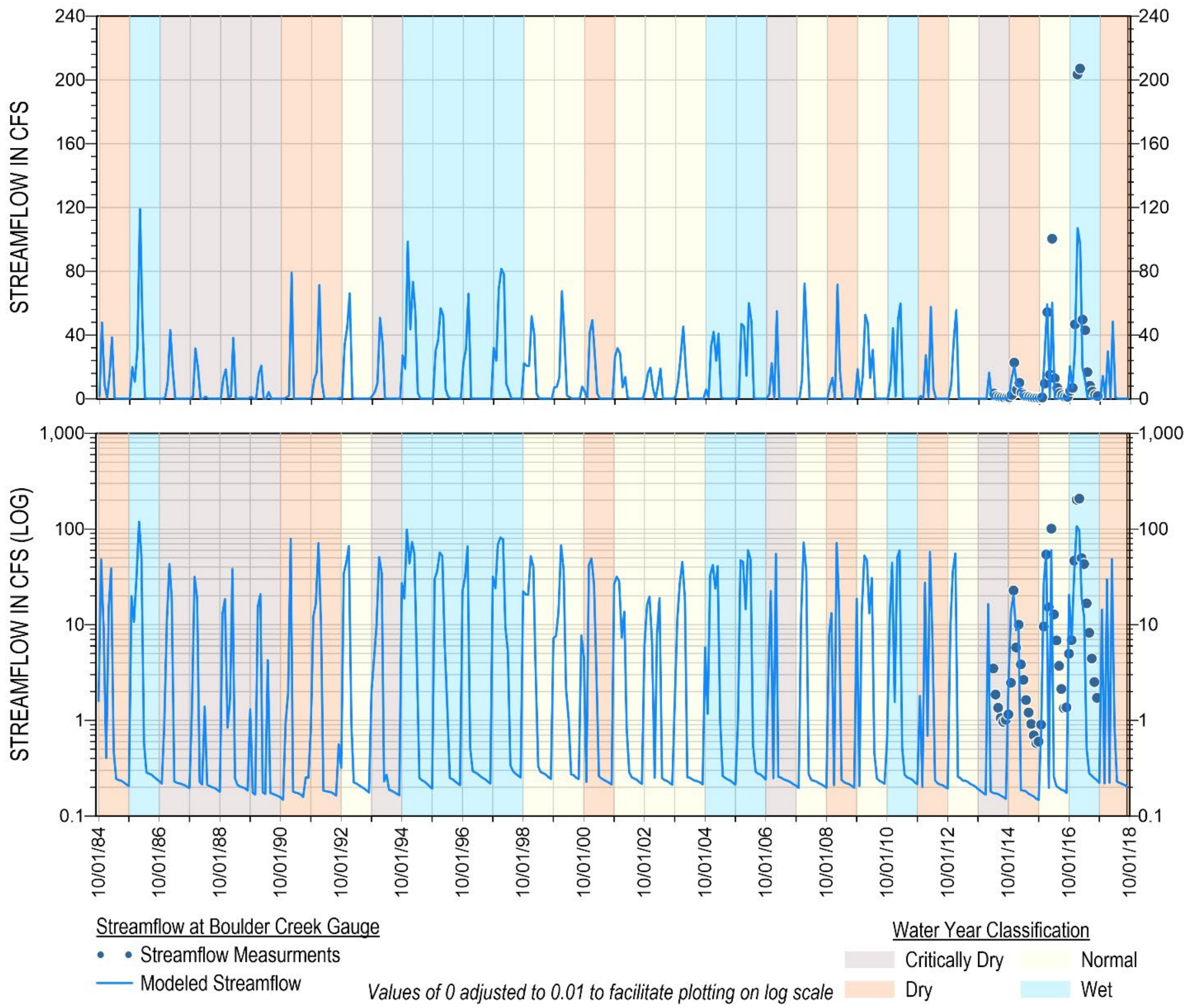


Figure 12. Boulder Creek Gauge Streamflow Hydrograph

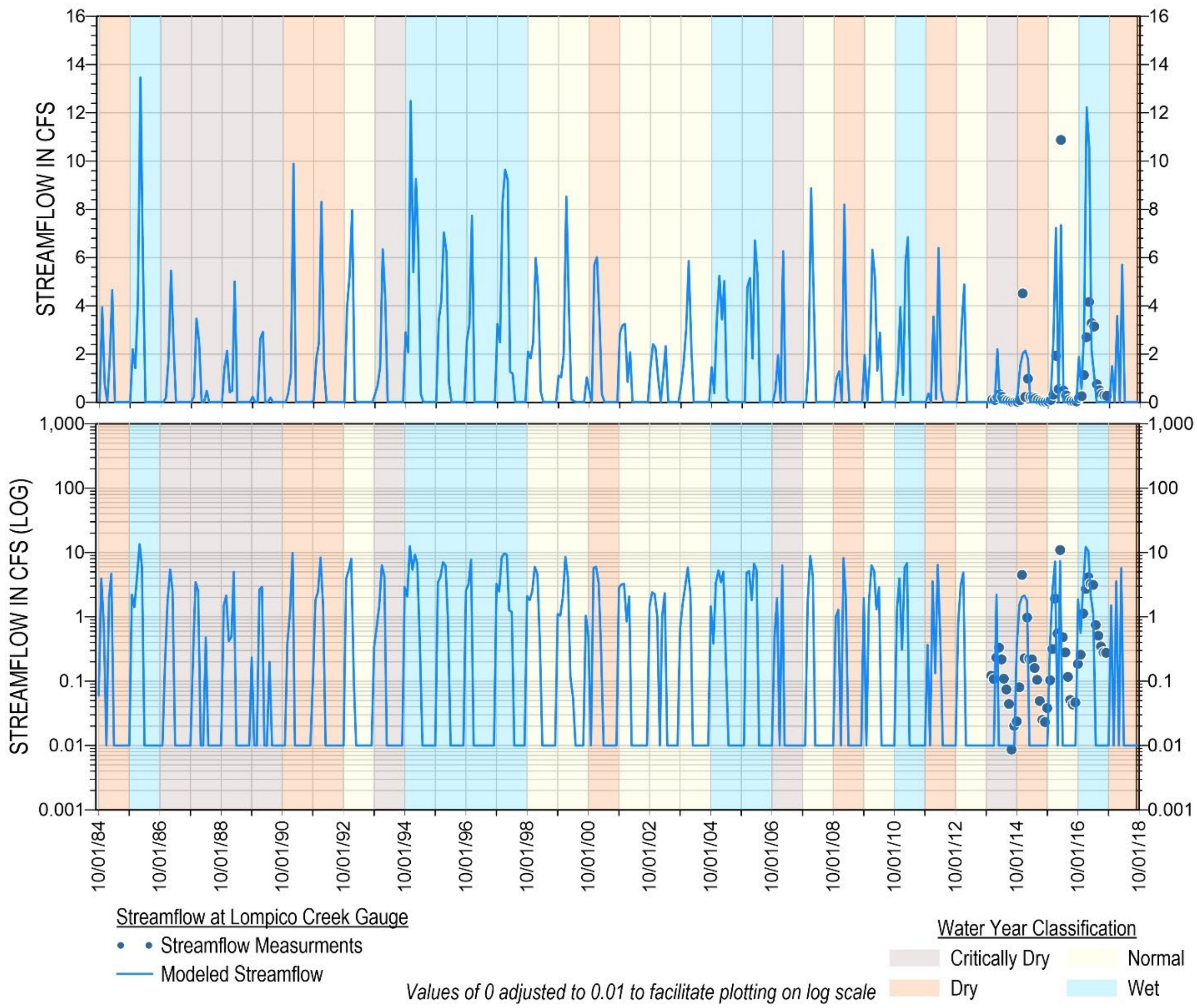


Figure 13. Lompico Creek Gauge Streamflow Hydrograph

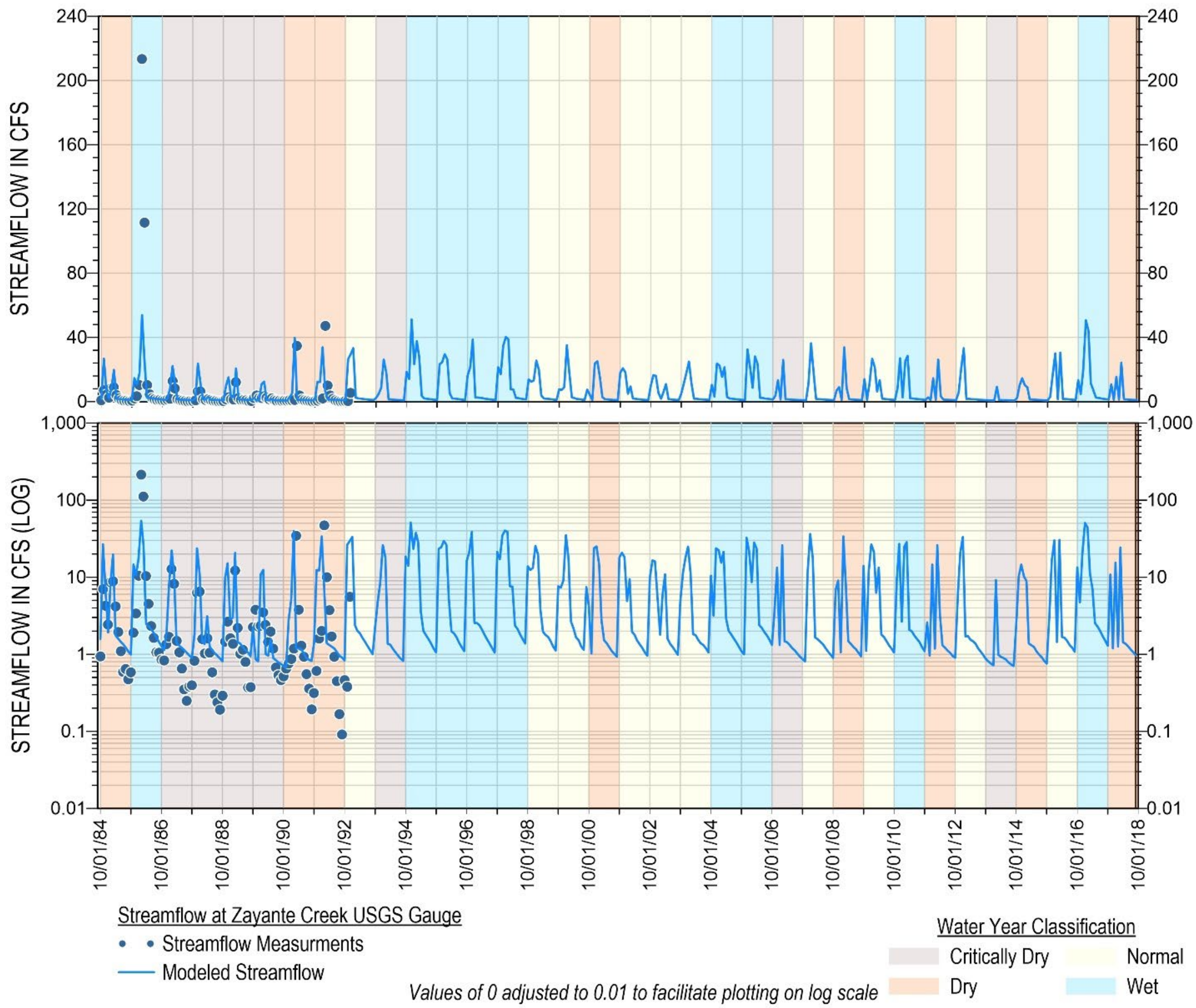


Figure 14. Zayante Creek USGS Gauge Streamflow Hydrograph

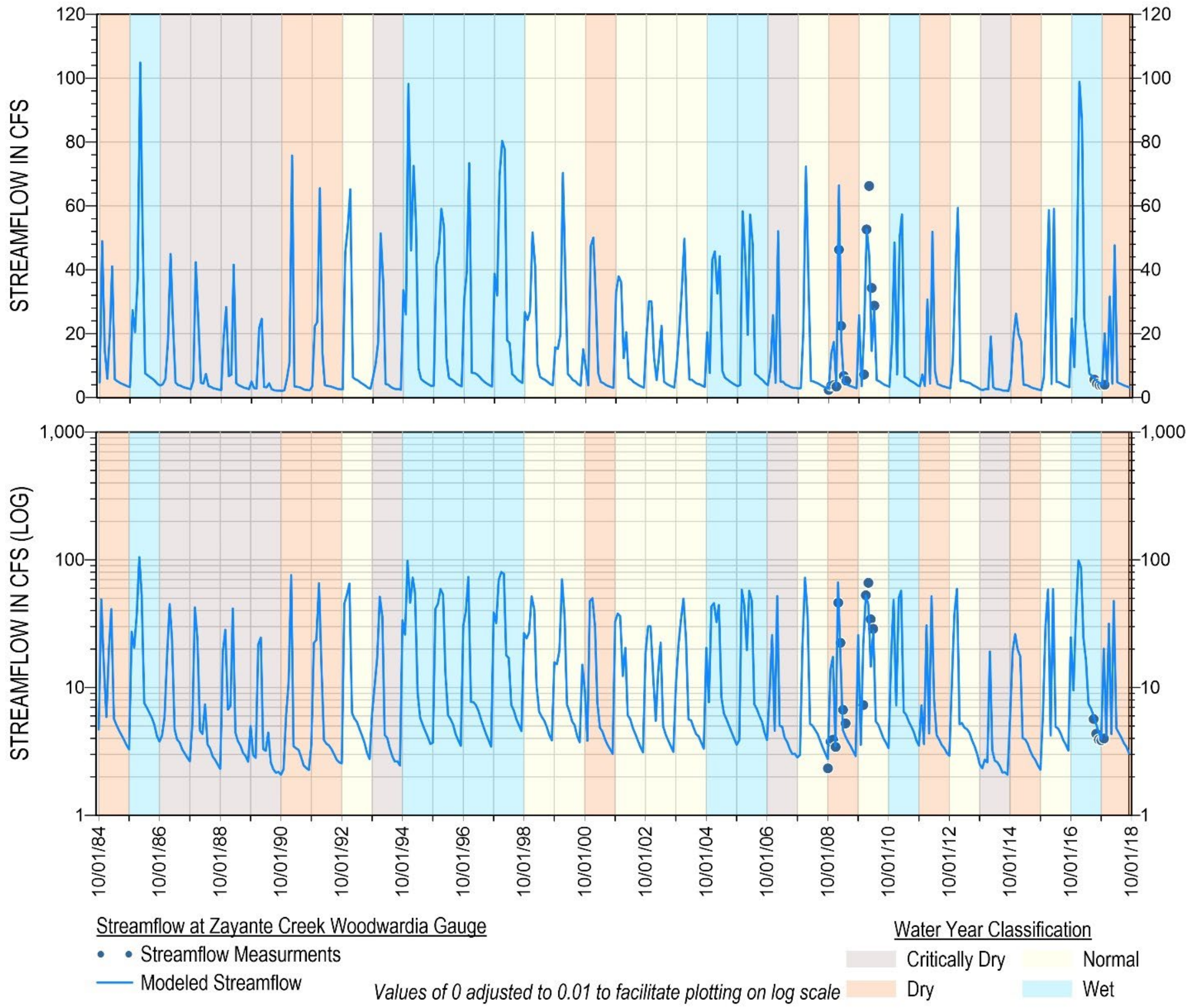


Figure 15. Zayante Creek Woodwardia Gauge Streamflow Hydrograph

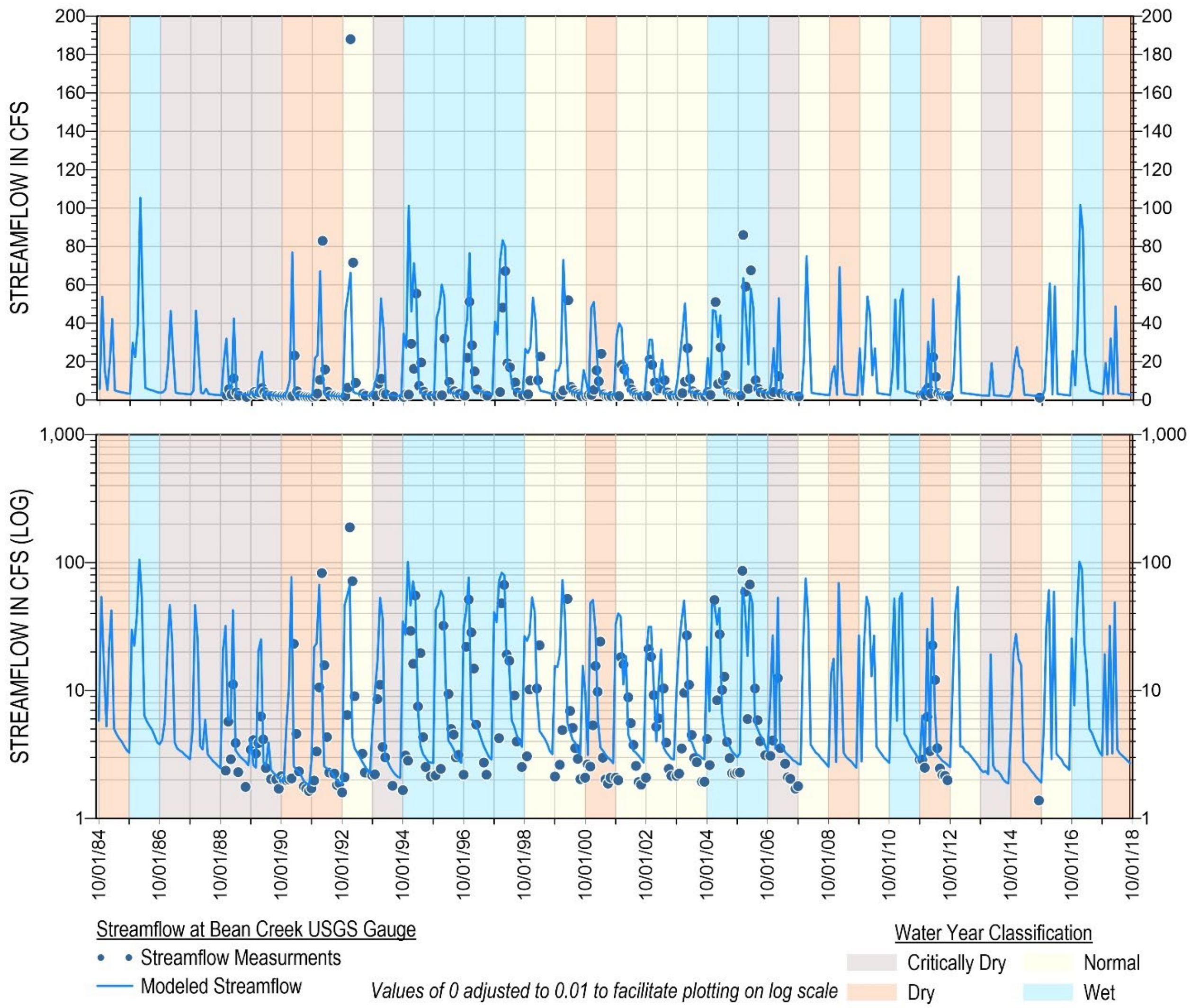


Figure 16. Bean Creek Near Mount Hermon Road Gauge Streamflow Hydrograph

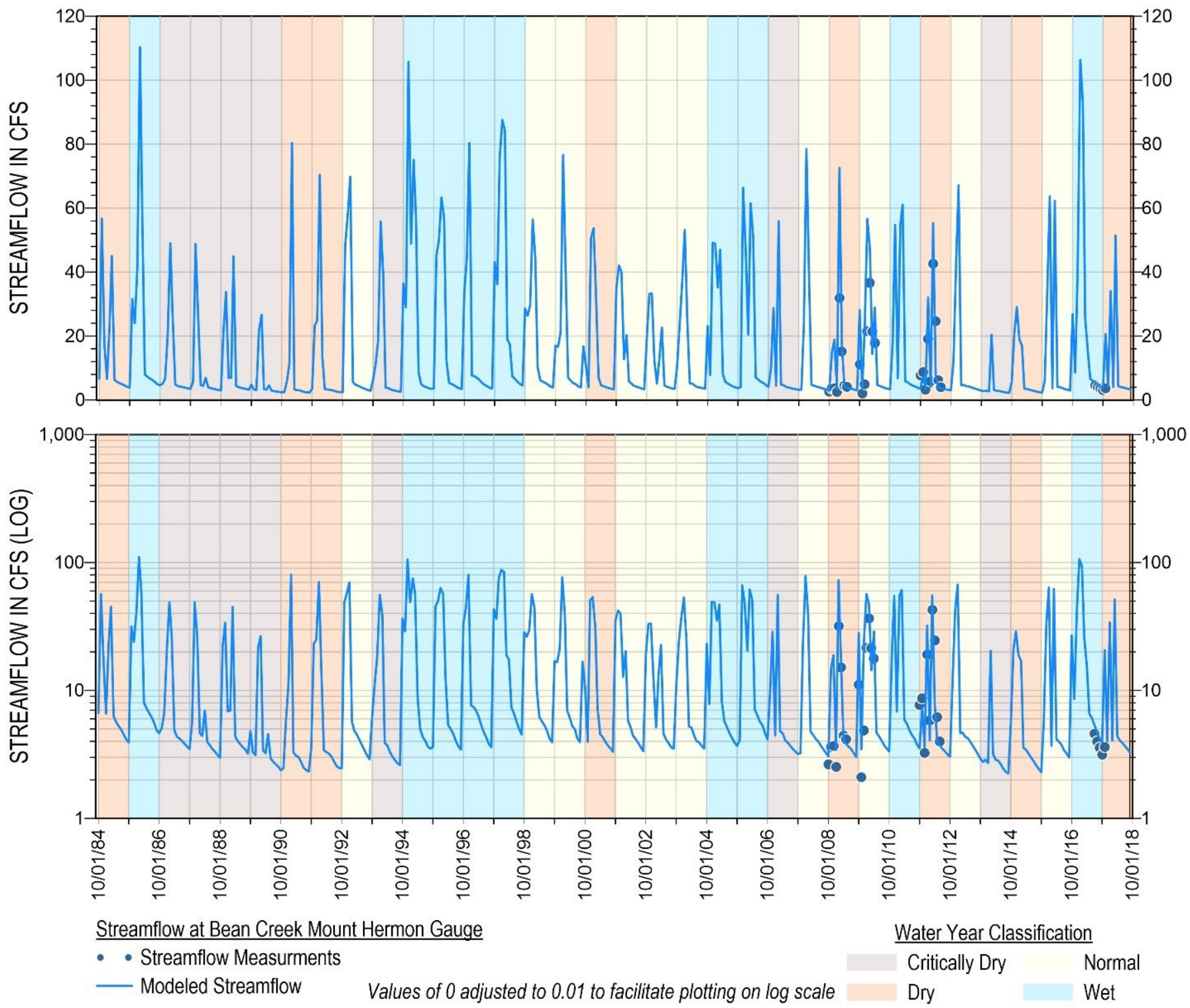


Figure 17. Bean Creek At Mount Hermon Camp Gauge Streamflow Hydrograph

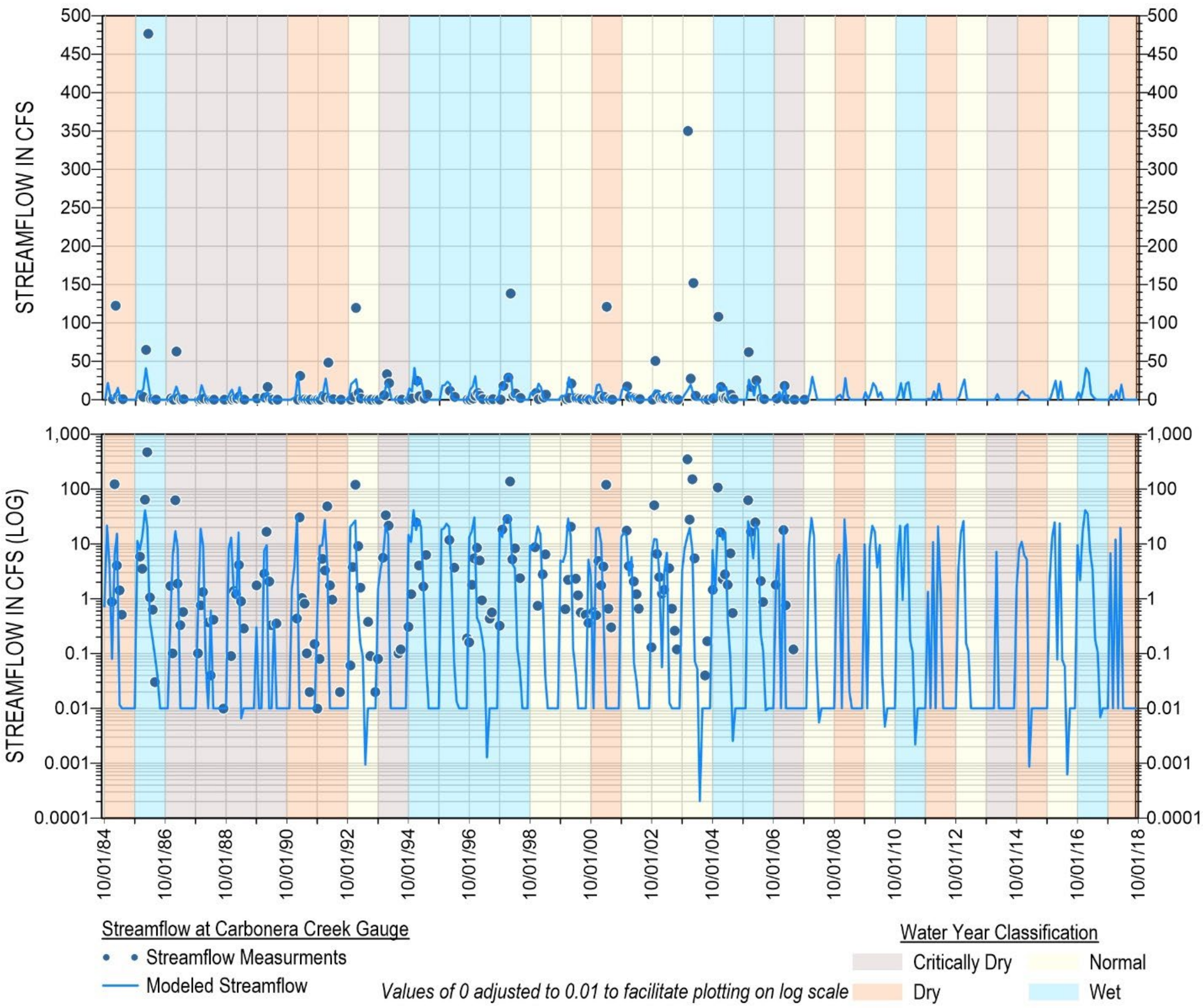


Figure 18. Carbonera Creek Gauge Streamflow Hydrographs

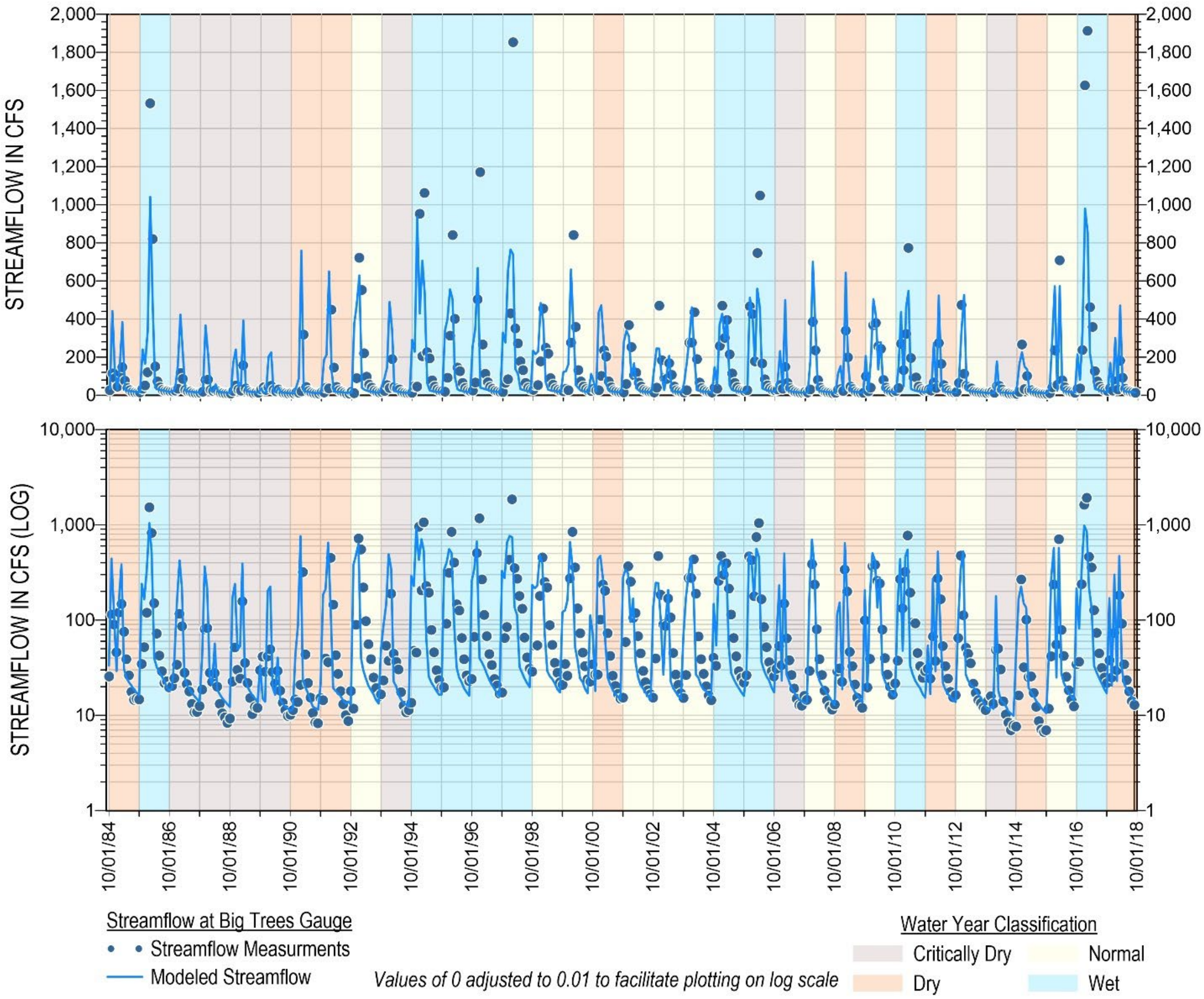


Figure 19. San Lorenzo River Big Trees Gauge Streamflow Hydrograph

Measured seepage is intended to be used for qualifying streams as gaining or losing. Simulated seepage is output on a cell-by-cell basis while measured seepage represents total seepage between 2 accretion points. Simulated seepage at each stream cell is extrapolated by multiplying cell-by-cell results by the number of stream cells between the 2 accretion points that bound the stream cells. This allows for a more similar comparison of magnitudes between measured and simulated as well as more granular identification of where the model simulates as gaining and losing.

Figure 20 compares measured to extrapolated seepage for SLR for September 2017. Stream gains are accurately simulated in Newell Creek and underestimated in Zayante Creek. San Lorenzo River gains are accurately simulated except for the stretch after the confluence with Zayante Creek where loss was simulated instead. Simulated seepage at the Big Trees gauge is overestimated compared to the neutral flows indicated by measured data but flows near Big Trees are typically large (Figure 19) and the measured data might not be a representative average.

Measured seepage for Bean Creek for June 2010 (Figure 21) shows gaining segments at the first and last segments with the middle segments as losing. Simulated seepage for Bean Creek shows stretches of gaining and losing in the middle segments with higher magnitudes which indicate more variation along segments than indicated by measured data.

Additional accretion data is provided by Balance Hydrologics for September 2019 to represent more recent trends. Simulated seepage for September 2019 is extracted from the predictive baseline simulation described in Section 7.2 and shows similar results to simulated seepage in June 2010. Measured data indicates dominantly gaining streams throughout Bean Creek which generally matches simulated trends (Figure 22).

The model calibration is sufficient for the purposes of evaluating stream conditions as gaining or losing which is the intention of measured seepage. Simulated seepage generally matches the direction of measured seepage along stream reaches with seepage data and additional accretion studies would help improve overall calibration.

Stream conductance zones 21-26 are along stream reaches that are not connected to any streamflow or seepage calibration points and there are relatively few groundwater level data in the area. Therefore, stream-aquifer flows for the eastern part of the Basin are not well calibrated. Stream conductance zone 24 represents the Upper Blackburn Gulch area near the edge of the model and has the highest conductance to better simulate high groundwater levels in the Butano aquifer. Streamflow or seepage data would be needed to better evaluate whether the stream is a source of recharge or whether there is another explanation for high groundwater levels in the area.

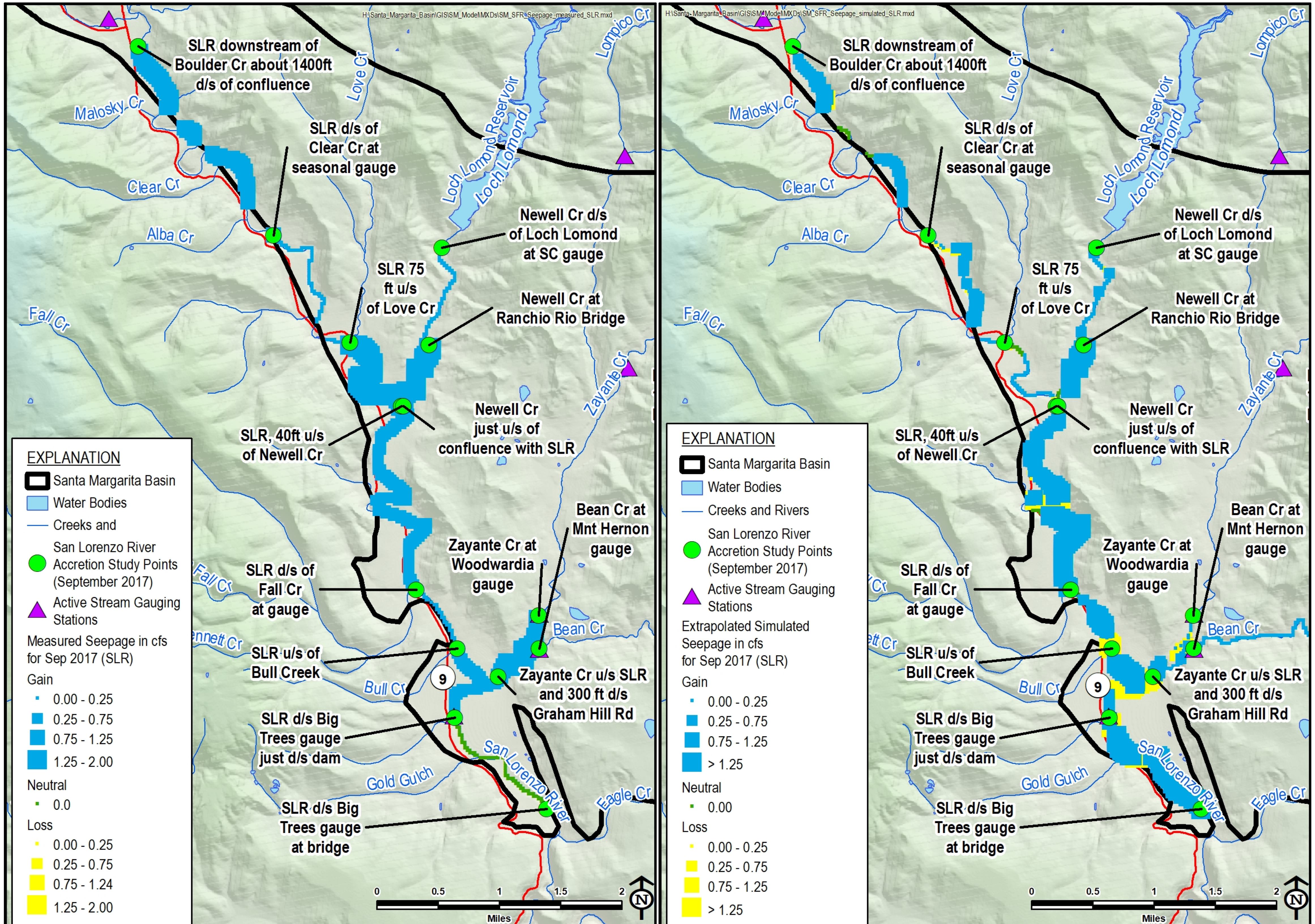


Figure 20. Measured and Extrapolated Simulated Seepage for San Lorenzo River

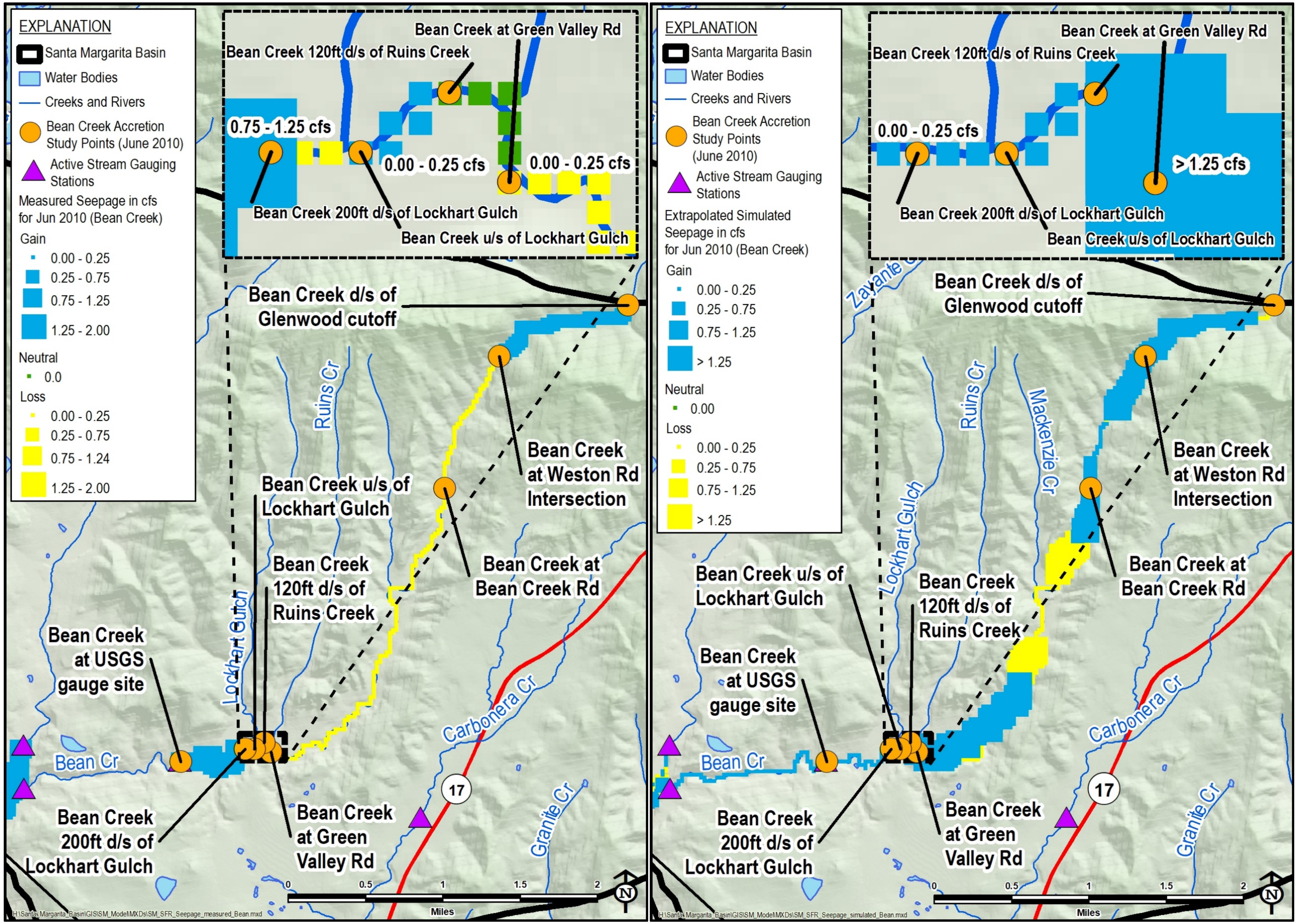


Figure 21. Measured and Extrapolated Simulated Seepage for Bean Creek

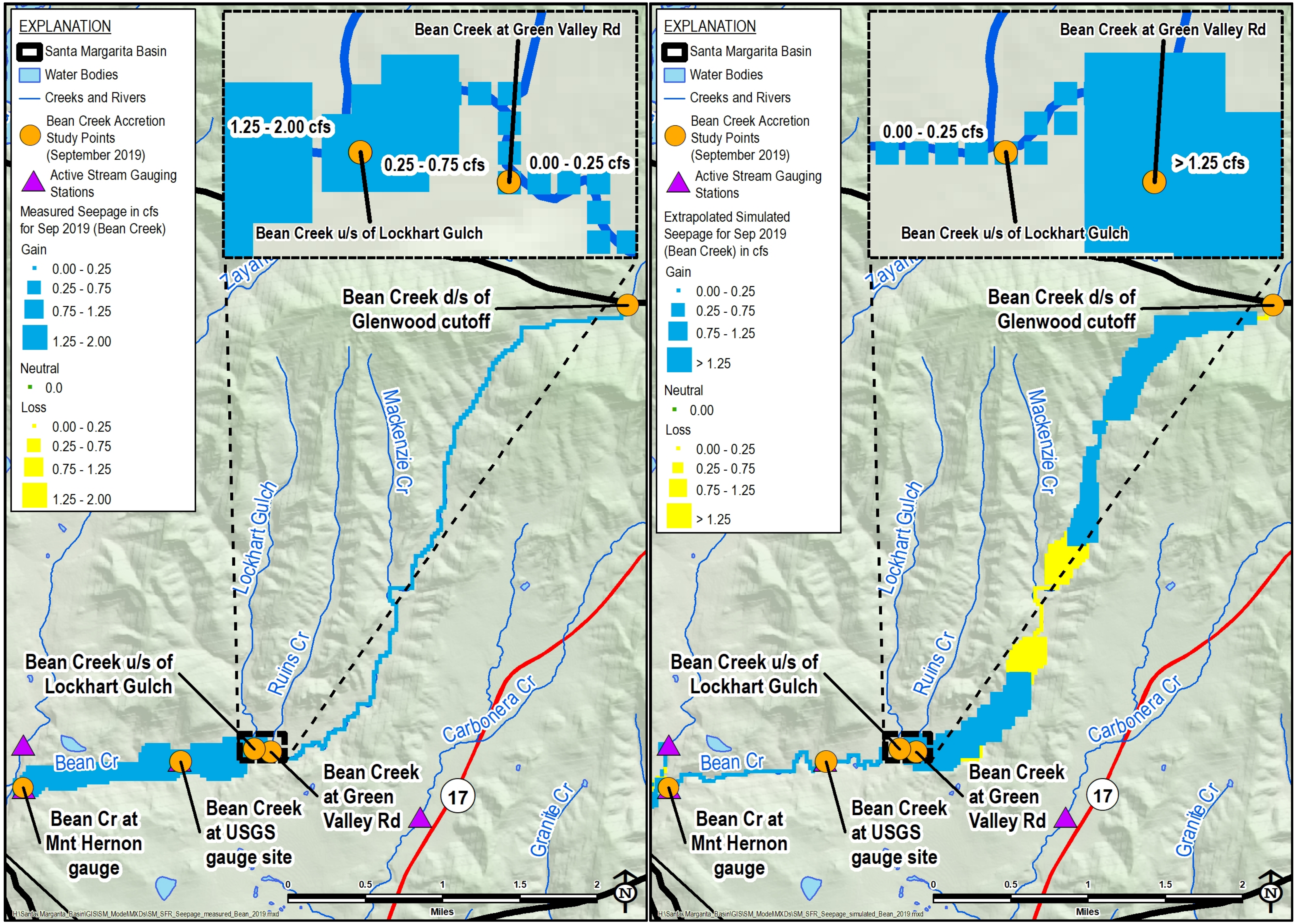


Figure 22. Measured and Extrapolated Simualted Seepage for Bean Creek in 2019

6.2.2 Groundwater Calibration Results

Calibrated parameters for Kx, Kz, Sy, and Ss are shown in Figure 23 through Figure 30. Comparison of simulated head and observed head (Figure 31) indicates that the model simulates heads matching observations for most layers, but underpredicts heads in Butano aquifer Layers 5-7. Updated reference point elevations (RPE) provided post-calibration resulted in more instances of underprediction. Figure 32 shows mean target residuals by aquifer calculated as the average of observed data less modeled data in model time. The model has a similar spread of over- and underprediction in the Santa Margarita aquifer and Monterey Formation with relatively small mean residuals. There are more locations of underprediction than overprediction in the Lompico aquifer, while Butano aquifer is generally underpredicting groundwater levels.

The GSP has 14 representative monitoring points (RMP) at which sustainable management criteria are defined. These are selected from 59 well targets used in calibration to represent groundwater level conditions for each model layer. Hydrographs showing observed groundwater levels and simulated groundwater levels from the M&A model and the KJ model for the 14 RMPs are shown in Figure 33 through Figure 46. RMPs for each aquifer are as follows:

- **Santa Margarita aquifer**: SLVWD Quail MW-A, SLVWD Quail MW-B, SLVWD Olympia #3, SLVWD Pasatiempo MW-2, SVWD TW-18, and SV4-MW
- **Monterey Formation**: SVWD #9
- **Lompico aquifer**: SLVWD Pasatiempo MW-1, SVWD #10, SVWD #11A, and SVWD TW-19
- **Butano aquifer**: SVWD #15 Monitoring Well, Canham Well, and Stonewood

Santa Margarita aquifer RMPs show good fits at SLVWD Olympia #3 (Figure 33) and SLVWD Quail MW-A (Figure 35); overprediction with good long-term trend at SLVWD Quail MW-B (Figure 36); underprediction with good long-term trends at SV4-MW (Figure 37); and underprediction without good long-term trends at SLVWD Pasatiempo MW-2 (Figure 34) and SVWD TW-18 (Figure 38). SLVWD Olympia #3 and SLVWD Pasatiempo MW-2 performed similarly to KJ model (2015) while SLVWD Quail MW-A and SV4-MW show improved fit. SVWD TW-18 and SLVWD Quail MW-B show worse overall fit to data, but the latter two show improved long-term trends compared to the KJ model (2015).

SVWD #9 (Figure 39) is the only RMP in the Monterey Formation and improves fit to declining trend from the beginning of the model period but deviates around 1995. There are improved simulation results starting in 2002 compared to the KJ model.

Lompico aquifer RMPs show good fit at SVWD #11A (Figure 42) and underprediction with good long-term trends for SLVWD Pasatiempo MW- 1 (Figure 40), SVWD #10 (Figure 41), and SVWD TW-19 (Figure 43). The KJ model performs better on SVWD #10 and Pasatiempo MW-1, but the latter has a better long-term trend while the M&A model shows improved fit at SVWD #11A and SVWD TW-19.

RMPs in the Butano aquifer show good fit at SVWD #15 Monitoring Well (Figure 45), but consistently underpredicts at Canham Well (Figure 44) and Stonewood Well (Figure 46). Canham Well and Stonewood Well for the M&A model performs better than the KJ model while SVWD #15 Monitoring Well predicts similarly between both models.

Vertical gradients were not used as part of the calibration, but 4 sites of the 9 presented by EKI in its review of the KJ model are available for comparison of vertical gradients from to the selection of target wells. Simulated results for Site 1 (Figure 47) indicate a greater downward gradient relative to the measured by about 30 ft. Site 2 (Figure 48) shows that simulated vertical gradient is less than observed while Site 4 (Figure 49) shows more variation and greater vertical gradient than observed. Site 9 (Figure 50) shows little vertical gradient for both simulated and observed during the period when vertical gradient data are available.

Model calibration to groundwater level data is sufficient because long term trends at RMPs are generally simulated. The calibrated model can be used to interpret projected hydrographs from future scenario models by accounting for simulated average water level offsets. The calibrated model can also be used to estimate historical, current, and projected water budgets as required for the GSP. Recalibration can improve the model with additional grondwater level data at existing RMPs and new areas of interest.

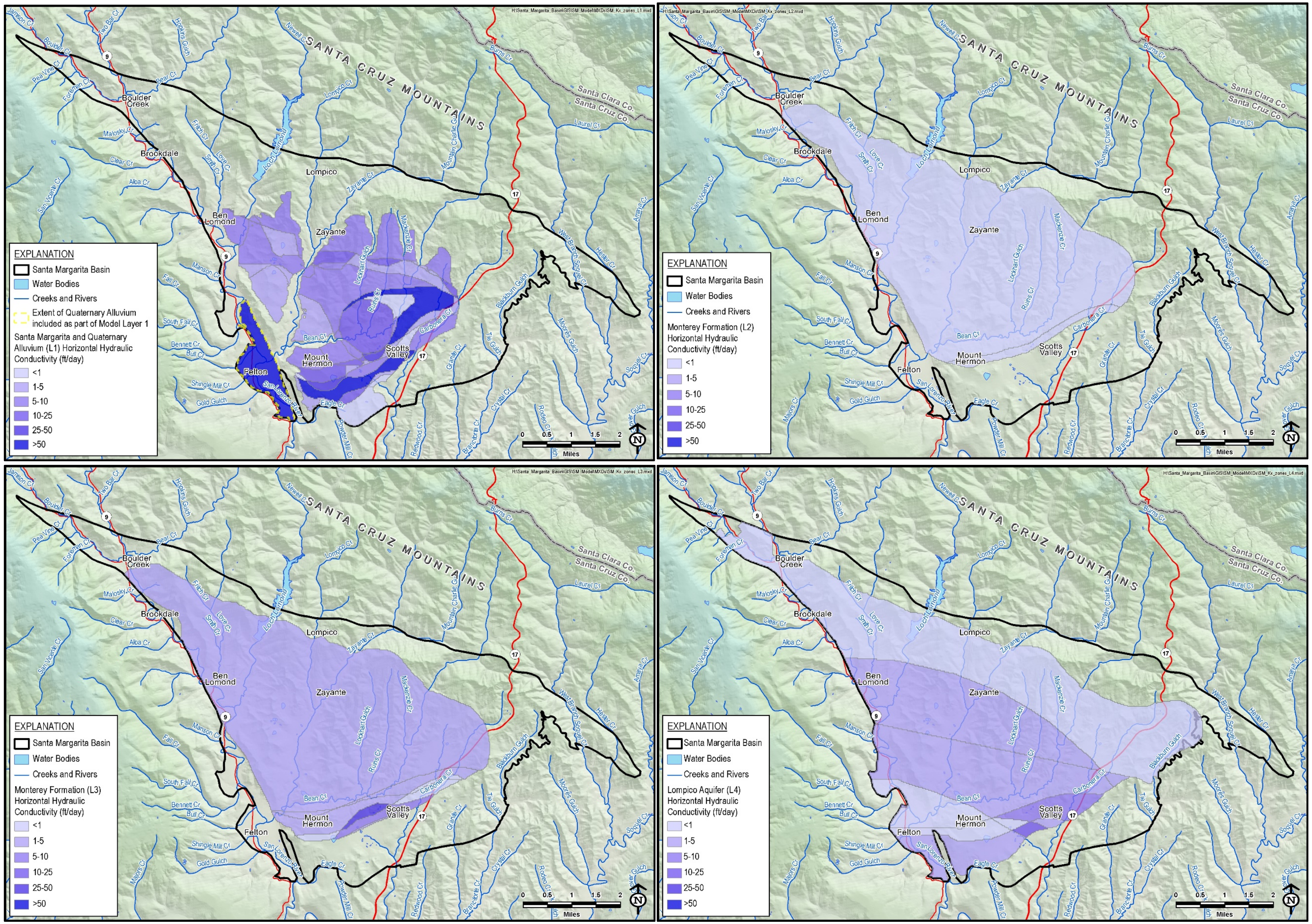


Figure 23. Horizontal Conductivity Zones for Santa Margarita Aquifer, Monterey Formation, and Lompico Aquifer

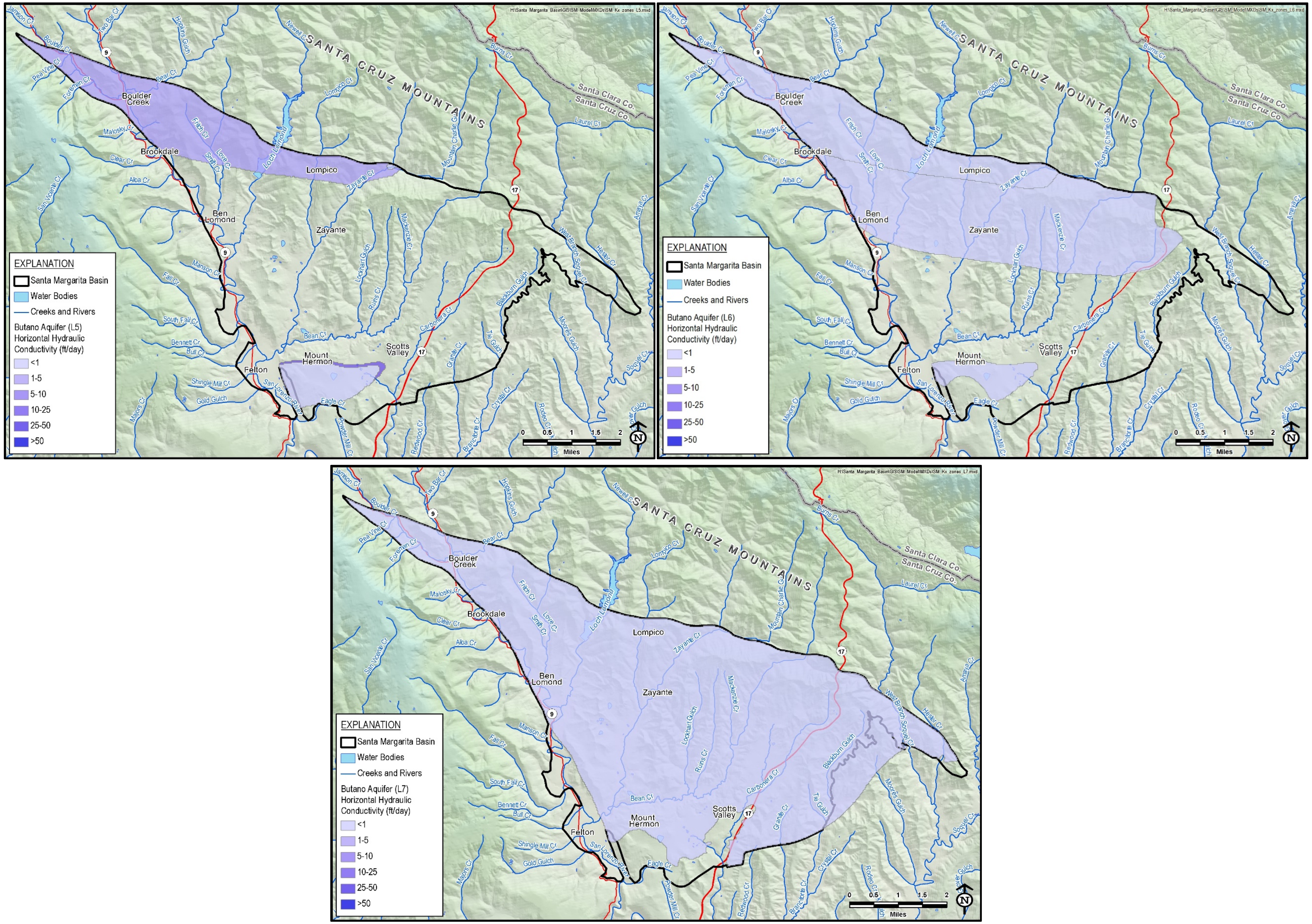


Figure 24. Horizontal Conductivity Zone Distribution for Butano Aquifer

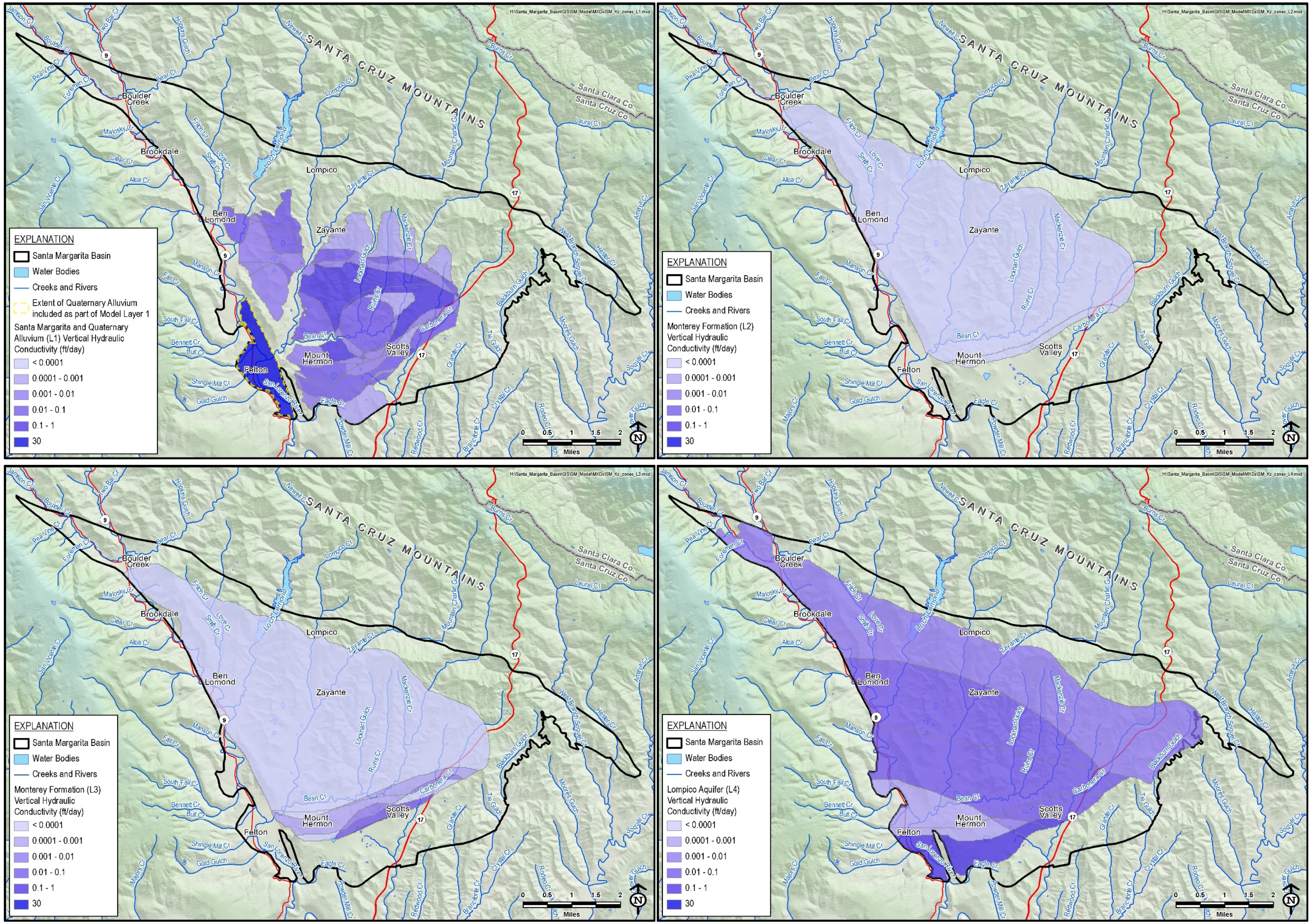


Figure 25. Vertical Conductivity Zones for Santa Margarita Aquifer, Monterey Formation, and Lompico Aquifer

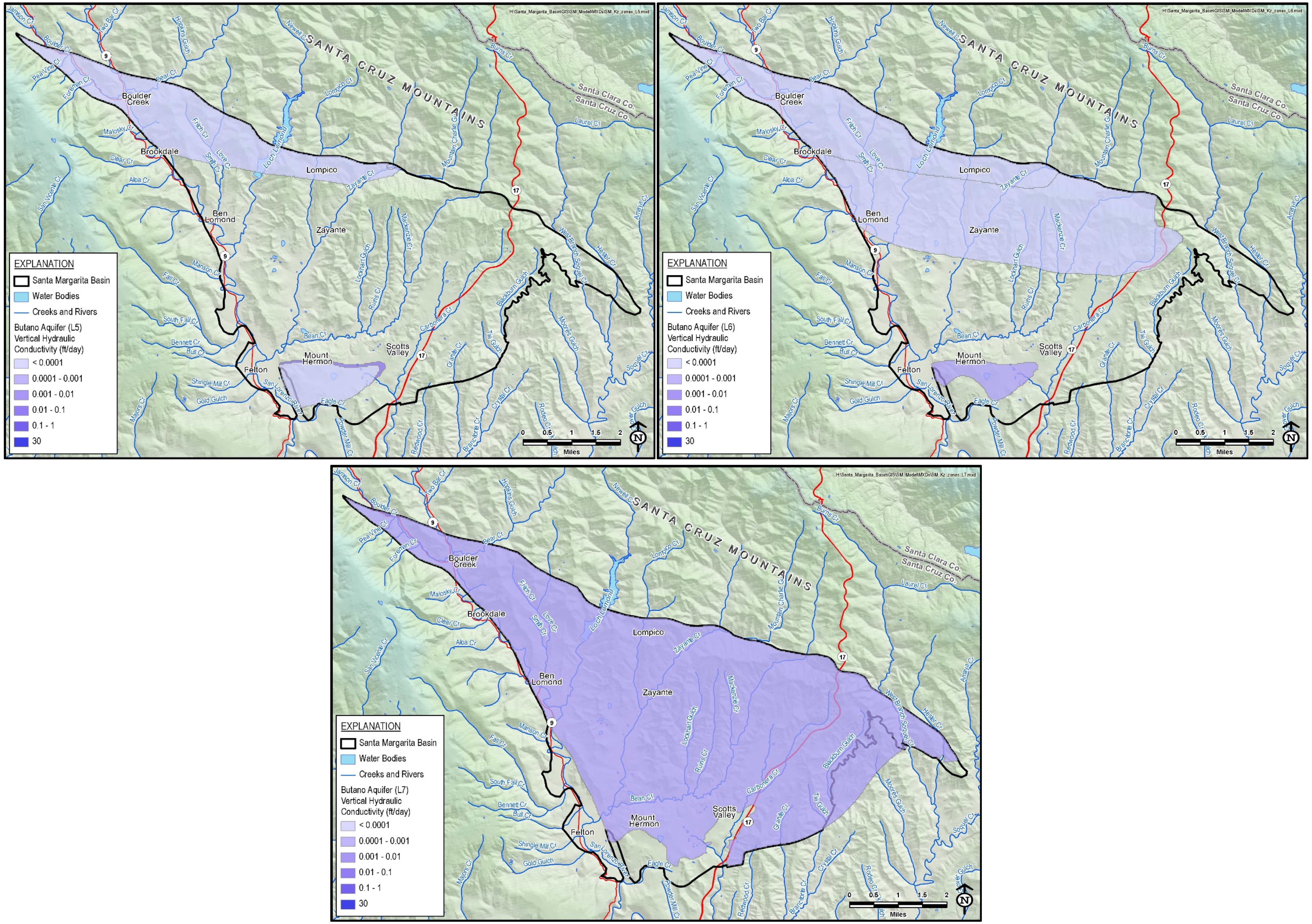


Figure 26. Vertical Conductivity Zone Distribution for Butano Aquifer

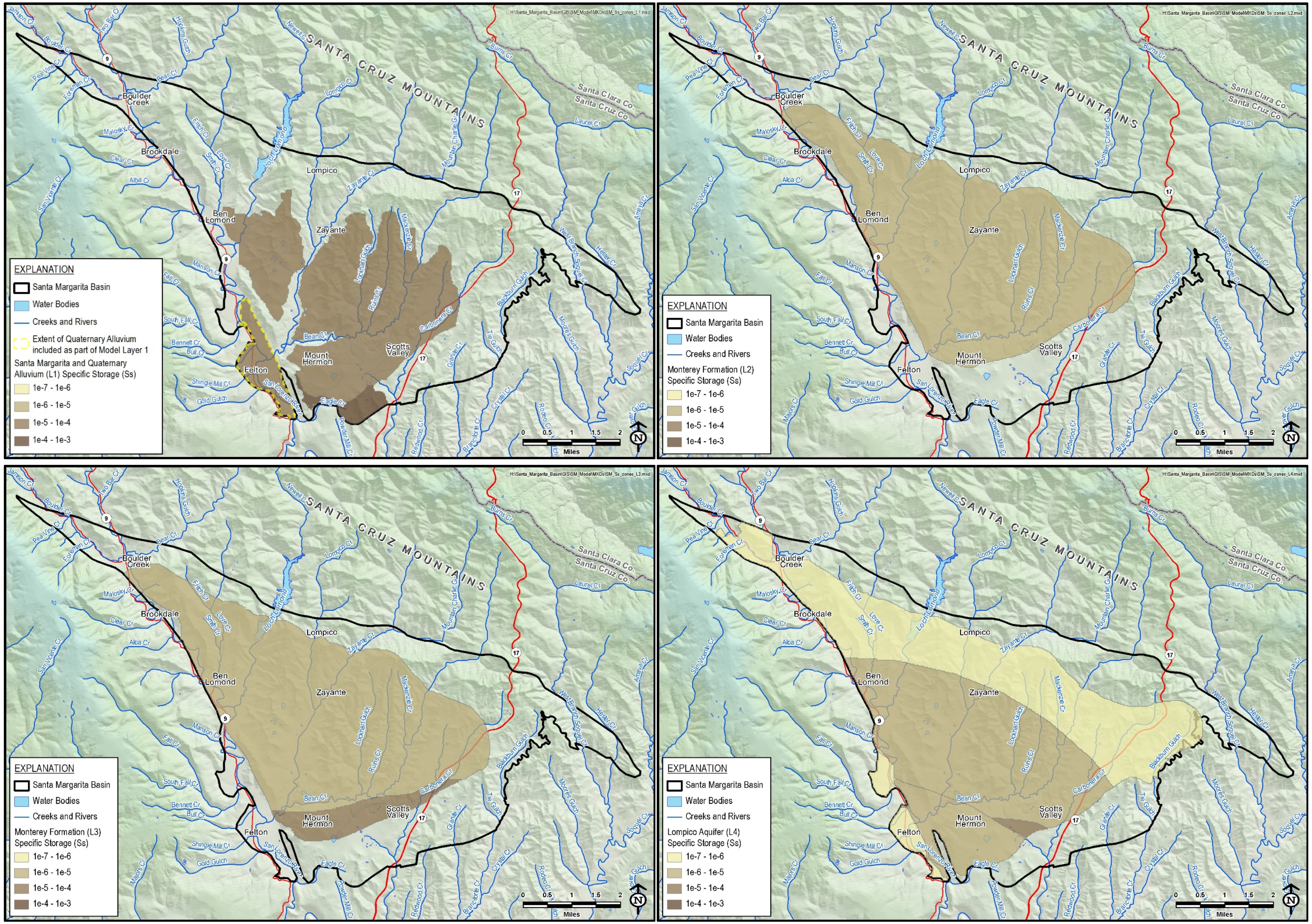


Figure 27. Specific Storage Zones for Santa Margarita Aquifer, Monterey Formation, and Lompico Aquifer

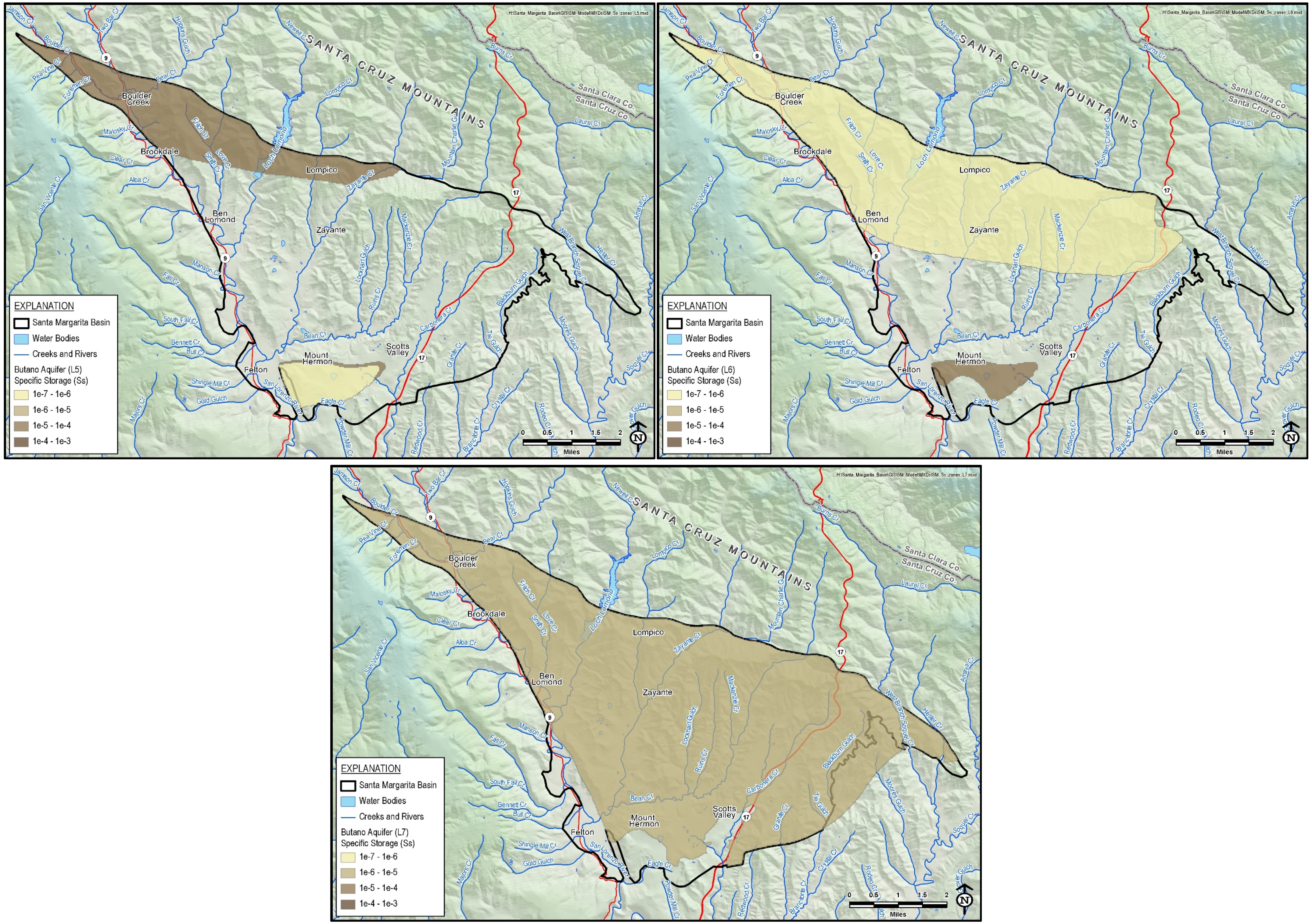


Figure 28. Specific Storage Zone Distribution for Butano Aquifer

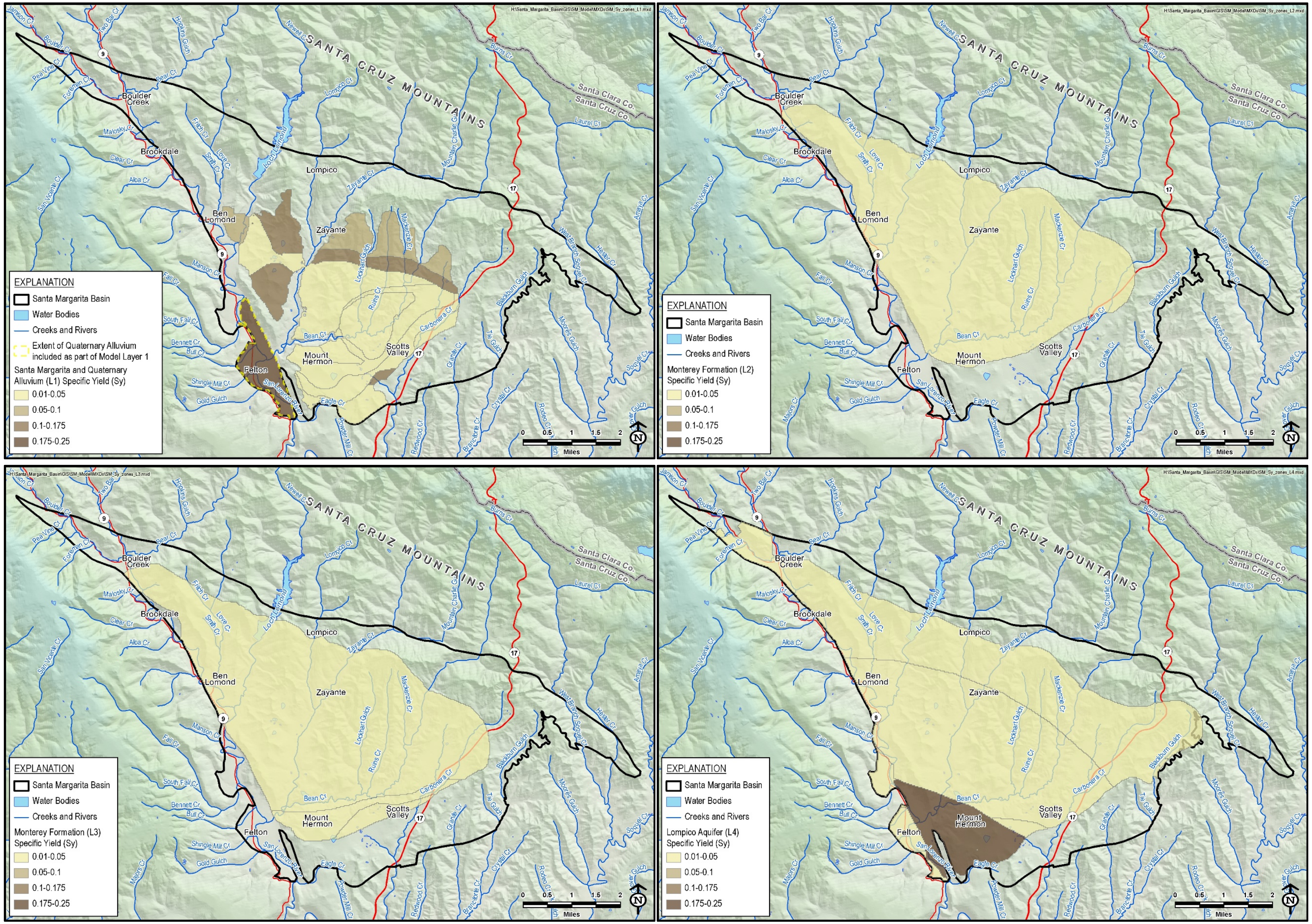


Figure 29. Specific Yield Zones for Santa Margarita Aquifer, Monterey Formation, and Lompico Aquifer

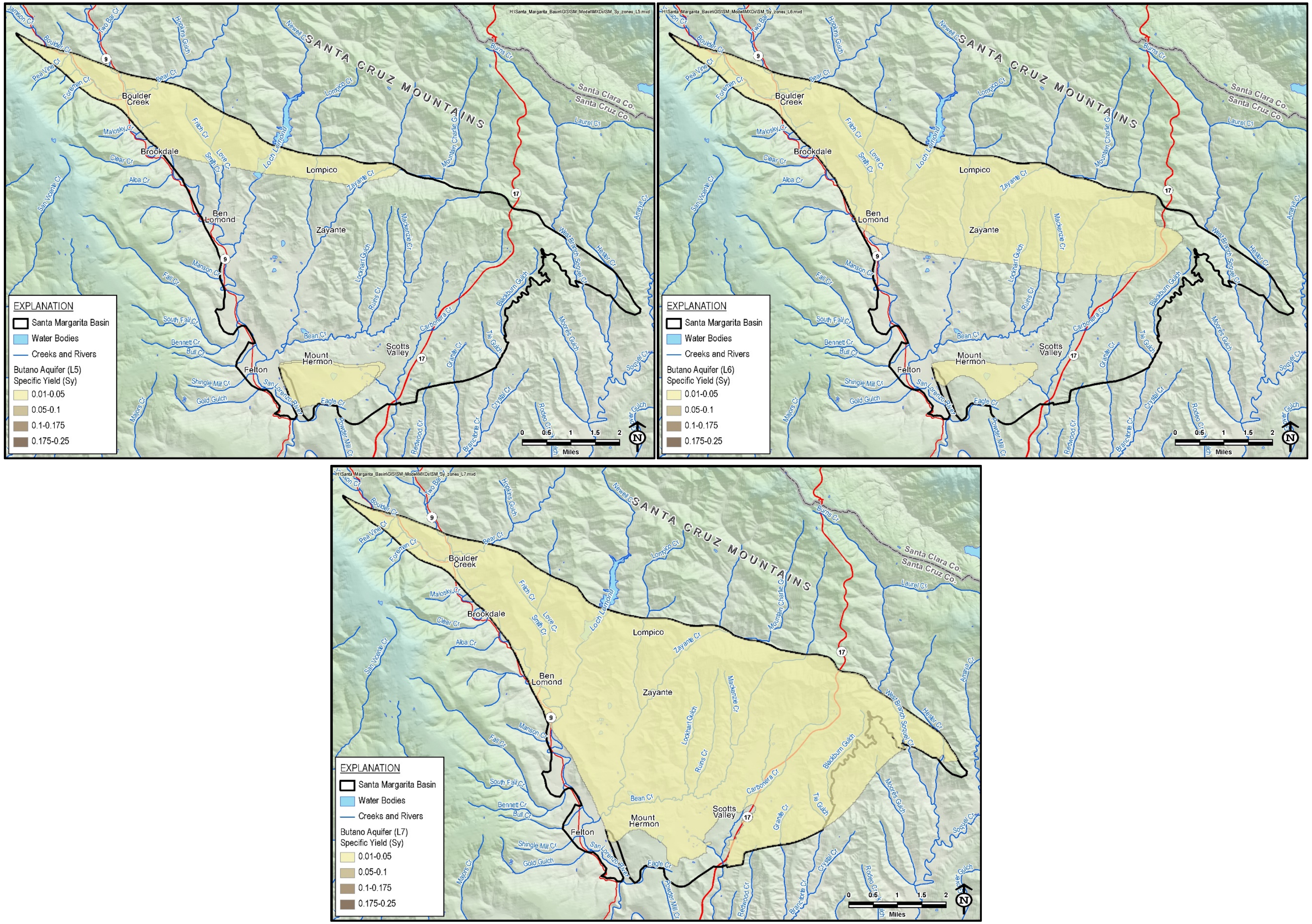


Figure 30. Specific Yield Zone Distribution for Butano Aquifer

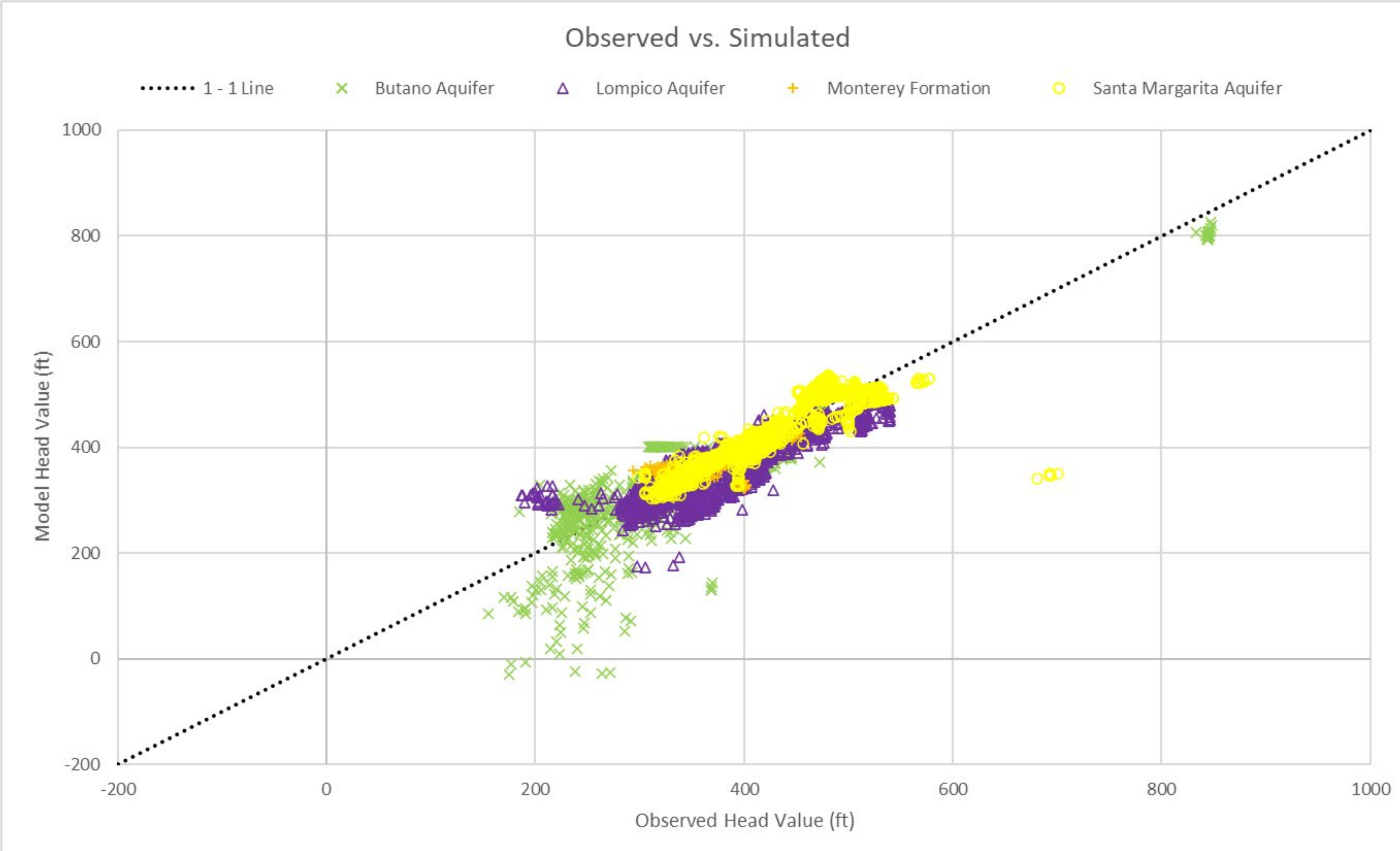


Figure 31. Simulated and Observed Head Target Comparison

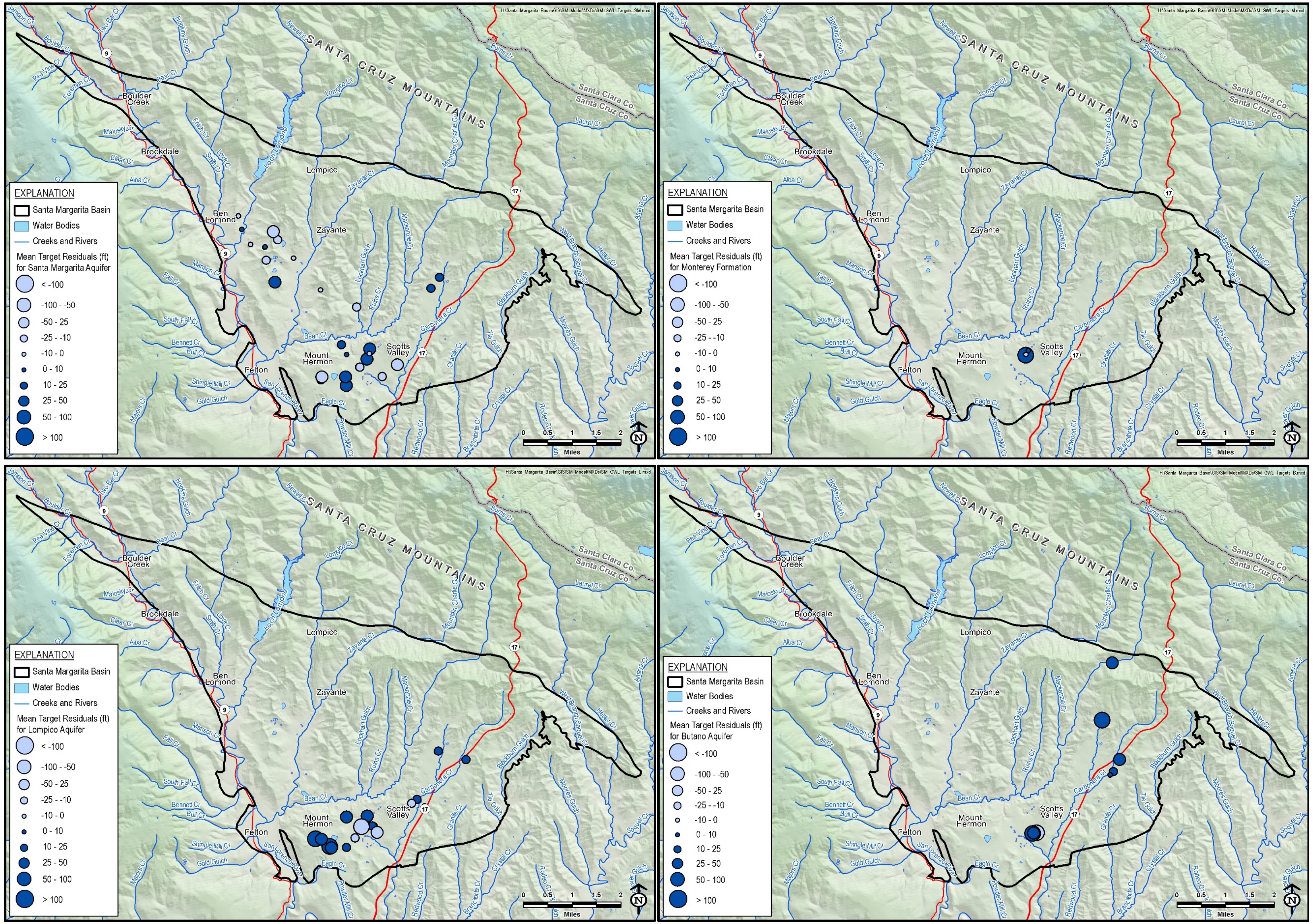


Figure 32. Mean Target Residual Maps (Observed – Simulated)

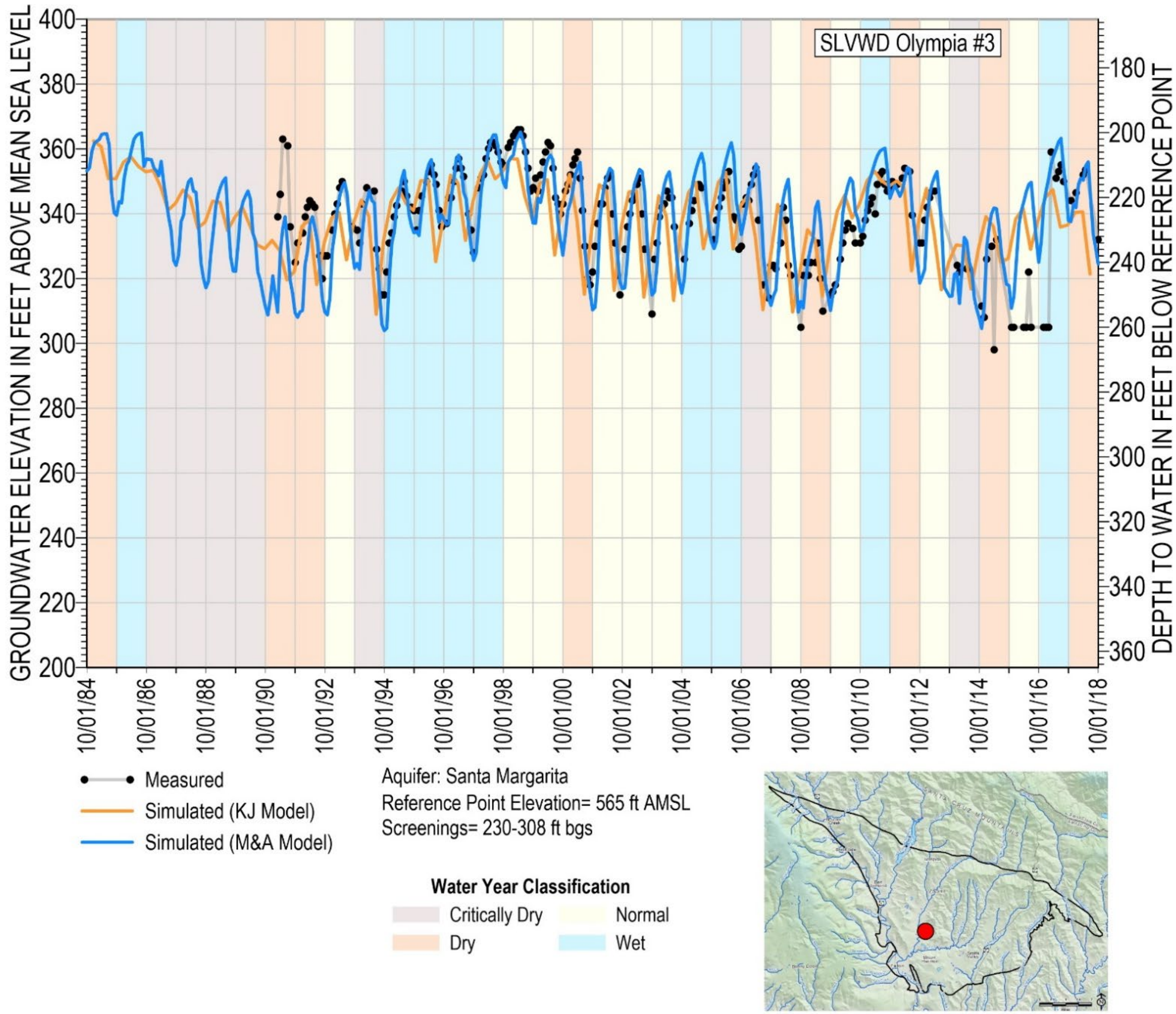


Figure 33. SLVWD Olympia #3 Hydrograph

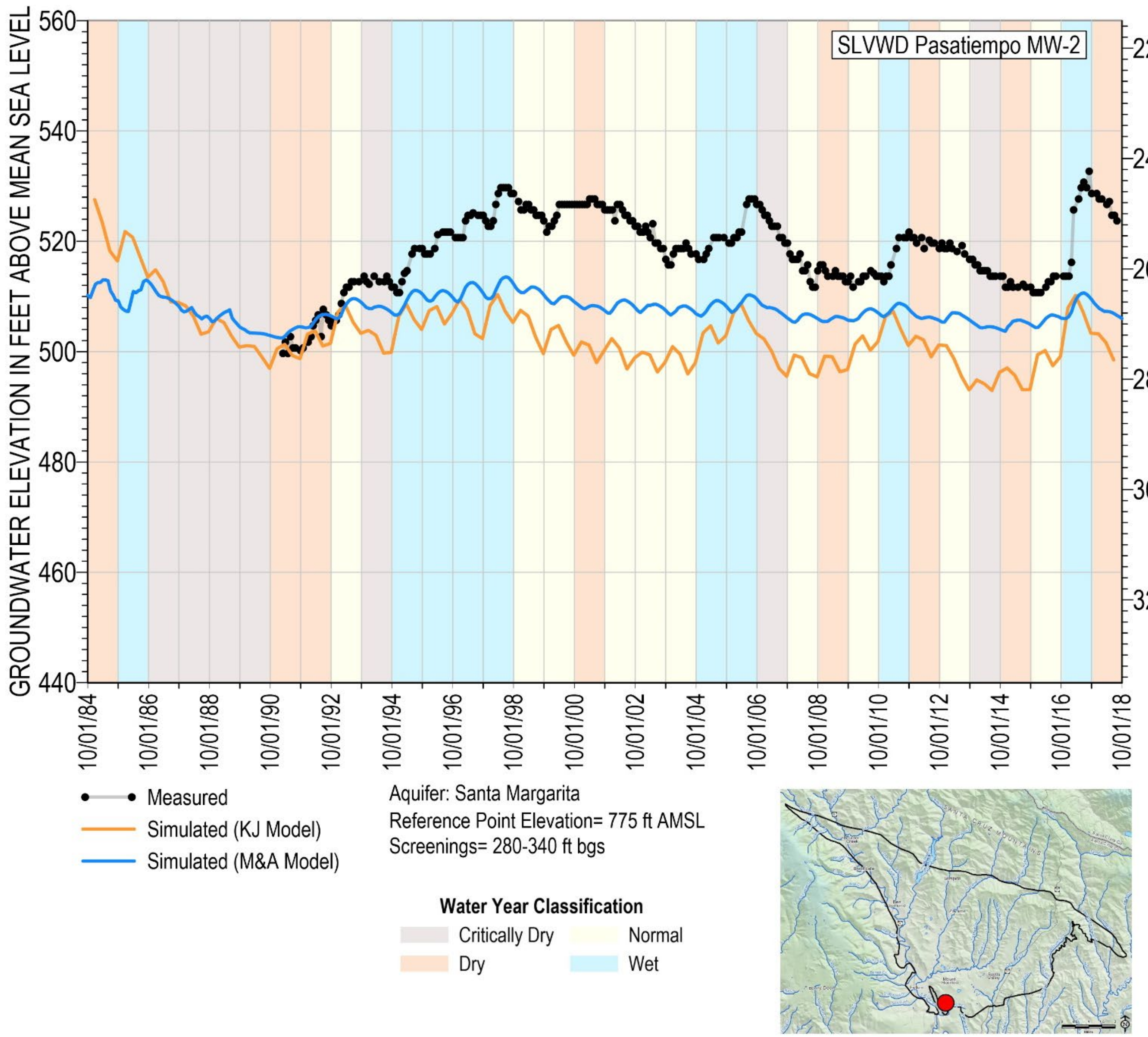
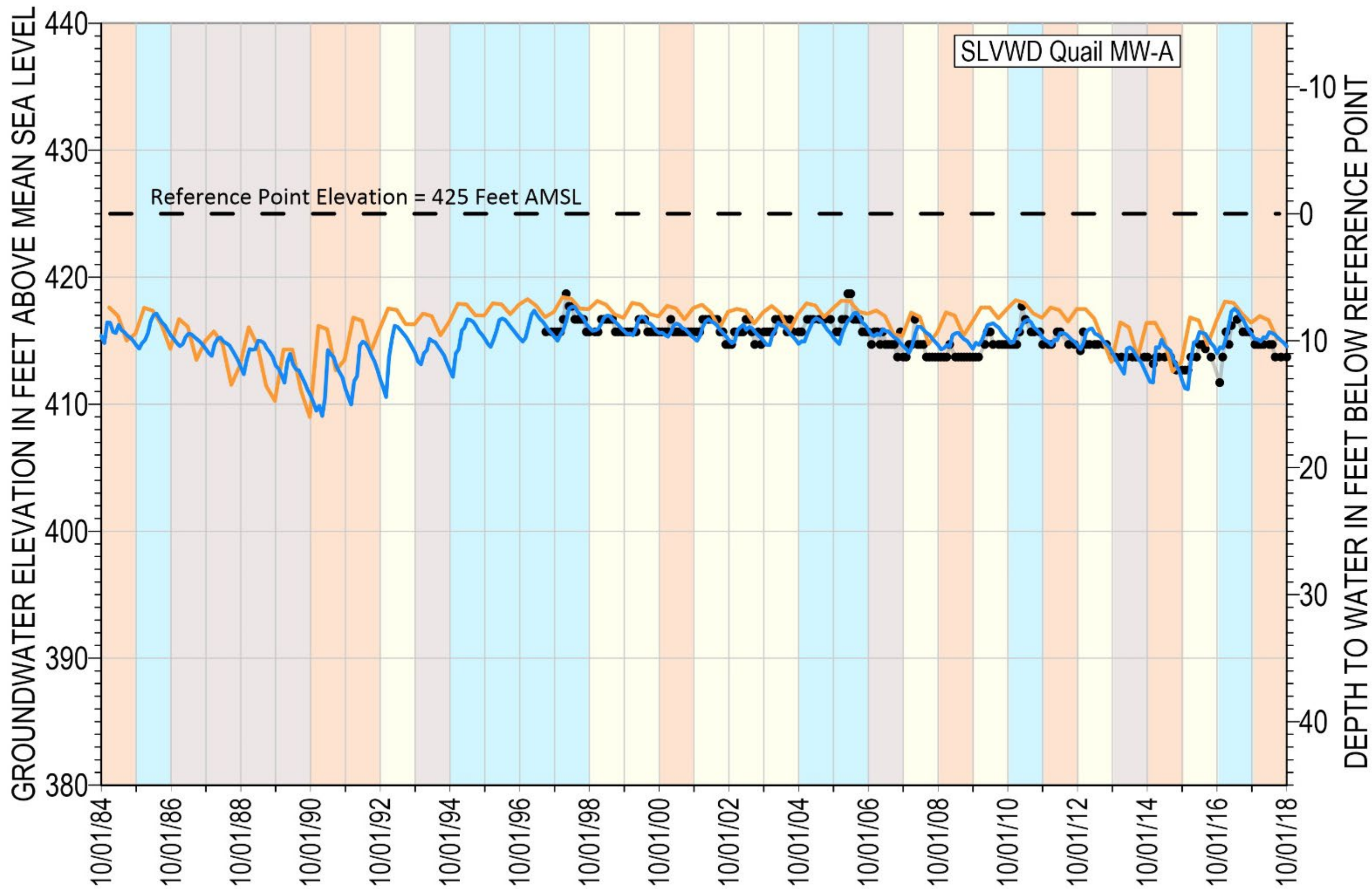


Figure 34. SLVWD Pasatiempo MW-2 Hydrograph



Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 425 ft AMSL
Screenings= 38-88 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

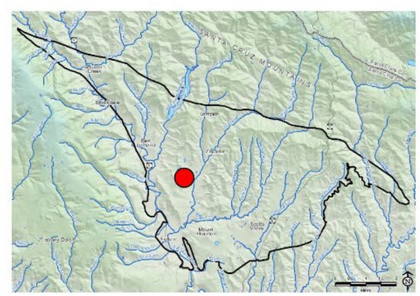


Figure 35. SLVWD Quaill MW-A Hydrograph

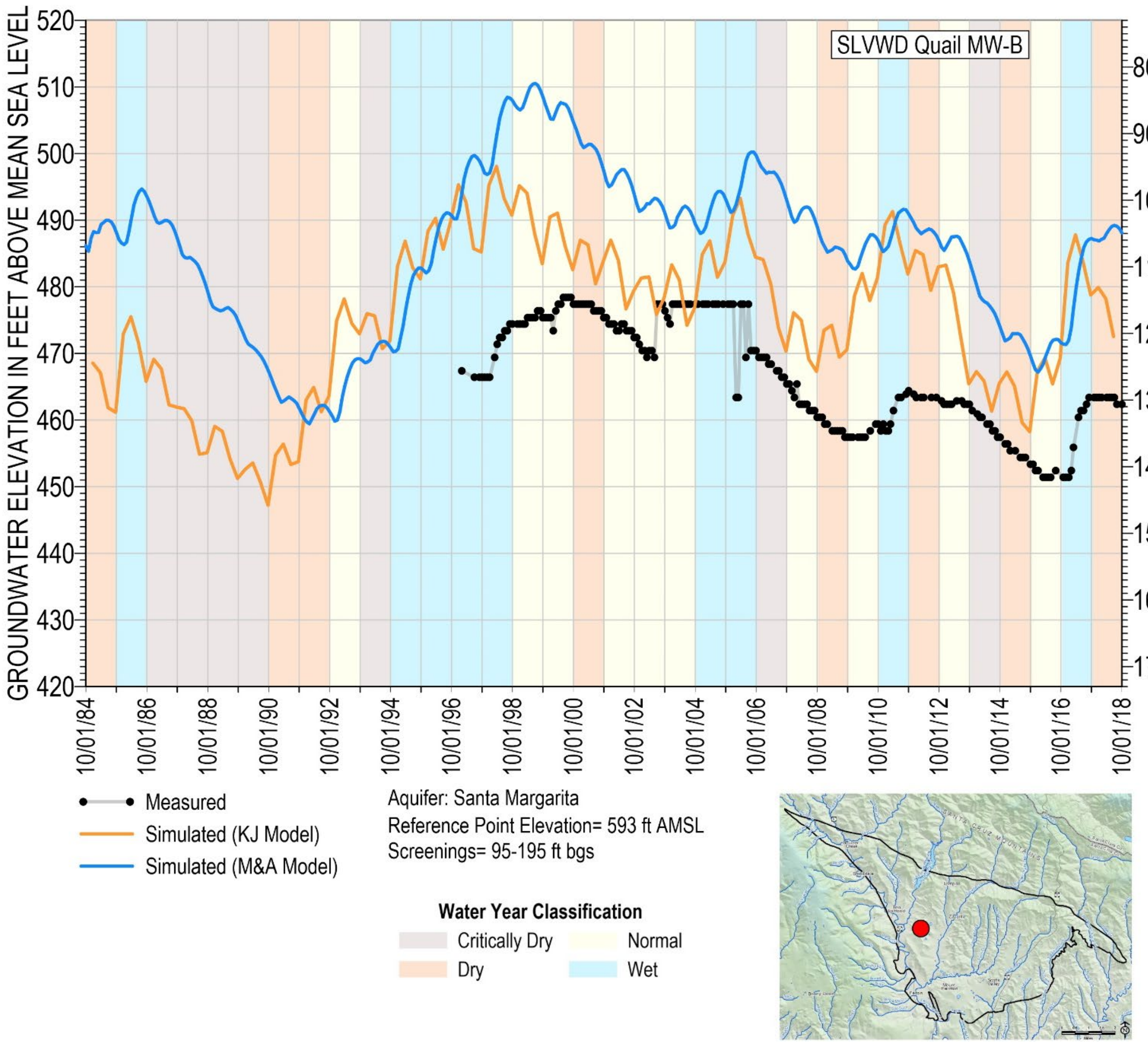


Figure 36. SLVWD Quail MW-B Hydrograph

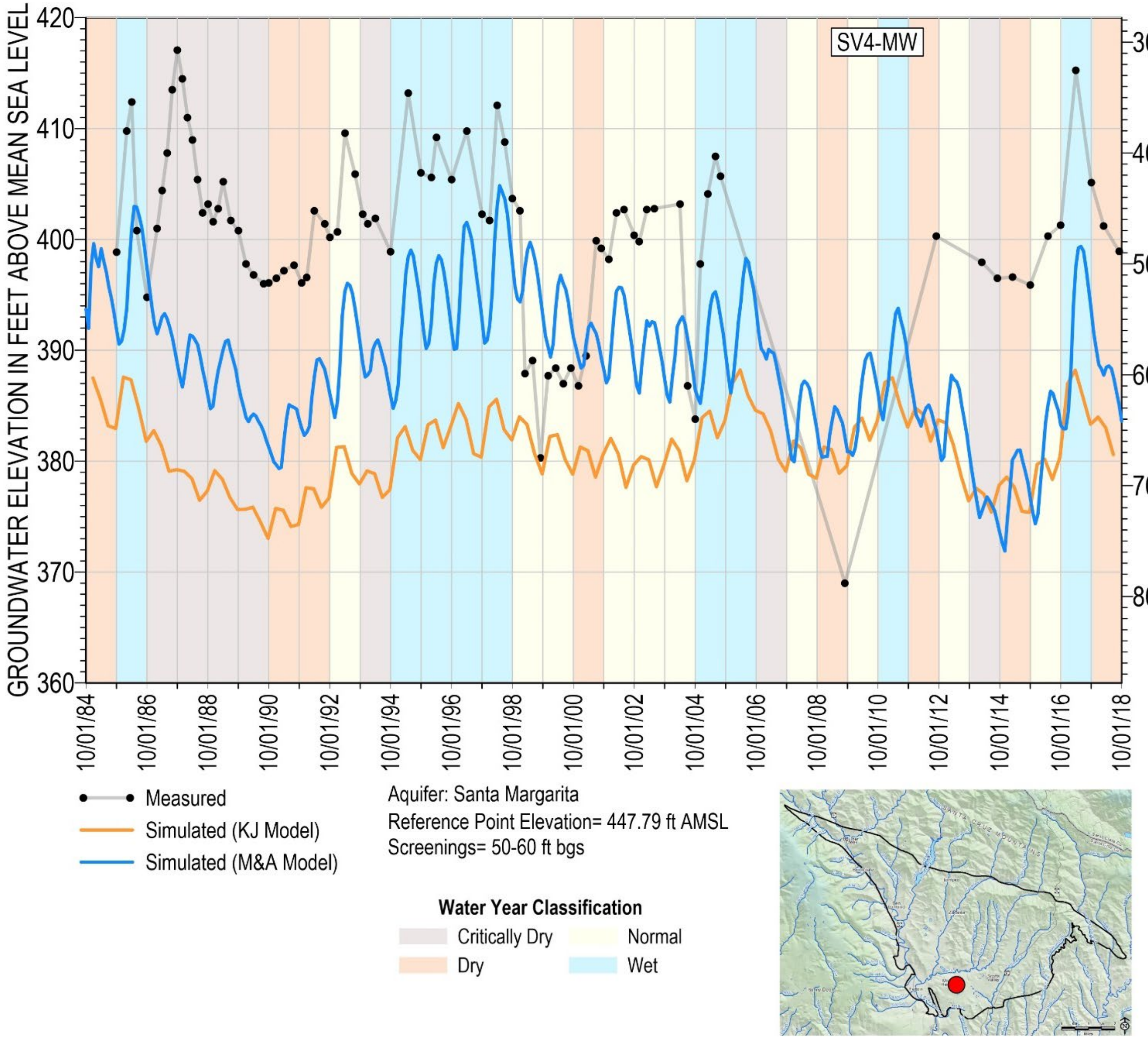


Figure 37. SV4-MW Hydrograph

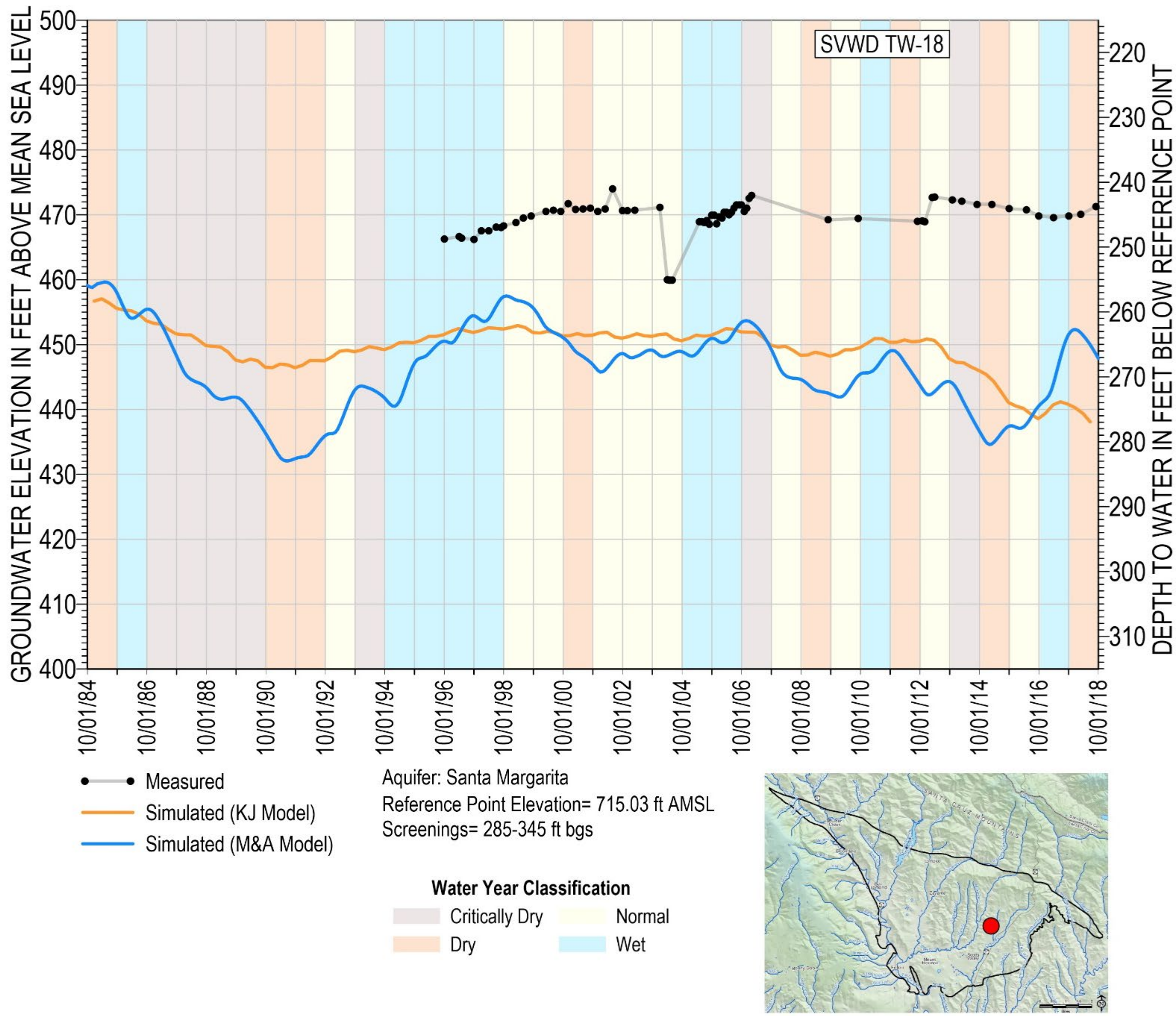
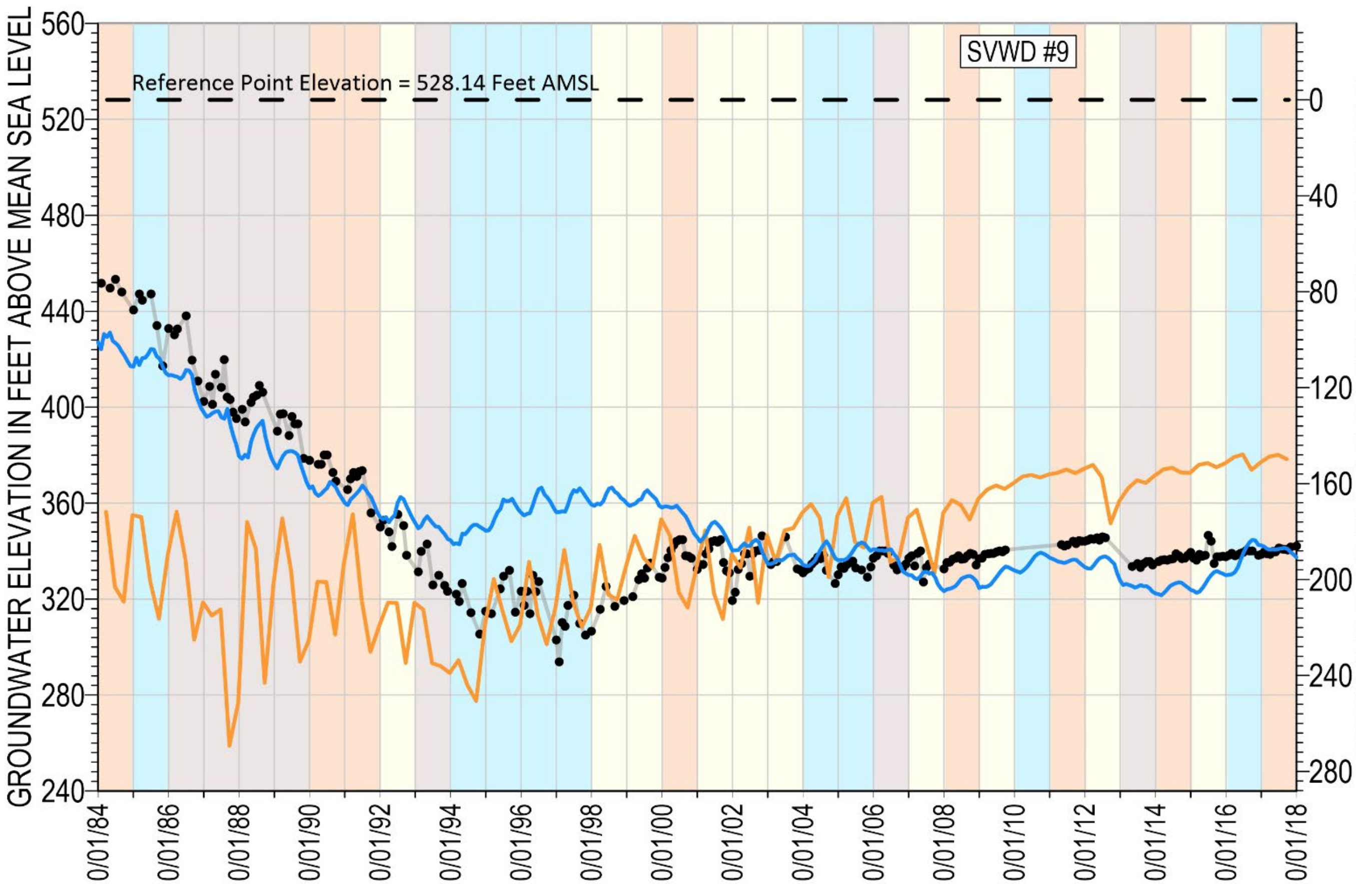


Figure 38. SVWD TW-18 Hydrograph



Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Monterey
Reference Point Elevation= 528.14 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry | Normal
Dry | Wet

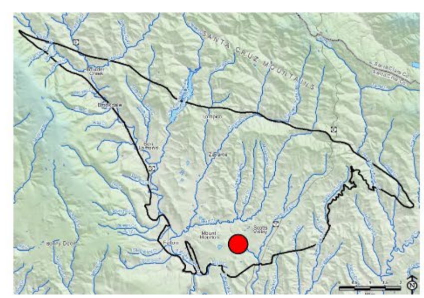


Figure 39. SVWD #9 Hydrograph

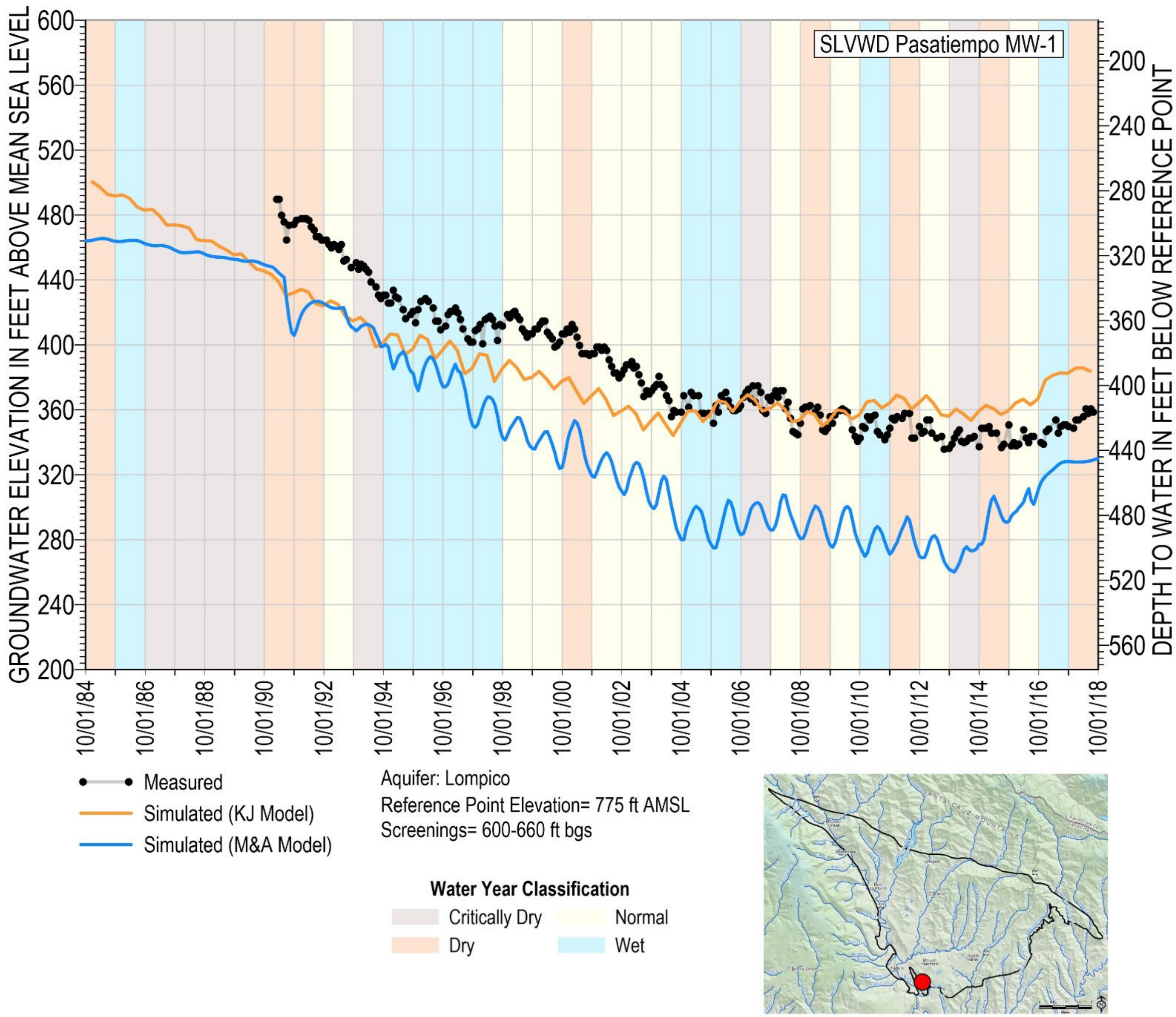


Figure 40. SLVWD Pasatiempo MW-1 Hydrograph

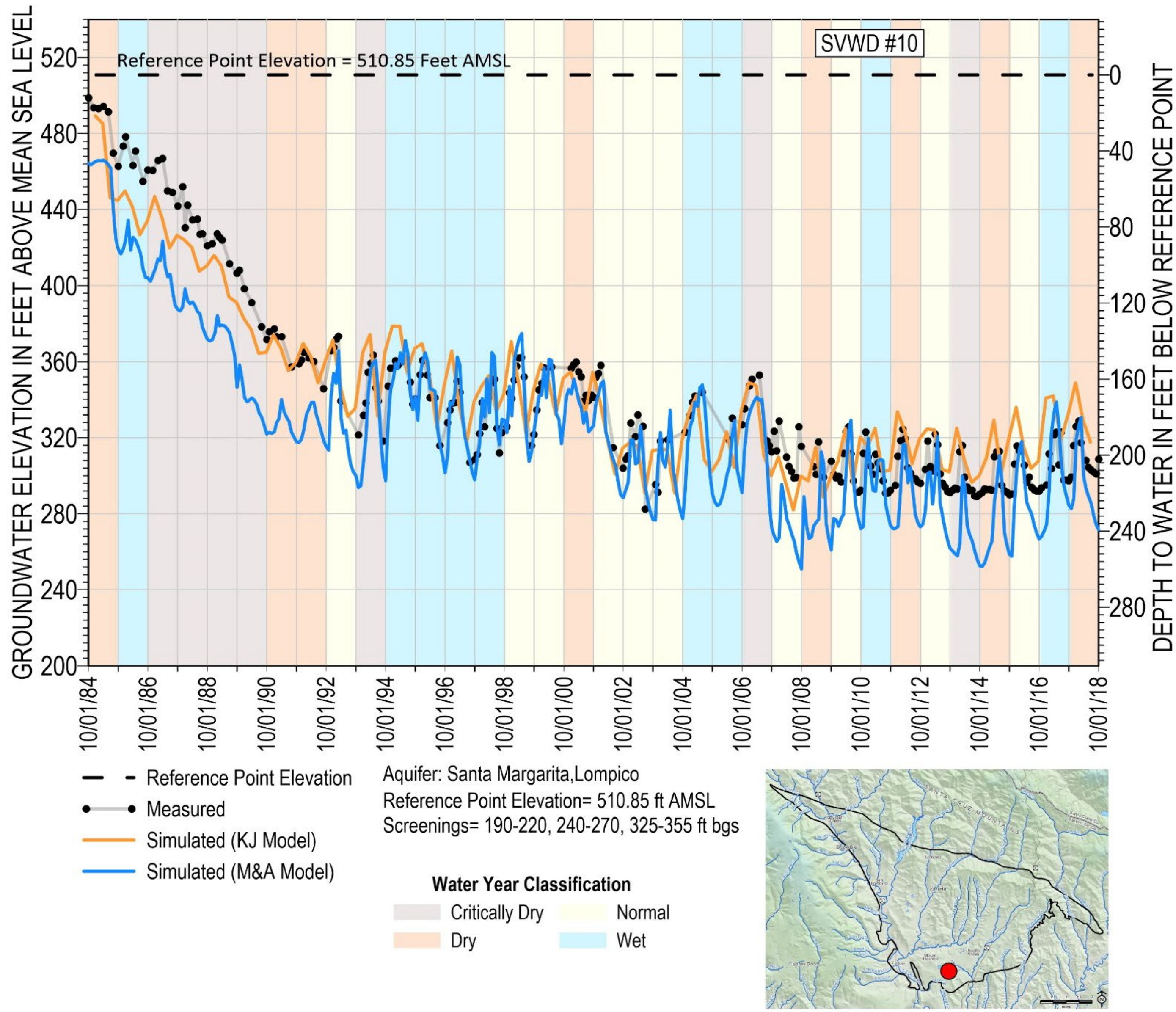


Figure 41. SVWD #10 Hydrograph

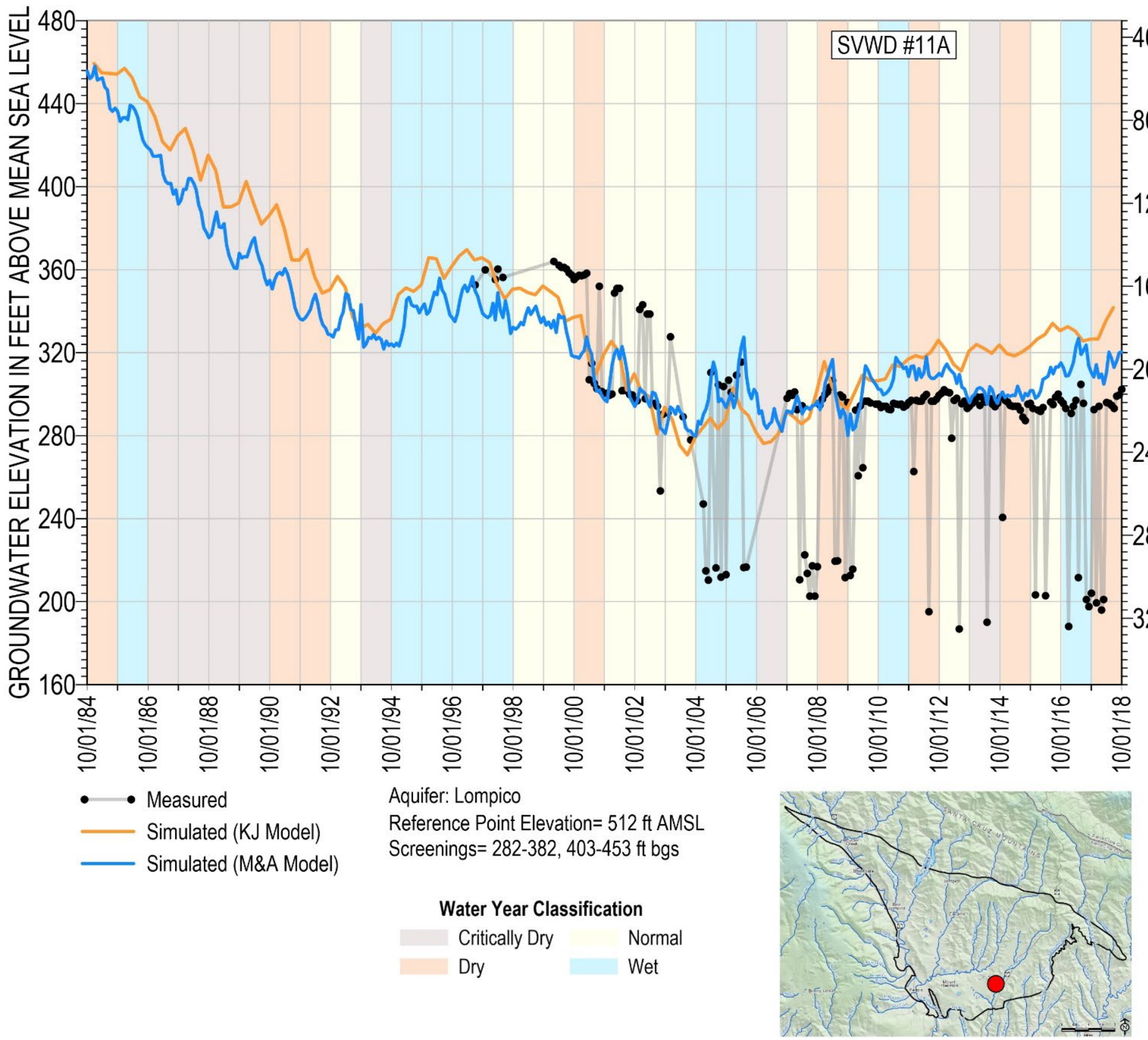
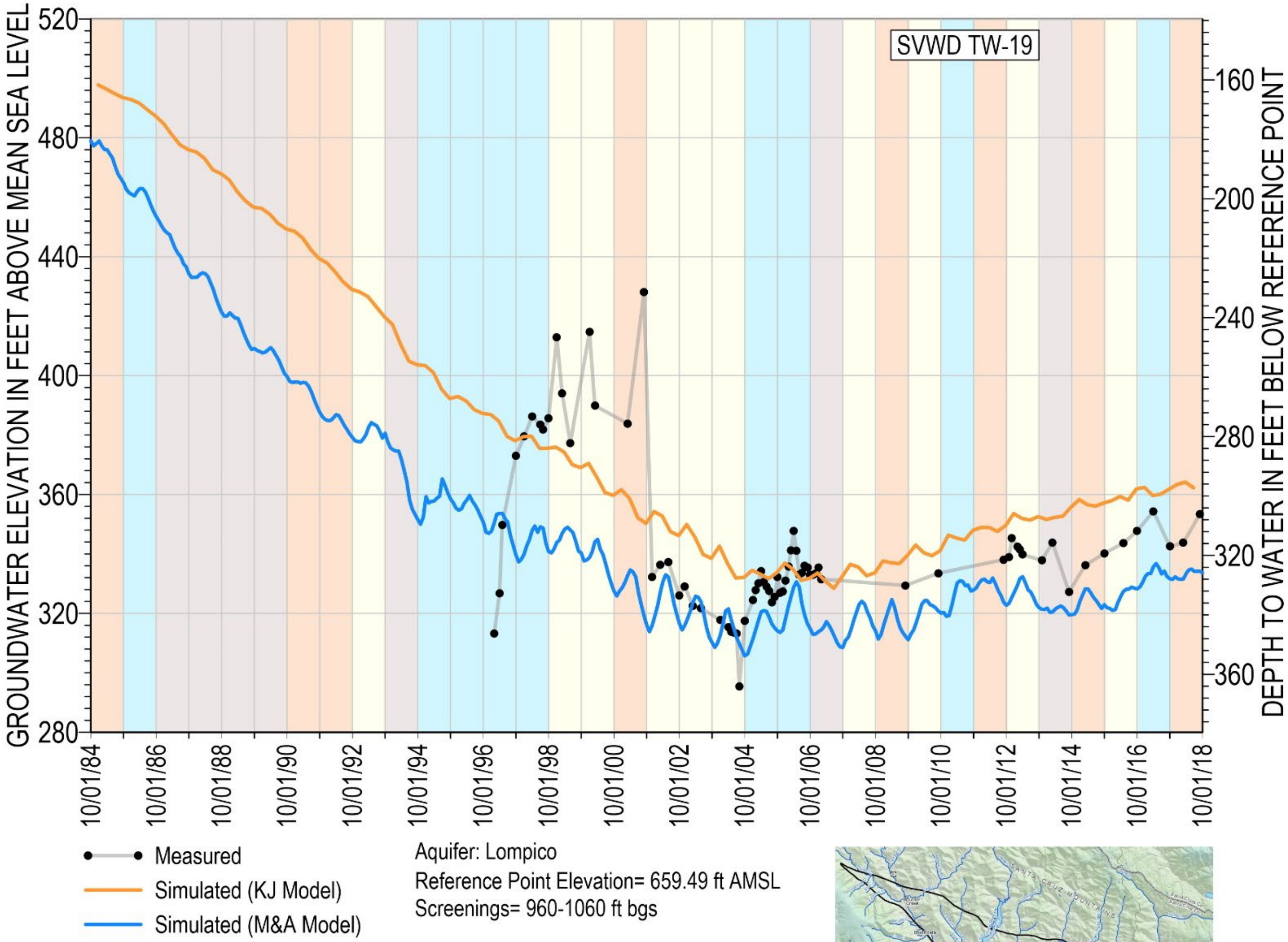


Figure 42. SVWD #11A Hydrograph



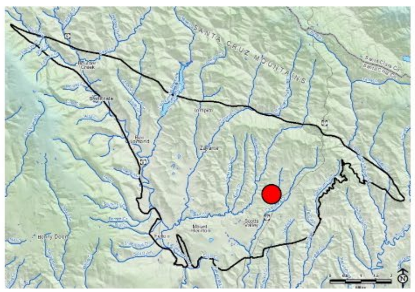


Figure 43. SVWD TW-19 Hydrograph

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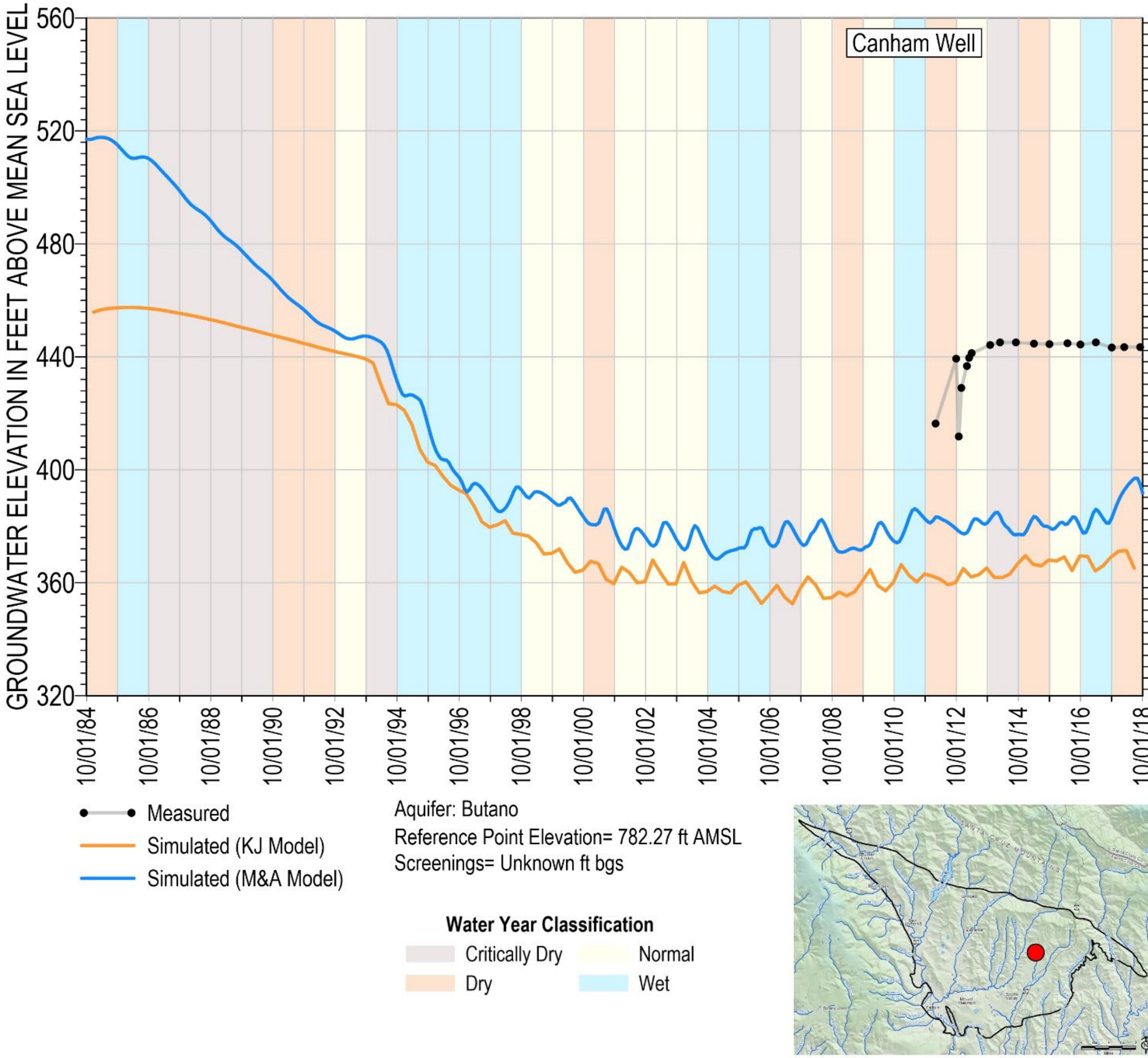


Figure 44. Canham Well Hydrograph

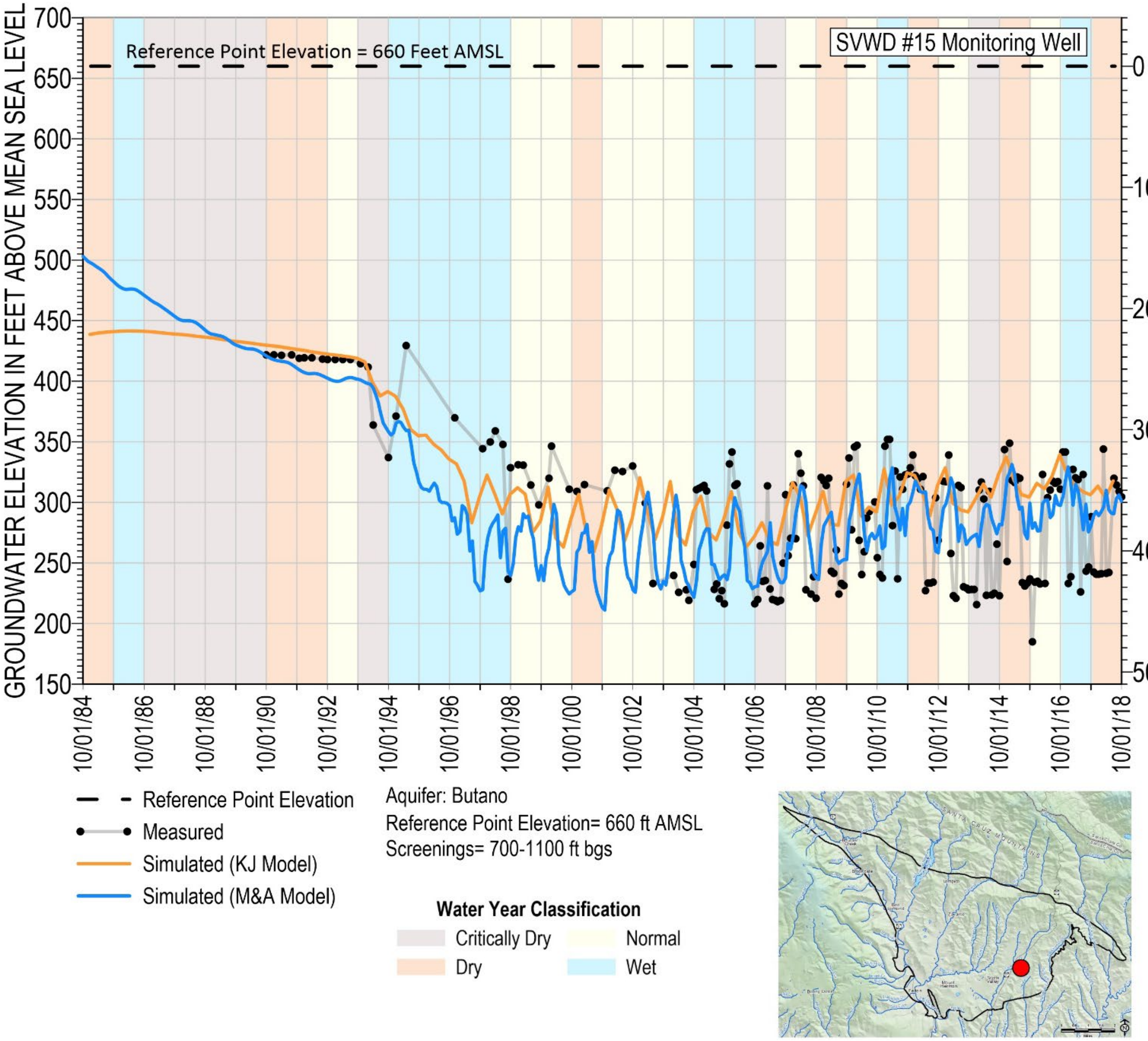
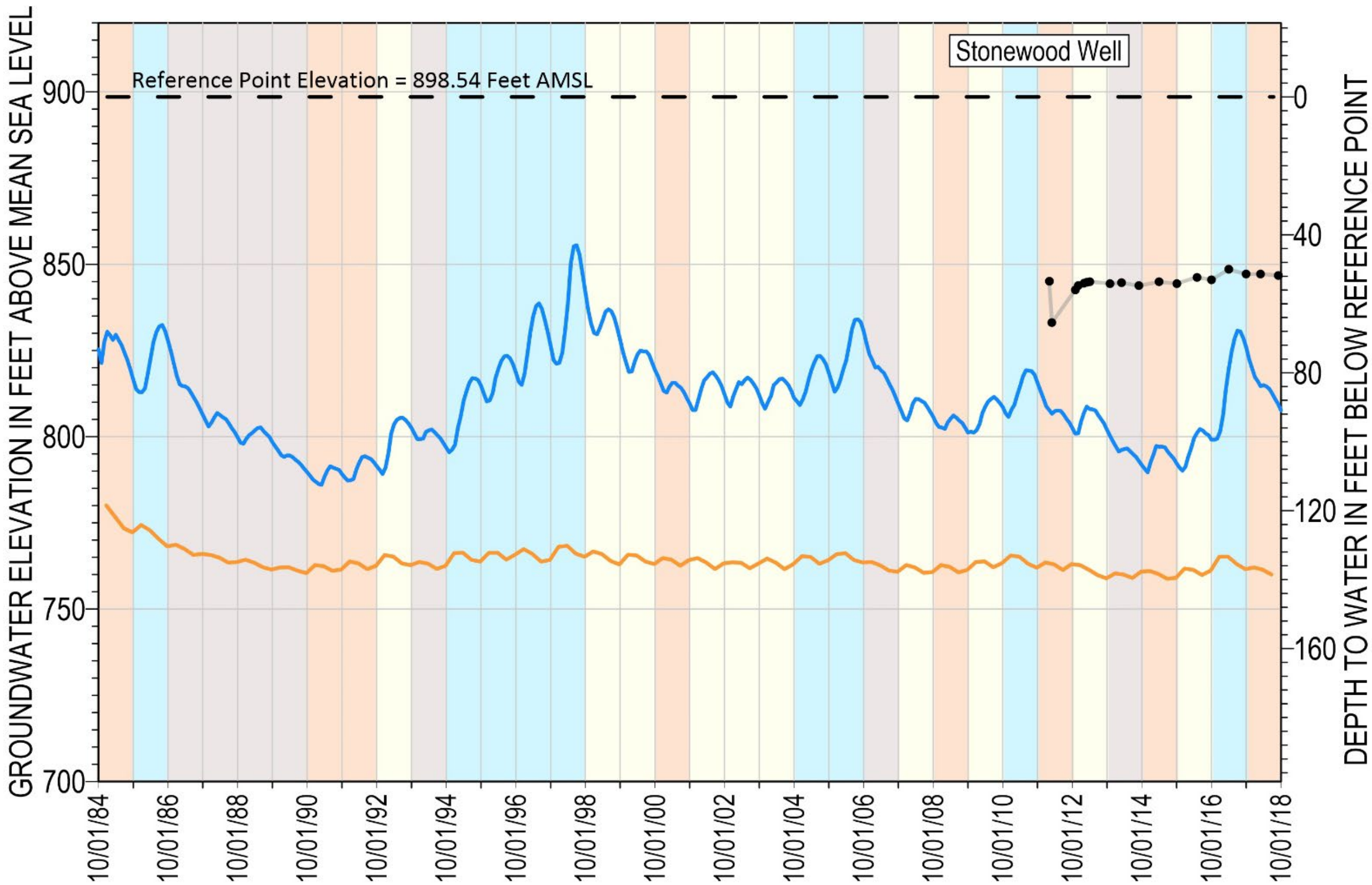


Figure 45. SVWD #15 Monitoring Well Hydrograph



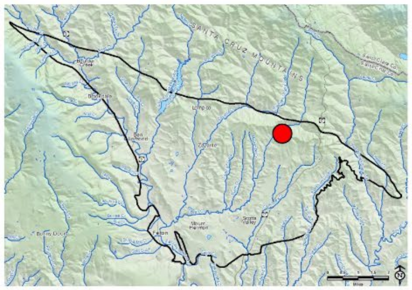


Figure 46. Stonewood Hydrograph

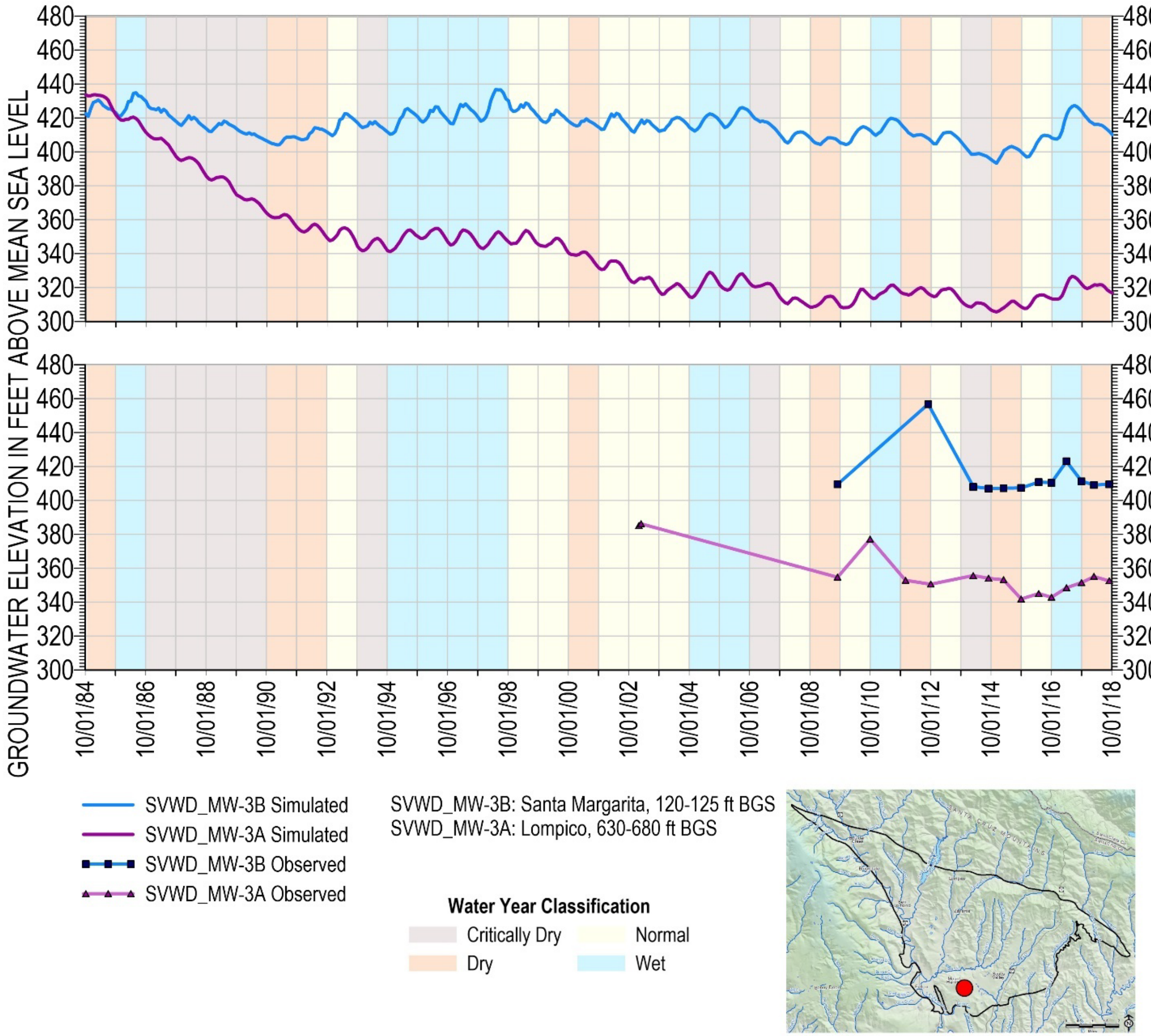


Figure 47. EKI Vertical Gradient Site 1

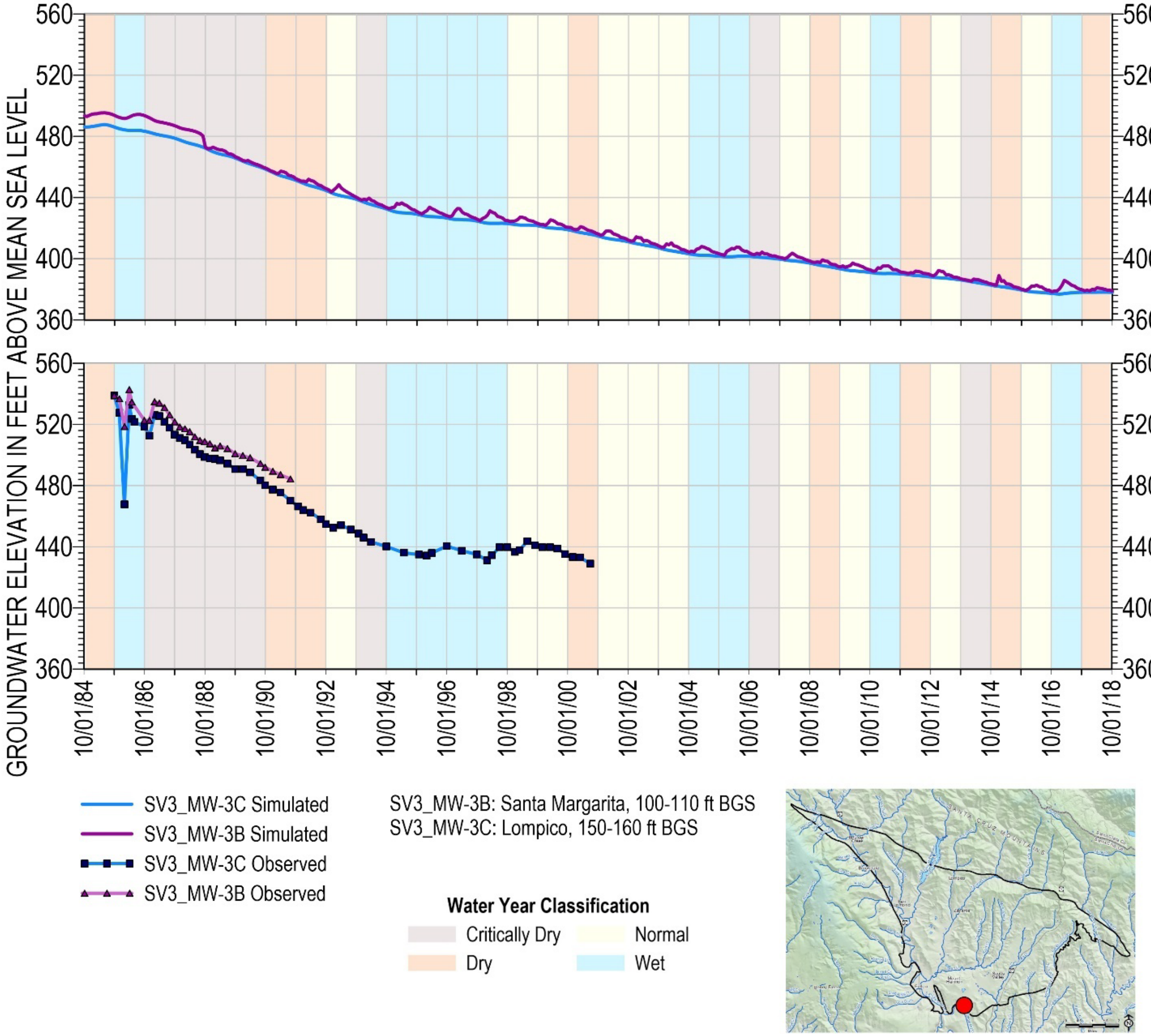


Figure 48. EKI Vertical Graident Site 2

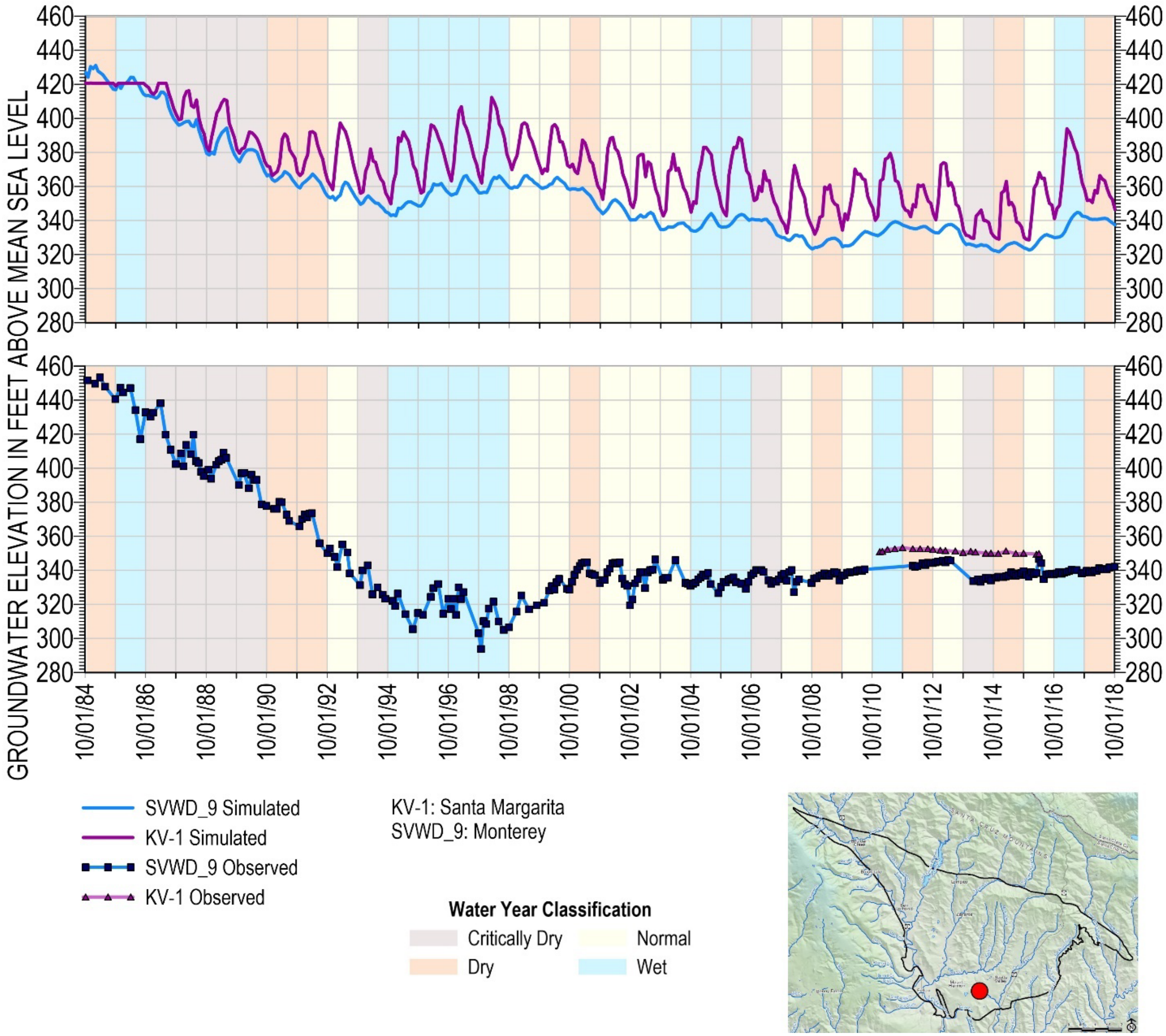


Figure 49. EKI Vertical Gradient Site 4

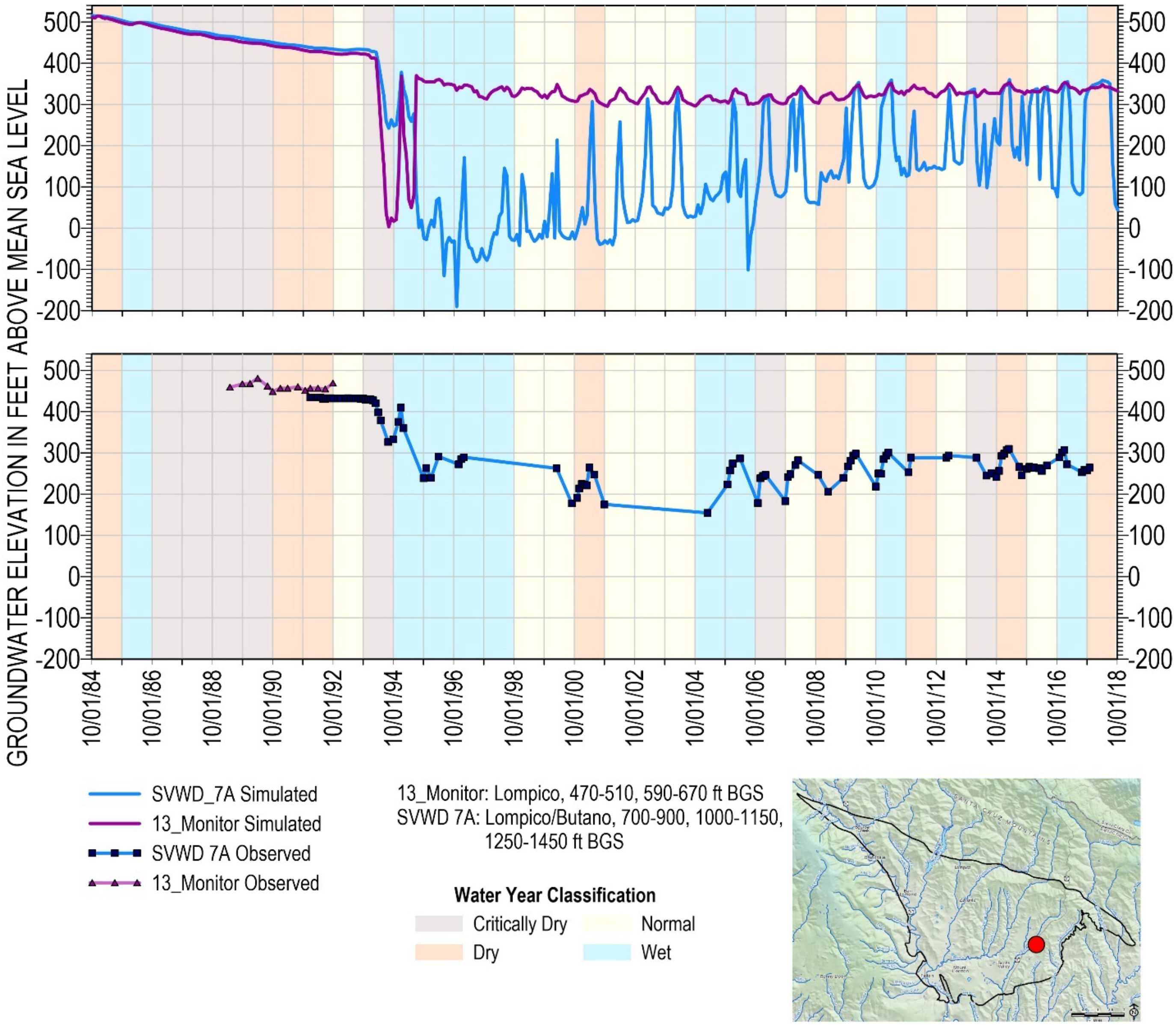


Figure 50. EKI Vertical Gradient Site 9

7 PREDICTIVE SIMULATIONS

A predictive baseline simulation based on projected climate change has been developed to set up the M&A model for alternative predictive simulations. Alternate predictive simulations are developed to evaluate the effects of 2 groundwater management projects:

- Expanded conjunctive use of surface water and groundwater for in-lieu recharge of groundwater by increased surface water use and proportional reduction in groundwater use by SLVWD and SVWD
- Recharge of purified wastewater via injection wells

7.1 Projected Climate Change Scenario

EKI's recommendation 10 to include down-scaled climate change in projected hydrology is based on GSP regulation requirements for the GSP's projected water budget to incorporate projected climate change over the planning and implementation horizon. It also follows that model evaluation of expected benefits of projects and management actions over the planning and implementation horizon should also incorporate projected climate change. Projected climate change has been incorporated into the predictive simulations as described below.

7.1.1 Local Datasets for Climate Change

Although DWR provides projected climate change data sets for use in GSP development, DWR's guidance document on climate change data sets (DWR, 2018) states:

> *Local considerations and decisions may lead GSAs to use different approaches and methods than the ones provided by DWR for evaluating climate change. For example, the use of a transient climate change analysis approach may be appropriate where local models and data have been developed that include the best available science in that watershed or groundwater basin.*

While DWR's datasets are based on a climate period approach that incorporates the effects of climate change based on projected change from historical conditions to a specific future period (e.g. 2030 or 2070), transient climate change analysis evaluates the change of effects of climate change progressing over time (e.g., simulating the increasing effects of climate change from 2020 to 2070). Table 4 shows the local models and data that have previously been developed in the Basin's watershed and region.

Table 4. Climate Change Model Scenarios Used Locally

Name	Primary Client	Primary Project	Description
Climate Catalog	Santa Cruz Mid-County Groundwater Agenecy	Santa Cruz Mid-County Basin GSP	Probabilistic selection of climate from historical years with higher weight for warmer years (HydroMetrics WRI, 2017)
GFDL2.1 A2	City of Santa Cruz	Water Supply Advisory Committee	Single global circulation model in the CMIP3 ensemble (Stratus et. al, 2015)
CMIP5 Mod (CC Projection 2 in Balance, 2020)	City of Santa Cruz	Habitat Conservation Plan	Statistical sample of multiple global circulation models in CMIP5 ensemble(Balance, 2020)

7.1.2 Simulated Climate Change Scenario

The predictive simulations use a transient climate change analysis that is a statistical sample of 4 global circulation models in the CMIP5 ensemble. A transient analysis is appropriate to represent inter-annual variability of precipitation that is indicated by recent research (Swain et al., 2018). The statistical sample is developed using the methodology implemented by Balance for the CMIP5 Mod scenario (Balance, 2020). The 4 global circulation models included in the statistical sample represent moderate overall conditions and are ACESS1-0.1, CCSM4.1, HADGEM2-CC.1, CANESM1 models of the RCP8.5 high emissions scenario.

As described by Balance (2020), precipitation is assigned on an annual basis based on whether the average annual rainfall for all samples is below (dry) or above (wet) the average annual rainfall for the entire projection period. For dry years, the sample representing the 10^{th} percentile of annual rainfall is used. For wet years, the sample representing the 75^{th} percentile of annual rainfall is used.

The following plots label the climate change scenario used for the Santa Margarita basin model predictive scenarios as “Four Model Ensemble 50-99.” Figure 51 shows the annual variability in precipitation for the Four Model Ensemble 50-99 compared to Climate Catalog used for the Santa Cruz Mid-County GSP, GFDL2.1 from the CMIP3 global circulation model ensemble used for the City of Santa Cruz Water Supply Advisory Committee, and GFDL CM3 from the more current CMIP5 ensemble. As designed, the annual variability in precipitation for the Four Model Ensemble 50-99 is greater than the other 3 scenarios. Figure 52 shows the cumulative departure from historical mean for Four Model Ensemble 50-99 compared to the historical mean. The Four Model Ensemble 50-99 ends up slightly drier than the historical mean and simulates a wetter than average period from 2023-2030, a predominantly average period from 2035-2045, and an extended drought from 2050-2064. These periods can be used to evaluate basin sustainability under a wide range of potential future climatic conditions.

The climate change scenario used for the predictive scenarios differs from CMIP5 Mod in that a warming trend is enforced. Temperature is assigned on an annual basis based on whether the average annual temperature for all samples is below (cooler) or above (warmer) the average annual temperature for the entire projection period. For the cooler years, the sample representing the 50th percentile of annual temperature is used. For the warmer years, the sample representing the 99th percentile of annual temperature is used.

Figure 53 shows how the simulated temperature of the Four Model Ensemble 50-99 translates to reference evapotranspiration used in the predictive simulations compared to the three other scenarios. Reference evapotranspiration increases over time in the predictive simulations consistent with the expected warming trend due to climate change.

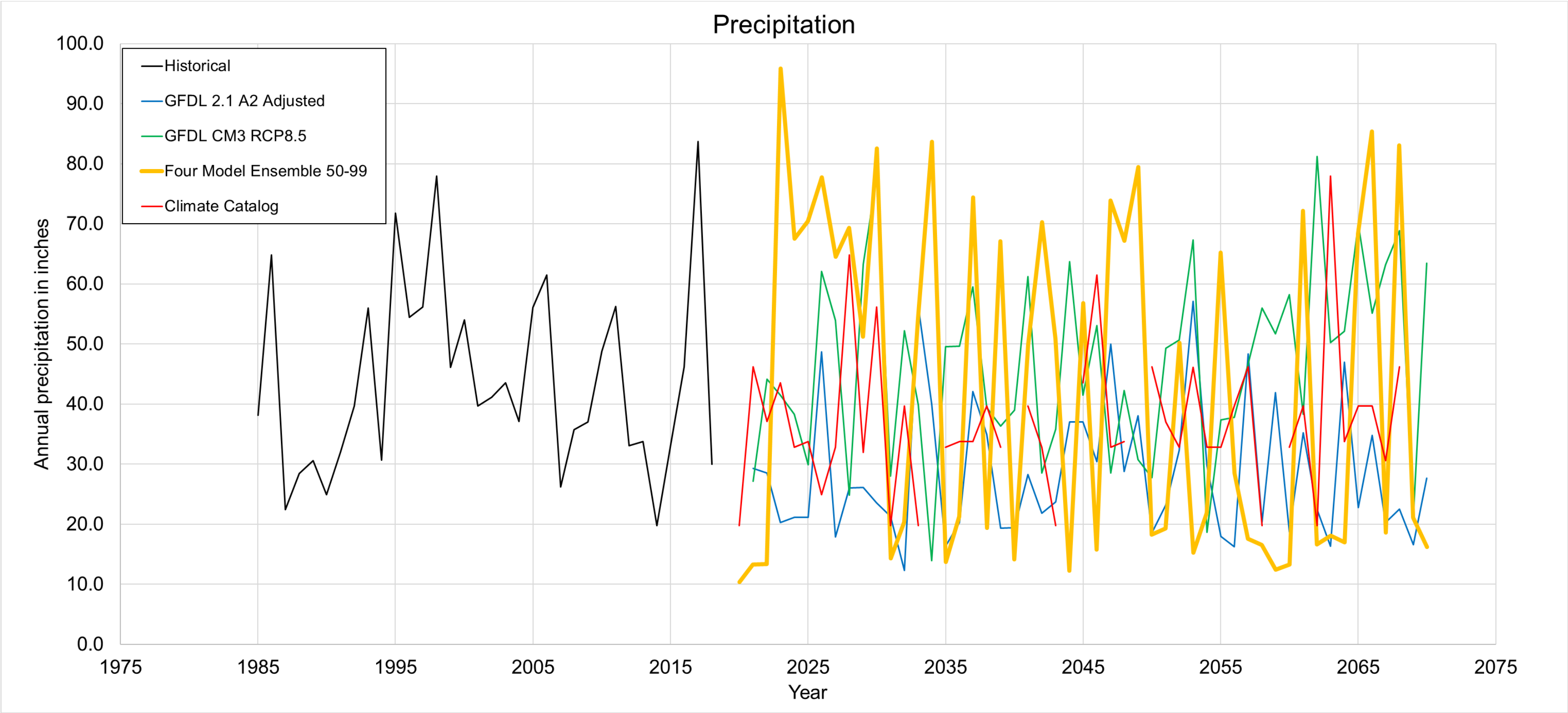


Figure 51. Precipitation Variability between Climate Models

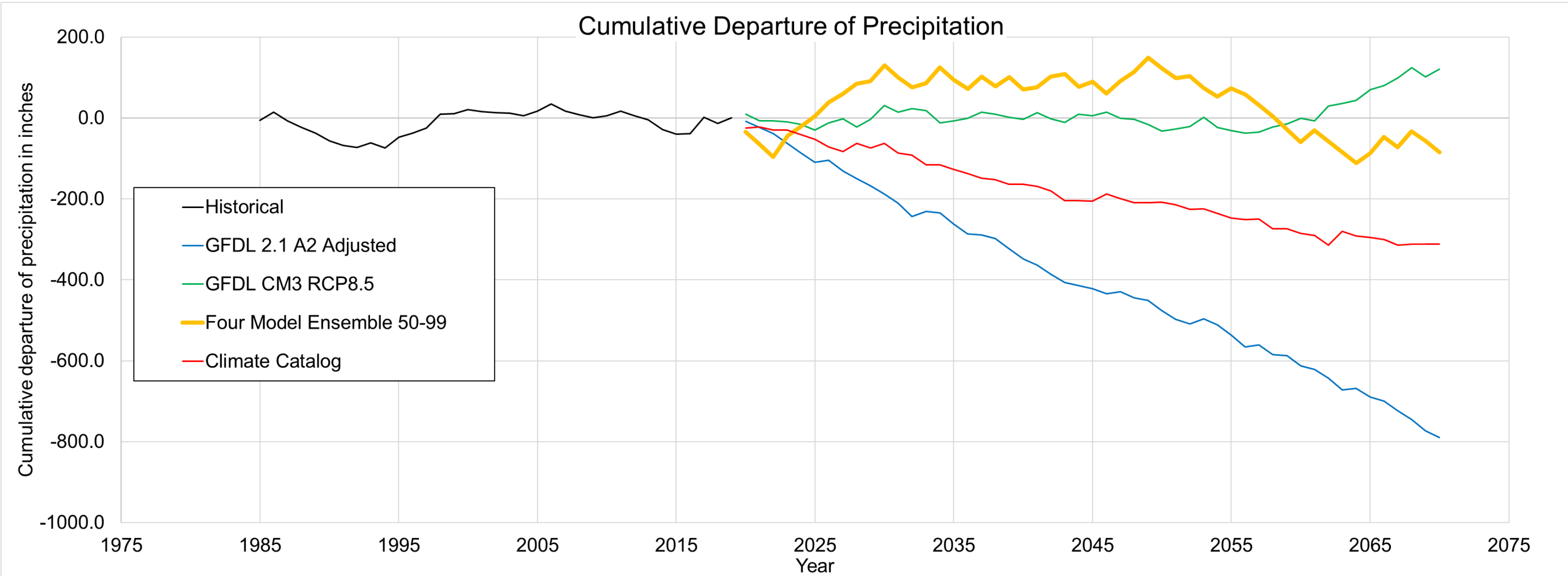


Figure 52. Variation of Cumulative Departure of Precipitation between Climate Models

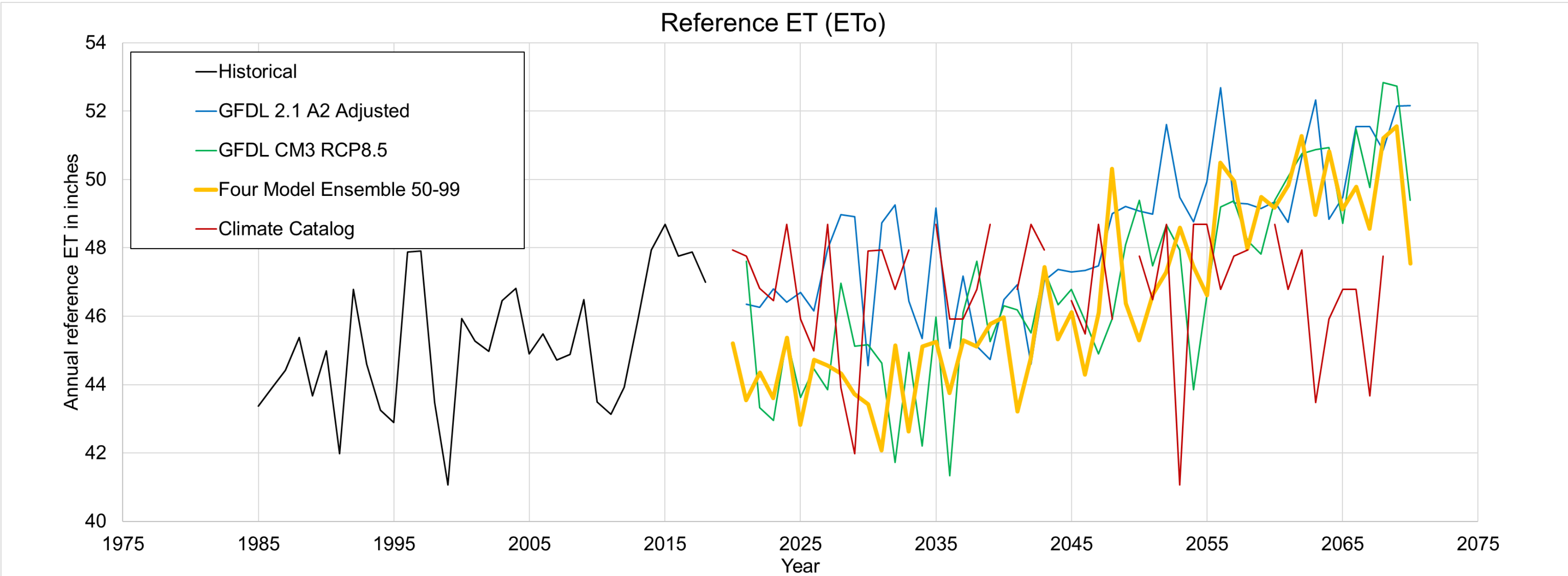


Figure 53. Variation of Annual Reference ET Betweeen Climate Models

7.2 Baseline Simulation

A 54-year predictive baseline simulation was developed starting from WY2019, which is the year following the last water year of the calibrated model, through WY2072. The predictive period covers the 50-year GSP planning and implementation horizon from WY2022 through WY2072 as required by the SGMA. A baseline simulation is needed to evaluate the impact on the Basin from potential projects and management actions to be implemented to achieve sustainability by 2042.

7.2.1 Baseline Groundwater Extraction

Where available, actual measured data for groundwater pumping is used for WY2019 and WY2020. For WY2021 through WY2072 the following assumptions are made regarding groundwater pumping and water use:

- **Private domestic pumping:** since there are no meters on private well owner wells, metered pumping from small water systems that are required to be metered is used to determine a likely WUF. For the entire predictive period, the WUF remains constant at 0.3 AFY and there is no assumed increase in rural population over time. The amount of pumping each month is based on the seasonal distribution of SVWD's residential potable water demand consistent with the historical simulation of the M&A model.
- **Small Water Systems pumping:** where available, metered pumping data reported to County of Santa Cruz are used. In cases where there are gaps in reported pumping, the same annual pumping and monthly distribution used in the historical simulation of the M&A model is used for the predictive period.
- **Mount Hermon Association pumping:** the current residential area in MHA is built out and thus no increase in water demand is assumed over the predictive period. Since there are large areas of turf irrigation in MHA, annual groundwater pumping is varied by predicted water year type from projected climate described in Section 7.1.2. Average annual groundwater pumping for each of the 4 water year types is calculated, and that average pumping is applied to predicted water year types to arrive at predicted MHA annual pumping which is then distributed using the same monthly distribution used in the historical simulation of the M&A model.
- **San Lorenzo Valley Water District water demand and well pumping:** annual water demand increase is assumed to be 0.18% over the predictive period. Historical rainfall and diversion data are used to provide an approximate correlation between annual rainfall versus annual diversions. The historical correlation is applied to predicted annual rainfall from climate change hydrology (Section 7.1.2) to arrive at predicted surface water

diversions. Groundwater pumping makes up the difference between water demand and surface water diversions. An adjustment is made to October through March 2021 surface water diversions where diversions are assumed to be zero because of damage to SLVWD's surface water systems caused by the August CZU Lightning Complex fire. During the months where there are no surface water diversions, groundwater pumping is increased to meet water demand. The distribution of pumping by well is based on the distribution of actual pumping during September 2020.

- **Scotts Valley Water District water demand and well pumping:** the amount of groundwater pumping from WY2021 through 2072 is based on an assumed water demand increase of 0.3% per year (2015 Urban Water Management Plan (UWMP), Kennedy/Jenks Consultants, 2016) starting at actual WY2020 water demand. It is noted that the demand increase used for the predictive simulation is higher than the 2020 UWMP projection of 0.15% (WSC and M&A, 2021) which was developed after the predictive simulations were developed. Reasons for the lower rate of demand increase is because system water losses are expected to decrease 10% by 2040 due to water use efficiency measures such as advanced metering infrastructure, leak detection and reduction, WaterSmart technology, and active promotion of lawn rebates. Due to a reduction in recycled water demand in Scotts Valley, projected recycled water use each year is held constant at 200 AFY. Groundwater pumping makes up the difference between water demand and recycled water use.

7.2.2 Results of Baseline Simulation

Predicted groundwater level results for baseline simulation are shown on hydrographs for all RMPs on Figure 56 through Figure 69.

Minimum thresholds for sustainable management criteria as defined by GSP Section 3 for RMPs are shown in Table 5. Minimum thresholds are an average of the 5 lowest groundwater level measurements in the historical period. Each projected hydrograph is shifted by an average offset between measured and simulated groundwater levels in the calibrated model for improved fit. This allows for a more representative interpretation of projected water levels relative to measured historical data.

Most RMPs fall below minimum thresholds once extended drought occurs in WY2052. SLVWD Pasatiempo MW-2 (Figure 57), SVWD #9 (Figure 62), SLVWD Pasatiempo MW-1 (Figure 63), SVWD #10 (Figure 64), and SVWD TW-19 (Figure 66) maintain projected groundwater levels above their corresponding minimum thresholds without any projects and management actions.

7.3 Expanded Conjunctive Use with Loch Lomond (In-Lieu Recharge)

Expanded conjunctive use with the addition of SLVWD's entitlement to a portion of Loch Lomond water facilitates in-lieu recharge of the aquifers pumped by SLVWD and SVWD in the wet season months. The volumes of surface water available for conjunctive use are based on projected availability of surface water to satisfy SLVWD and SVWD demand during November through April. The following surface water sources are considered:

- 313 AFY from Loch Lomond, based on a draft agreement between SLVWD and the City of Santa Cruz (Exponent, 2019).
- Additional surface water diversions from North System streams tributary to the San Lorenzo River, subject to physical projected surface water availability, includes Peavine Creek, Foreman Creek, Clear Creek, and Sweetwater Creek.
- Additional surface water diversions from Felton System streams tributary to the San Lorenzo River, subject to both physical projected surface water availability and administrative constraints, includes Fall Creek, Bennet Spring, and Bull Creek.

Figure 54 shows the locations of SLVWD surface water diversions from the creeks listed above. Expansion of existing conveyance and treatment infrastructure would be required for the additional surface water diversions considered as part of this simulation. For modeling purposes, it is assumed that the infrastructure necessary for additional surface water diversion would be completed by WY2025.

Legal rights to transfer surface water outside of the SLVWD system from which the diversion takes place is not explicitly considered as part of this evaluation. In other words, it is assumed that any necessary surface water permits required to support additional surface water diversions will be in place by WY2025.

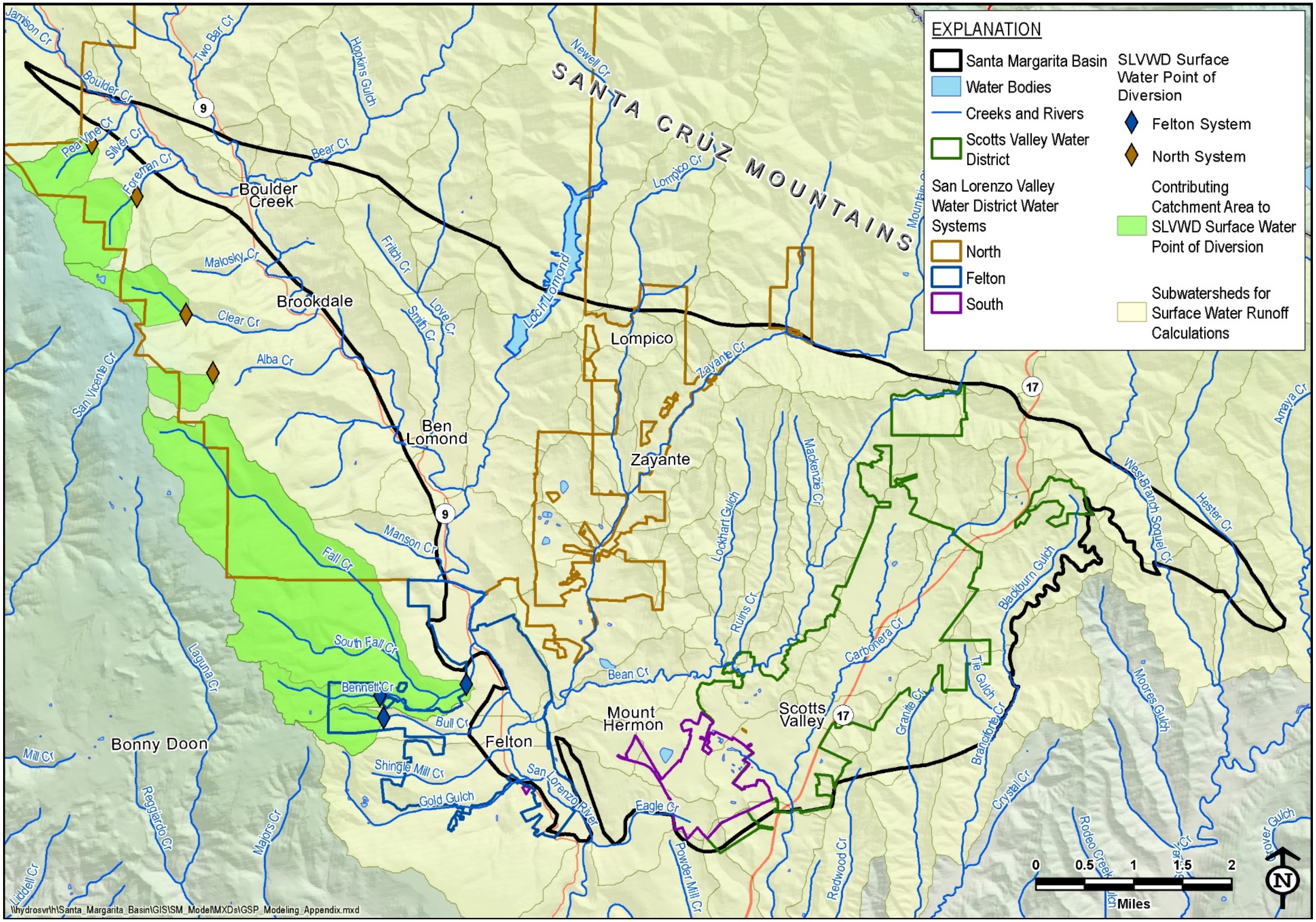


Figure 54. Location of SLVWD Surface Water Diversions

7.3.1 Projected Physical Availability of Surface Water

The physical availability of surface water is projected using the same assumptions and calculations used to determine surface water flows generated both inside and outside of the Basin (Section 5.1.3).

Surface water runoff calculations used to provide input to the groundwater model are at the subwatershed scale. The contributing area for each SLVWD point of diversion is smaller than the subwatersheds for which surface water runoff was calculated (Figure 54). Projected surface water runoff for each point of diversion is therefore rescaled to its corresponding contributing area by multiplying surface water runoff for the subwatershed area by the ratio of the contributing area to the subwatershed area for each point of diversion.

The surface water runoff calculations described in Section 5.1.3 do not explicitly consider or quantify baseflow or hydrograph recession following precipitation. Consequently, zero surface water runoff is calculated during a spring month with zero precipitation, even if that month was preceded by several months with above-average precipitation. This approach is used because evaluating and simulating watershed rainfall-runoff responses was outside the scope of the GSP model. However, baseflow in streams used for SLVWD surface water diversions is relevant for the purposes of determining how much additional surface water would be available to support in-lieu recharge.

Monthly streamflow for the streams used for in-lieu recharge is estimated as the cumulative runoff less the cumulative diversion over preceding months during each water year. For example, January streamflow would be computed as total October through January runoff less total October through January surface water diversions. The purpose of this simplified approach is to approximate the concept of surface water baseflow, even though baseflow is not explicitly quantified by the surface water runoff calculations used for the model.

7.3.2 Assumed Administrative Constraints on Additional Surface Water Use

In addition to water physically available in the stream, additional surface water diversions for conjunctive use are assumed to be constrained by the conditions of relevant surface water diversion permits.

Loch Lomond: It is assumed that Loch Lomond releases will be limited to 313 AFY.

SLVWD North System: It is assumed that additional diversions from streams in the SLVWD North System are limited solely to the water physically available in the creeks.

SLVWD Felton System: Additional diversions from creeks serving the Felton System are assumed to be limited by the following constraints (Exponent, 2019):

- Minimum Fall Creek winter (November 1 through March 31) bypass flow of 0.75 cfs for dry years, and 1.5 cfs for otherwise. Dry years are defined based on cumulative flow volume in the San Lorenzo River at Big Trees from the beginning of the water year, and it should be noted that the administrative definition of dry year used to constrain Felton System diversions differs from the definition of dry year used for the GSP.
- Maximum diversion rate of 1.7 cfs
- Maximum annual diversion volume of 1,059 AF

Furthermore, it is assumed that diversions from streams serving the Felton System are permitted only if streamflow in the San Lorenzo River at Big Trees is at least 20 cfs (Exponent, 2019). Projected streamflow in the San Lorenzo River at Big Trees as simulated in the baseline simulation was used to identify dry years and months with streamflow less than 20 cfs.

7.3.3 Reductions to Projected Groundwater Pumping

Reductions of groundwater pumping for in-lieu recharge is preferentially allocated to the SLVWD Pasatiempo wellfield and all SVWD extraction wells. This assumes, as noted in Section 7.3, that additional surface water can be treated and conveyed to the point of use. November through April groundwater pumping is reduced monthly as follows:

1. 313 AFY Loch Lomond water is used to offset SLVWD Pasatiempo wellfield pumping, followed by SVWD pumping.
2. SLVWD North System surface water is used to first offset SLVWD Pasatiempo pumping, followed by SVWD pumping. Any remaining surface water is used to offset SLVWD pumping from its Olympia and Quail Hollow wellfields. On average 99 AFY of surface water is used conjunctively from the North System over the predictive period.
3. SLVWD Felton System surface water is used to first offset SLVWD Pasatiempo pumping, followed by SVWD pumping. Any remaining surface water is used to offset SLVWD pumping from its Olympia and Quail Hollow wellfields. On average 128 AFY of surface water is used conjunctively from the Felton System over the predictive period.

Figure 55 shows projected groundwater pumping and surface water diversions by water district based on the conjunctive use evaluation described above. From WY2025 through WY2072, average groundwater pumping reductions by SLVWD and SVWD are 170 AFY and 370 AFY respectively, for a total average of 540 AFY.

Note that the estimate of available surface water for conjunctive use is only preliminary since there are future water rights change applications planned by the City of Santa Cruz and SLVWD that would change assumptions used in developing this preliminary estimate.

7.3.4 Results of Expanded Conjunctive Use

Predicted groundwater level results for simulation of 540 AFY of expanded conjunctive use are shown on hydrographs for all RMPs on Figure 56 through Figure 69.

Expanded conjunctive use predicted groundwater levels show little improvement in all Santa Margarita aquifer wells (Figure 56 through Figure 61) and in Stonewood Well in Butano aquifer well (Figure 69), but indicate a benefit in achieving minimum thresholds before the extended drought in the remaining wells in Monterey Formation, Lompico aquifer, and Butano aquifer (Figure 62 through Figure 68). Predictive groundwater levels begin to fall below minimum thresholds during the extended drought starting in WY2052 (Figure 62 through Figure 68).

7.4 Recharge by Injection Only

The injection only simulation was developed to determine improvements to Lompico aquifer groundwater levels due to aquifer recharge by injection. The source of injection water is not a consideration for purposes of modeling, although Section 4 of the GSP describes some potential sources. The simulation assumes a constant volume of 710 AFY is injected at 3 injection wells located near the SVWD's El Pueblo yard and injection is distributed uniformly over each month. The simulation assumes the injected water is left in the aquifer and not pumped out.

Predicted groundwater level results for simulation of 540 AFY of expanded conjunctive use with 710 AFY of injection of the Lompico aquifer are shown on hydrographs for all RMPs on Figure 56 through Figure 69.

Measurable objectives for sustainable management criteria as defined by GSP Section 3 for RMPs are shown in Table 5. Results from expanded conjunctive use for WY2040 are used to determine measurable objectives for RMPs at Monterey Formation, Lompico aquifer, and Butano aquifer. Santa Margarita aquifer RMP measurable objectives are based on historical values in WY2004.

Predicted groundwater levels from expanded conjunctive use with injection only share similar results as described in Section 7.3.3 where there is minimal benefit in Santa Margarita aquifer wells (Figure 56 through Figure 61) and Stonewood Well in Butano aquifer (Figure 69), but more favorable benefit in the remaining wells in the Monterey Formation, Lompico aquifer, and Butano aquifer (Figure 62 through Figure 68). Expanded conjunctive use with injection action can maintain predictive groundwater levels above measurable objectives and minimum thresholds throughout the entire projection period from WY2021 through WY2072 (Figure 62 through Figure 68).

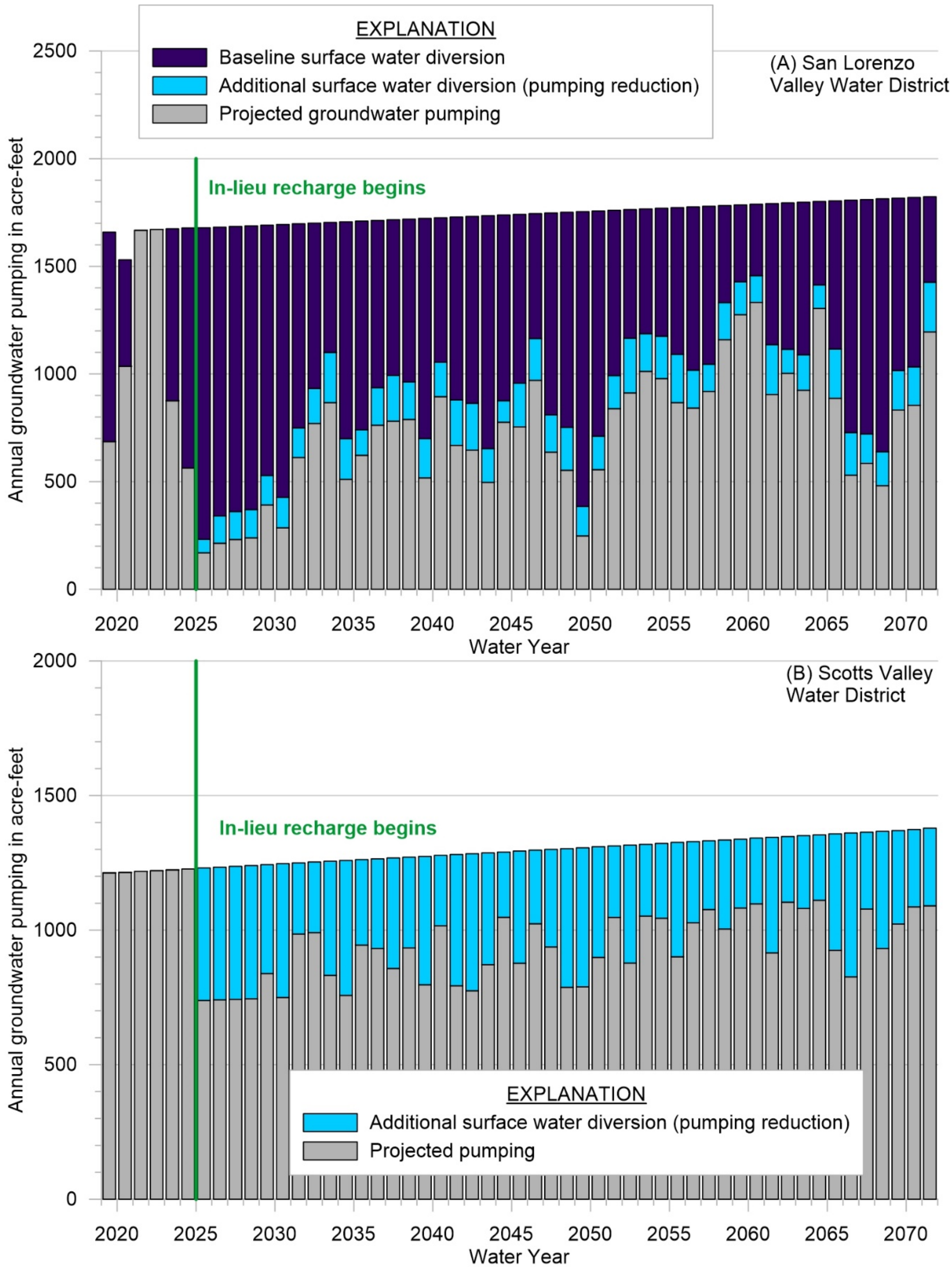


Figure 55. Projected Groundwater Pumping and Surface Water Diversion by Water District

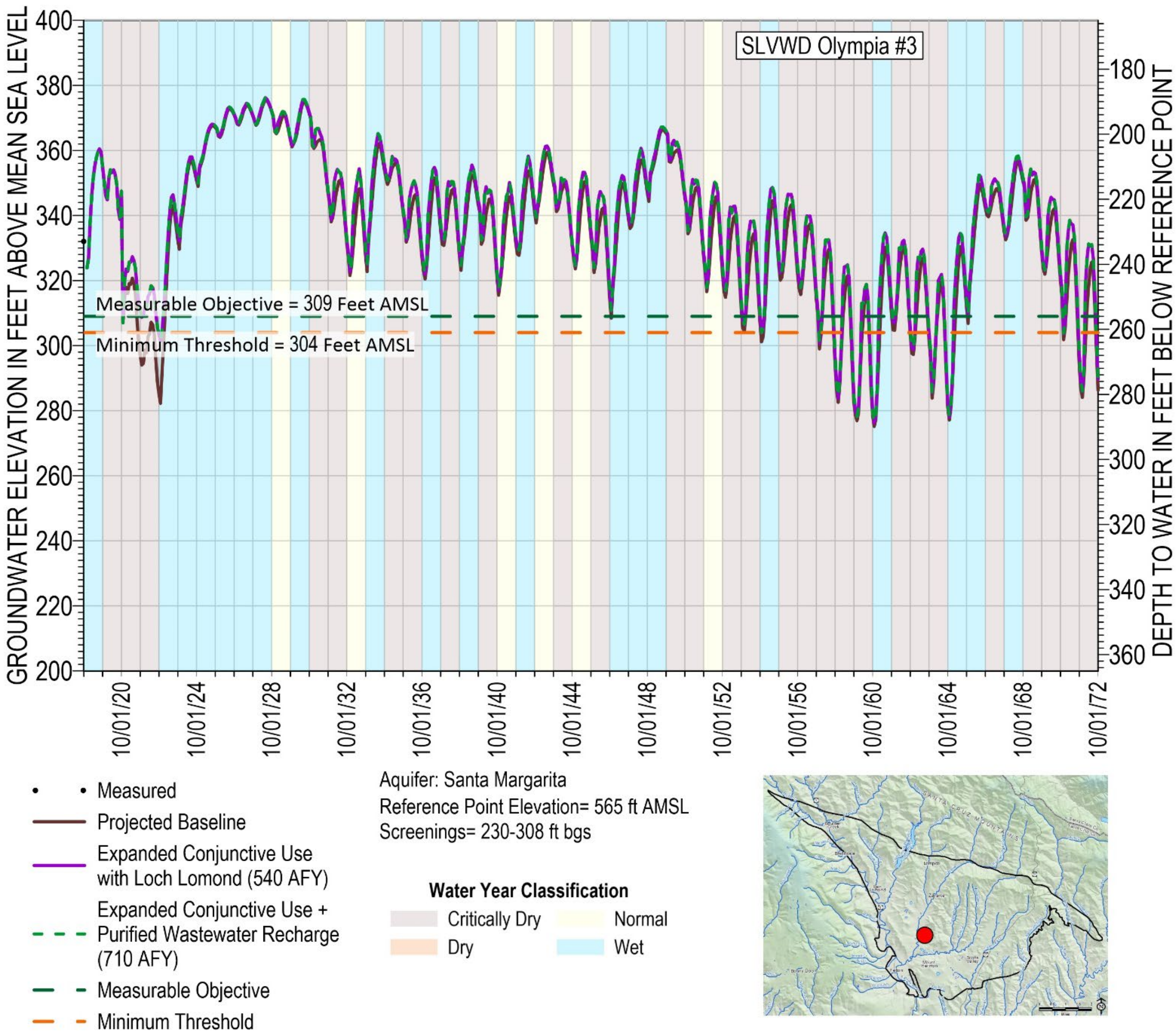


Figure 56. SLVWD Olympia #3 Projected Hydrograph

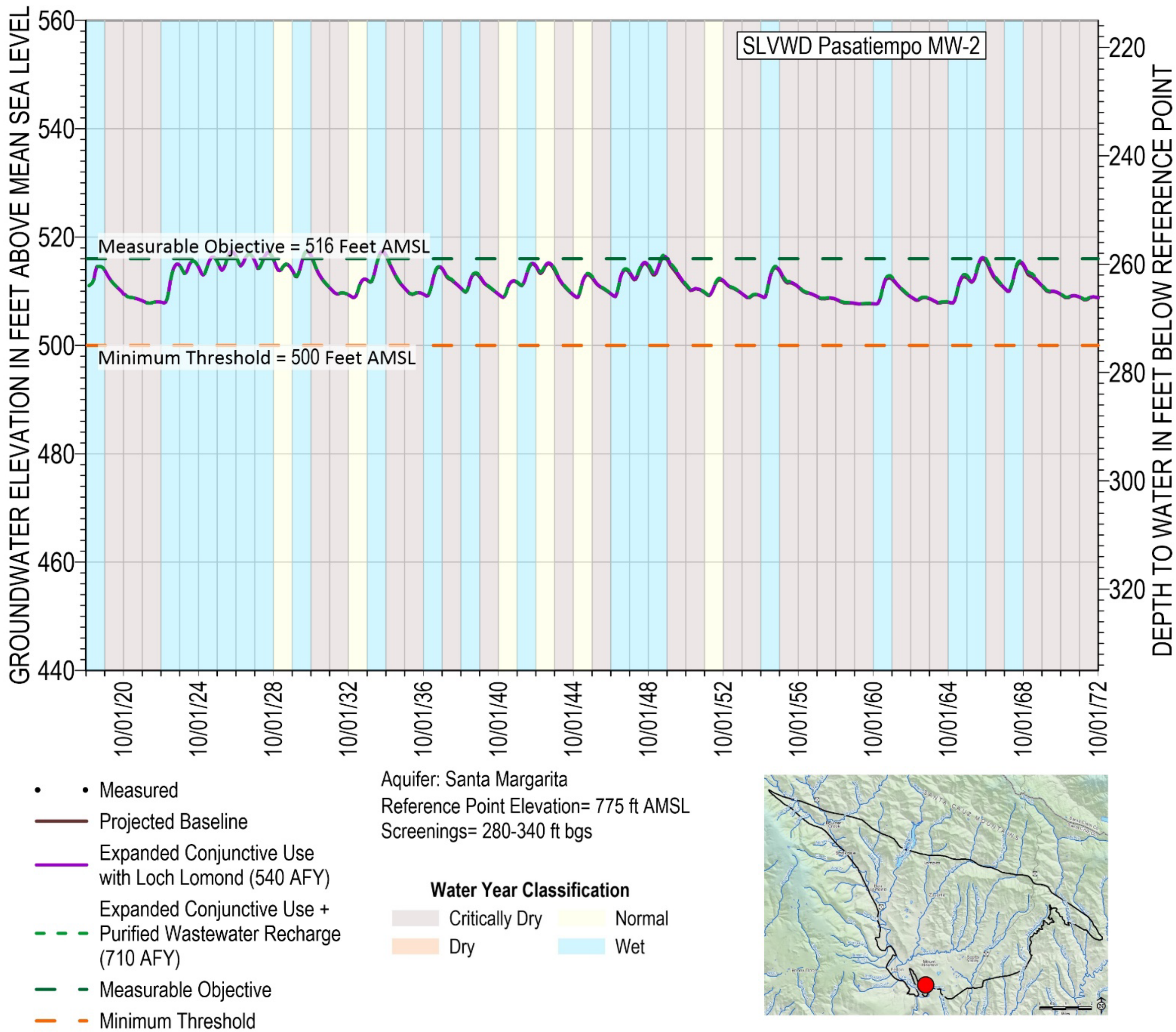


Figure 57. SLVWD Pasatiempo MW-2 Projected Hydrograph

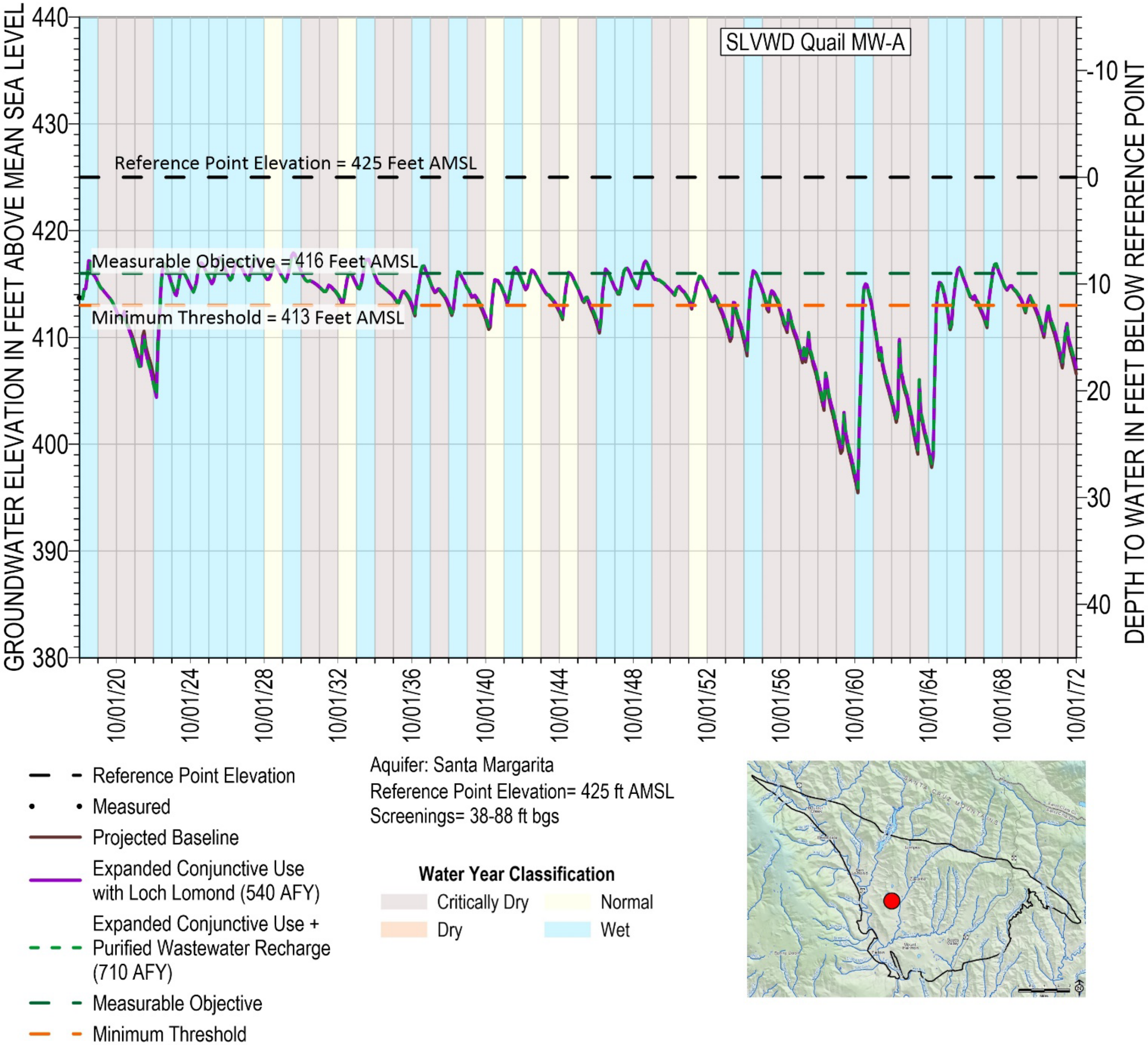


Figure 58. SLVWD Quaill MW-A Projected Hydrograph

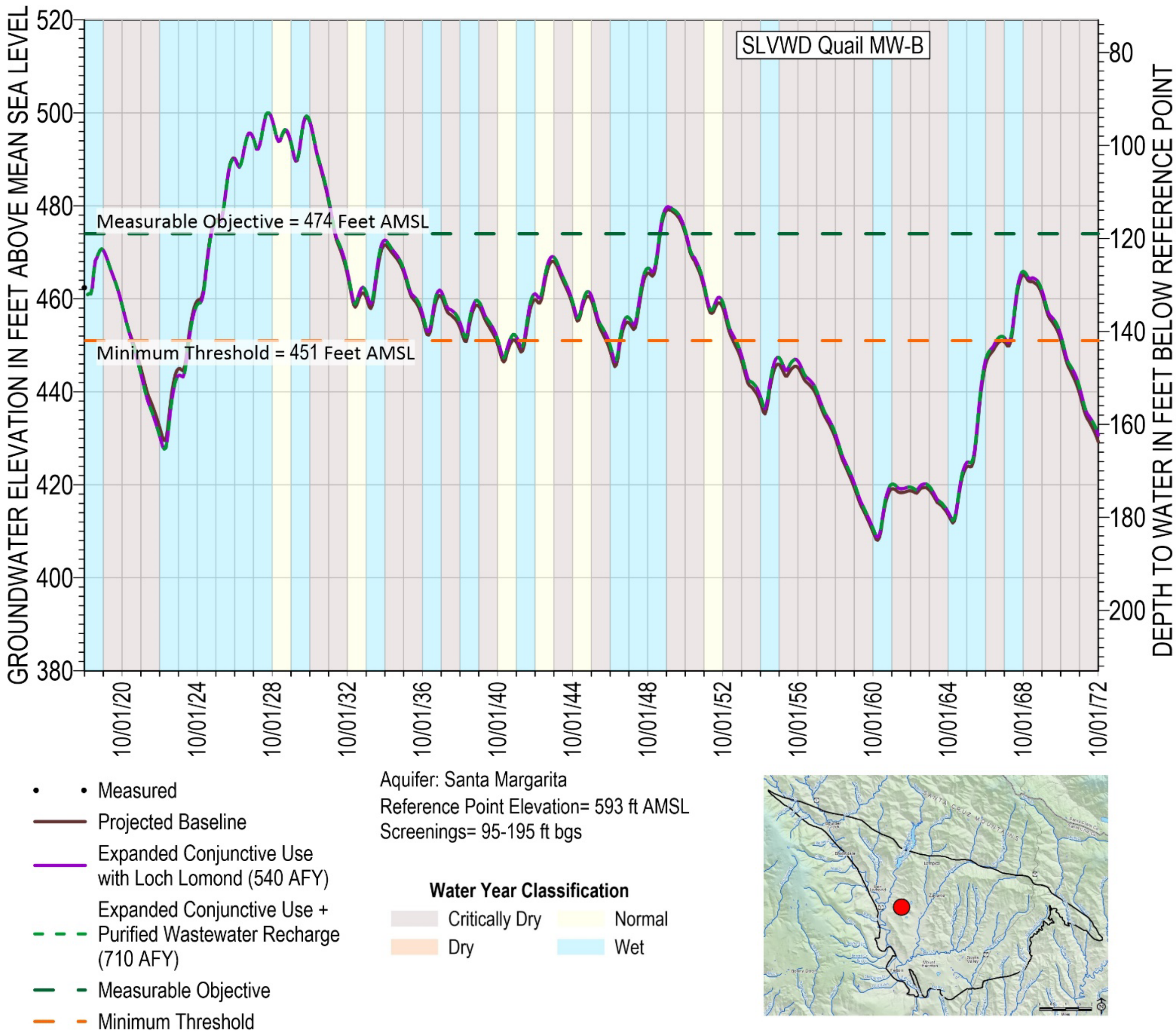
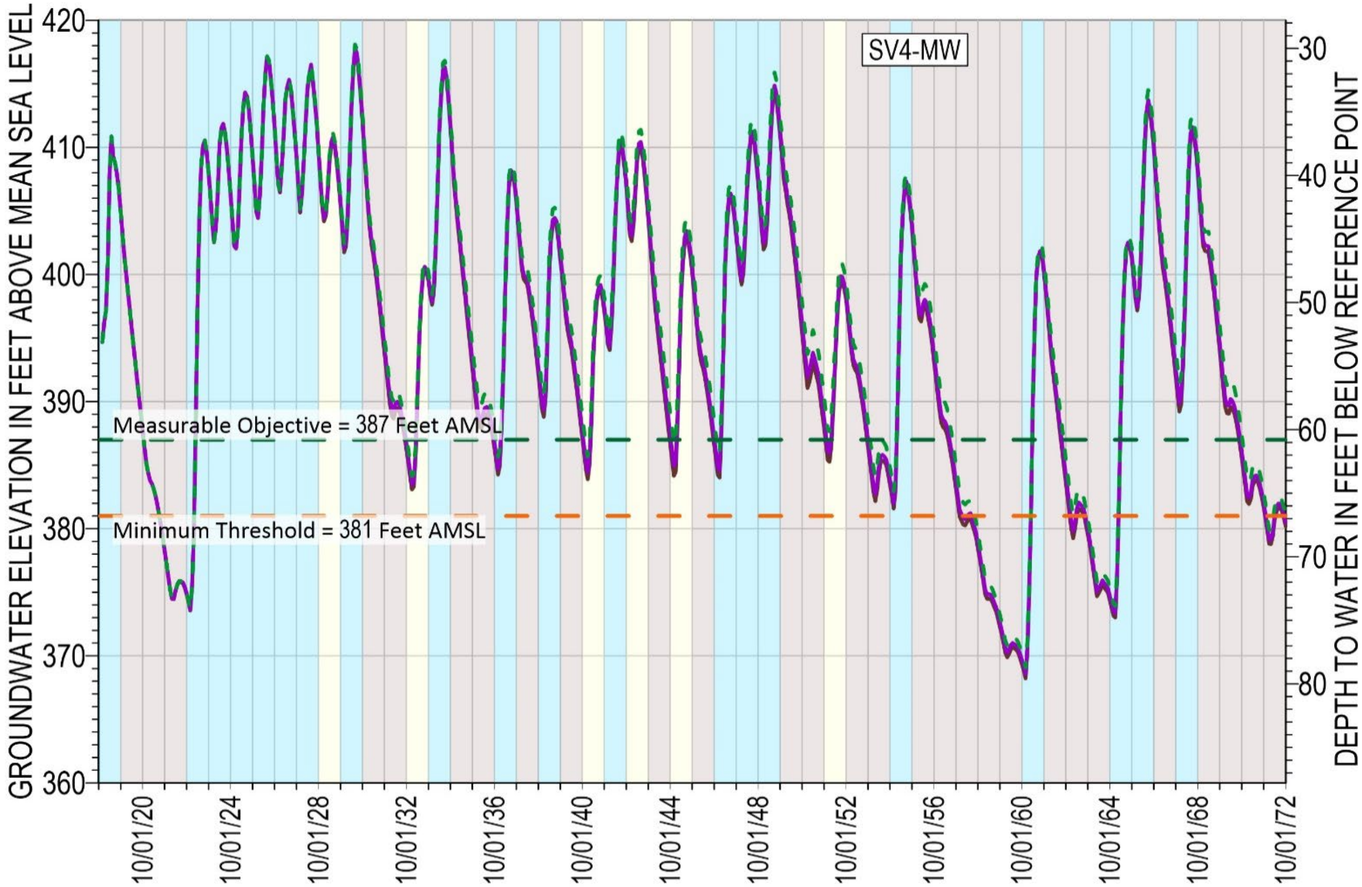


Figure 59. SLVWD Quail MW-B Projected Hydrograph



Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Santa Margarita
Reference Point Elevation= 447.79 ft AMSL
Screenings= 50-60 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

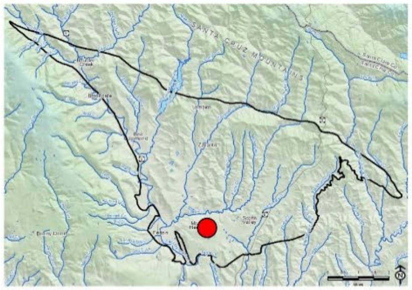
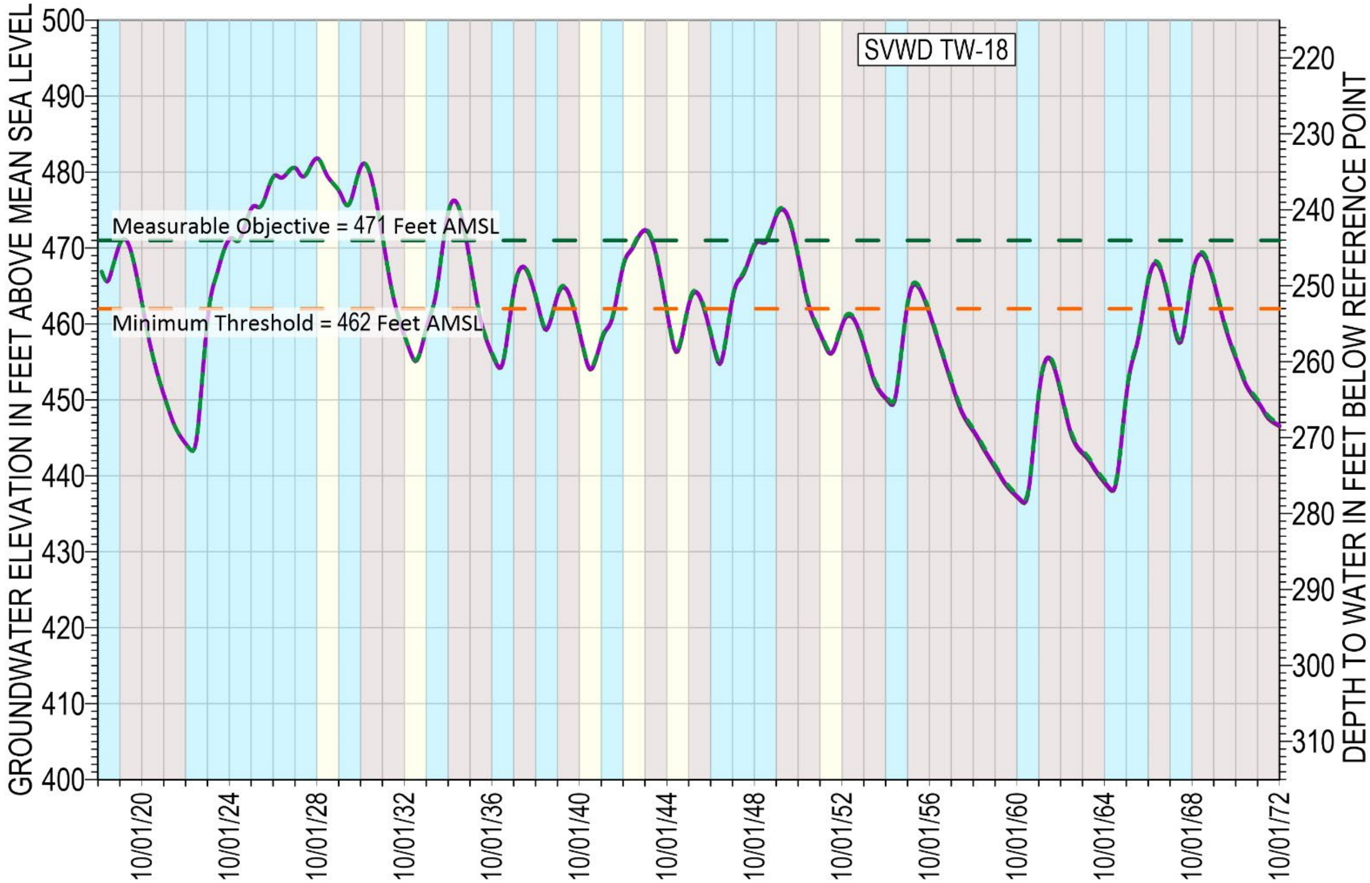


Figure 60. SV4-MW Projected Hydrograph



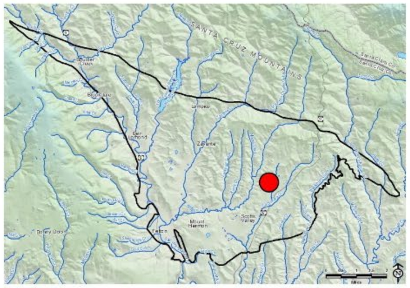
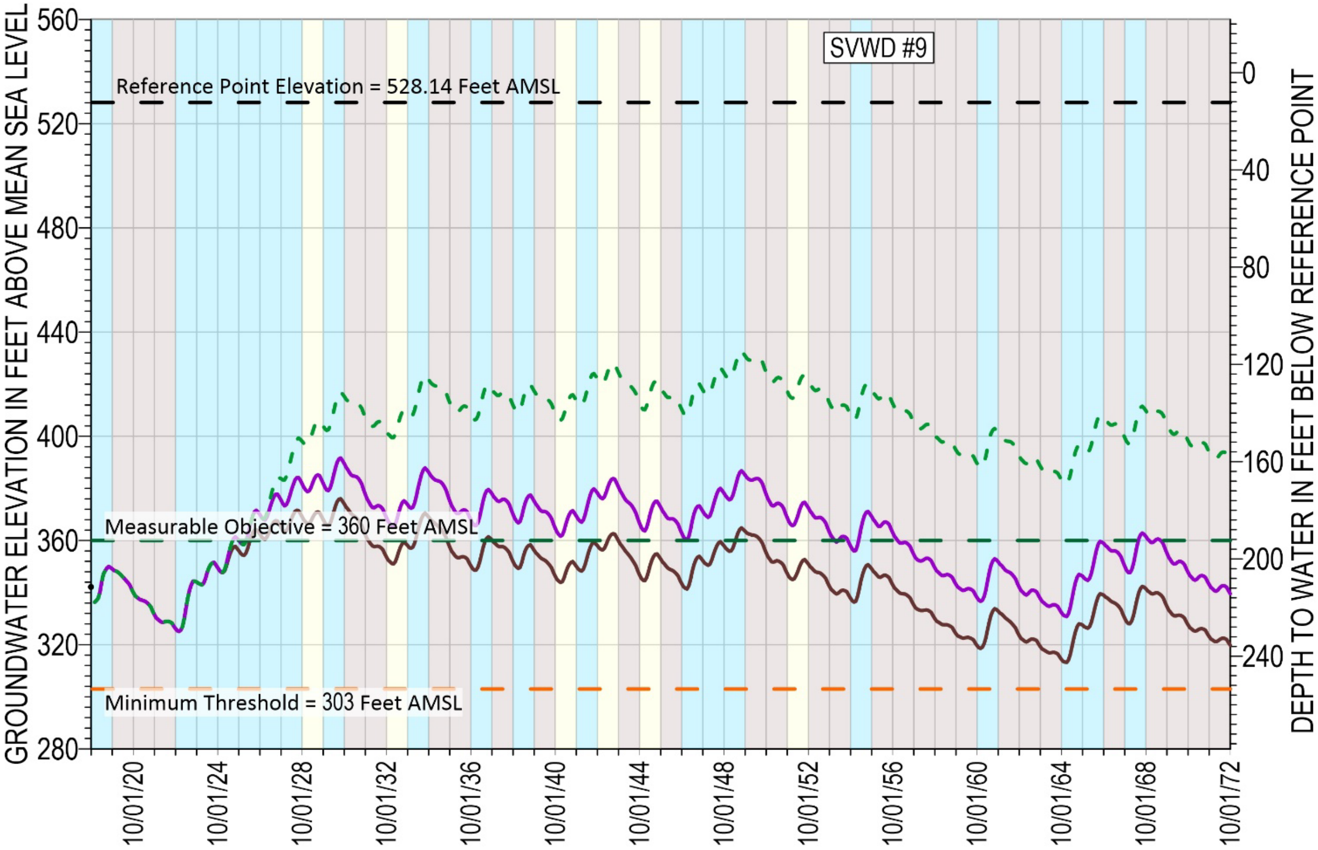


Figure 61. SVWD TW-18 Projected Hydrograph



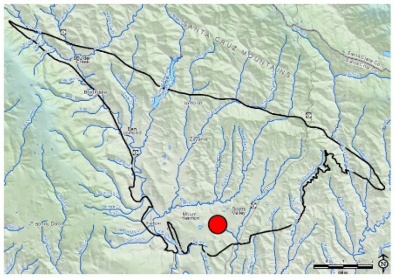


Figure 62. SVWD #9 Projected Hydrograph

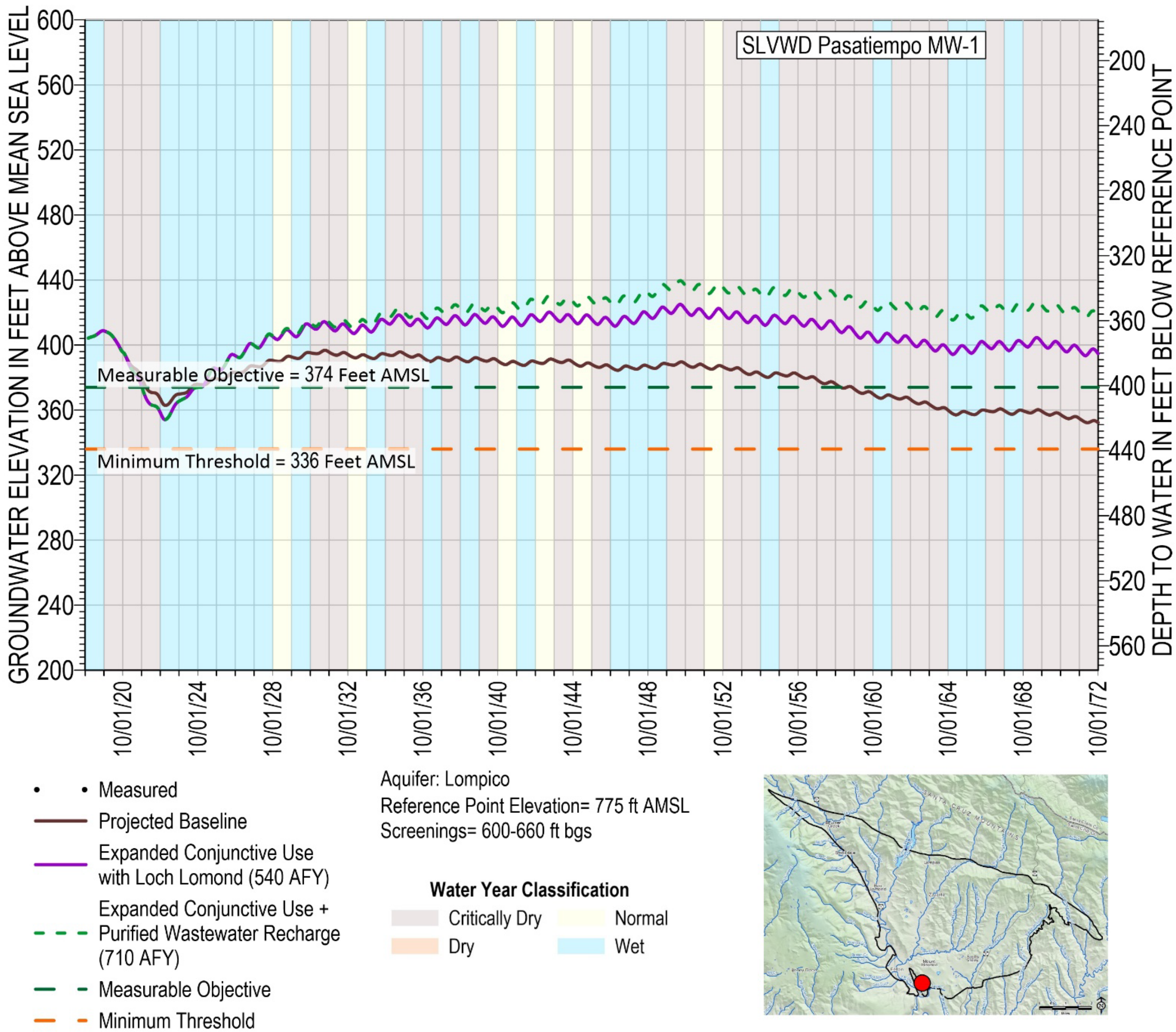


Figure 63. SLVWD Pasatiempo MW-1 Projected Hydrograph

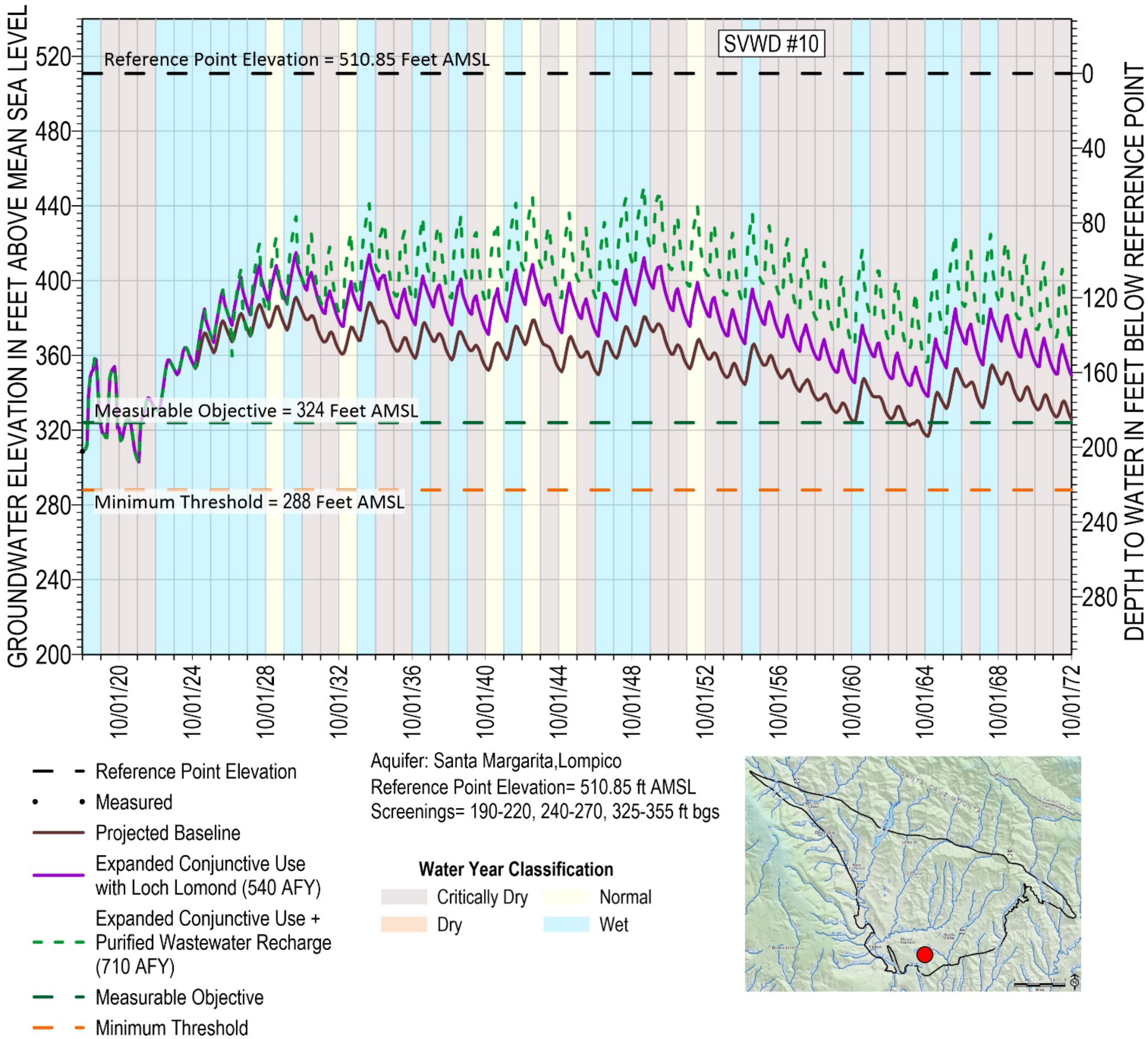
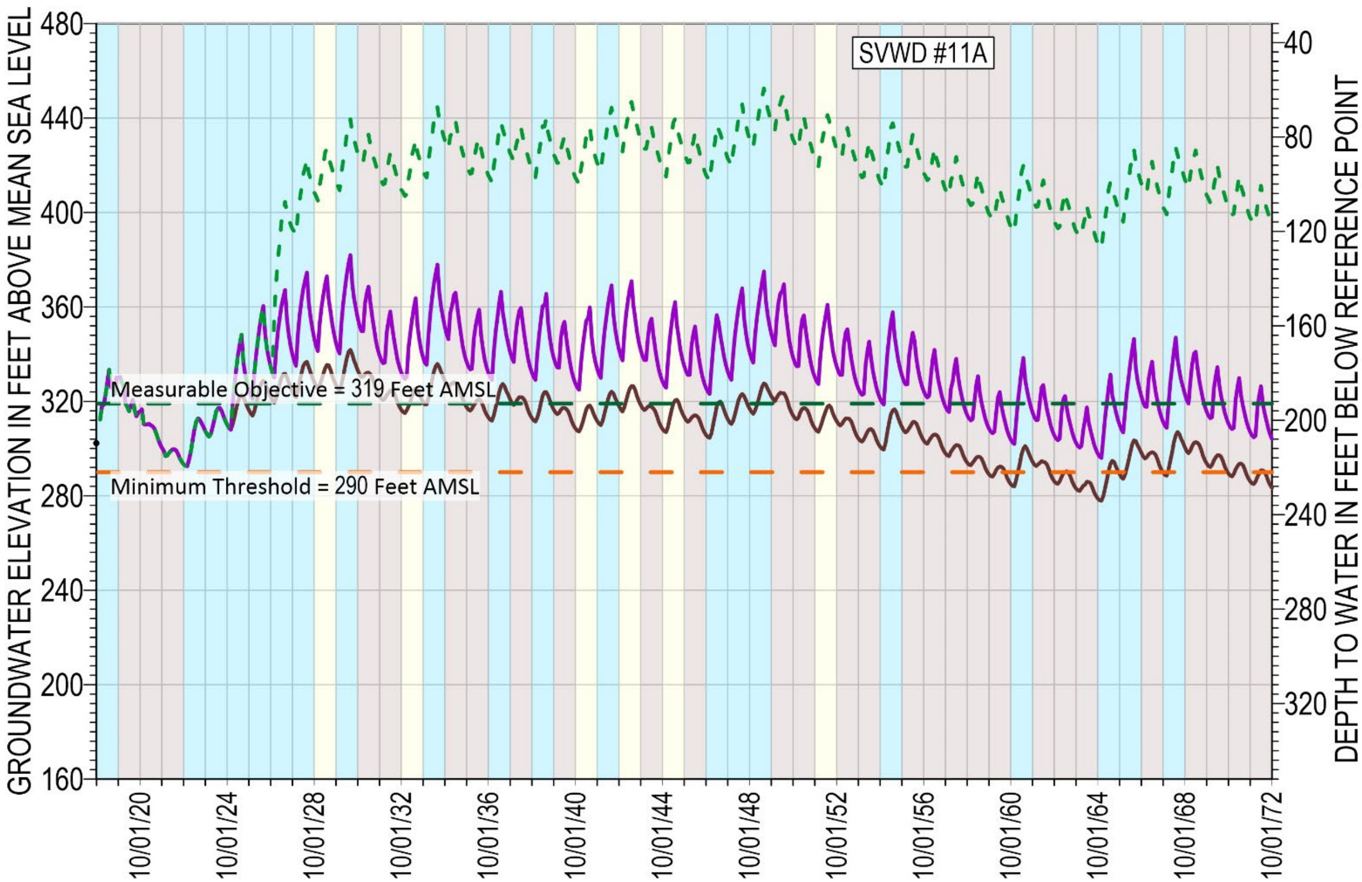


Figure 64. SVWD #10 Projected Hydrograph



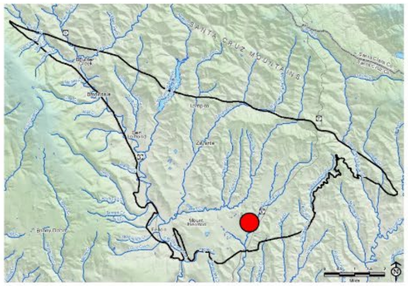
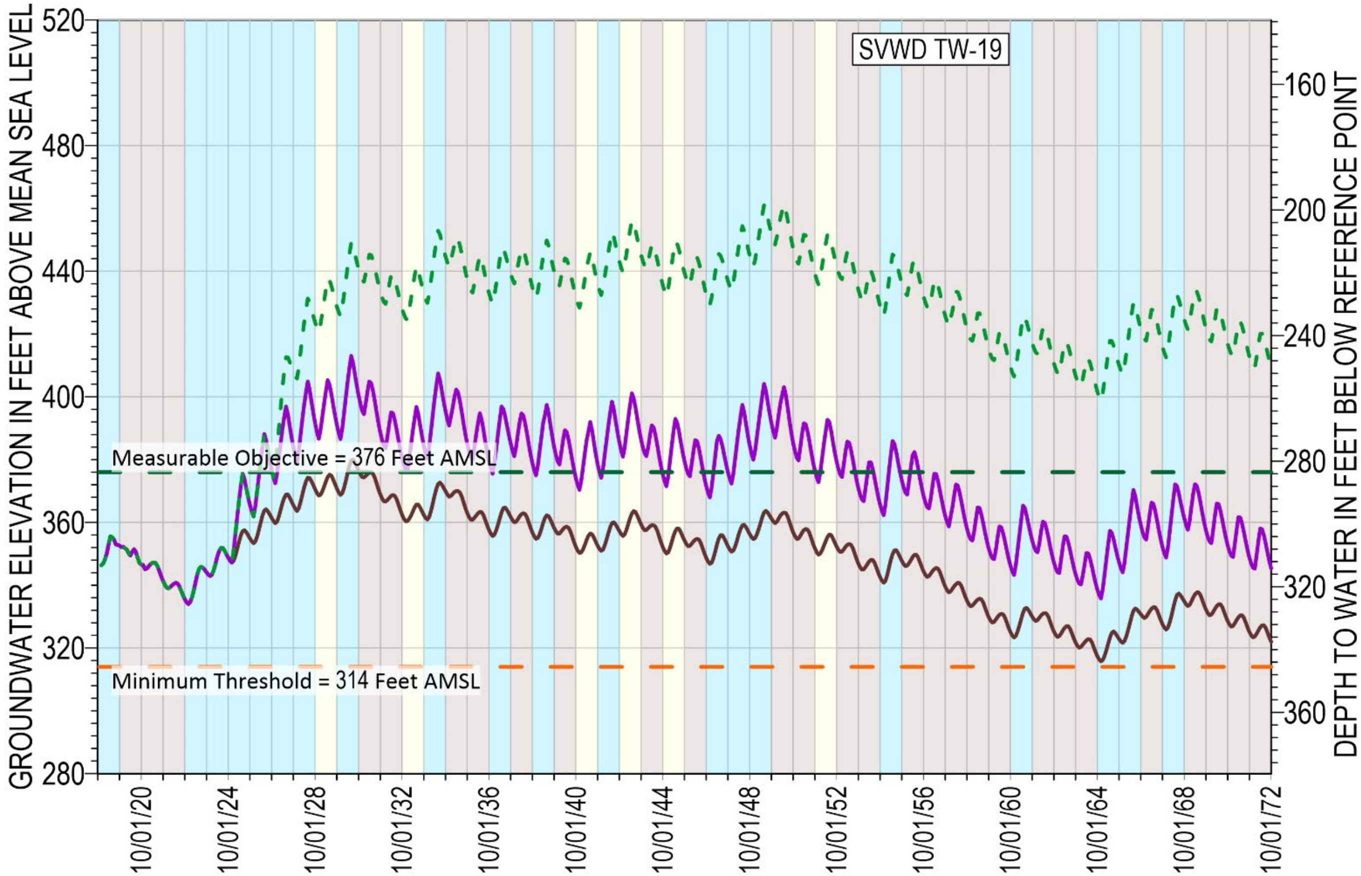


Figure 65. SVWD #11A Projected Hydrograph



• Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Lompico
Reference Point Elevation= 659.49 ft AMSL
Screenings= 960-1060 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

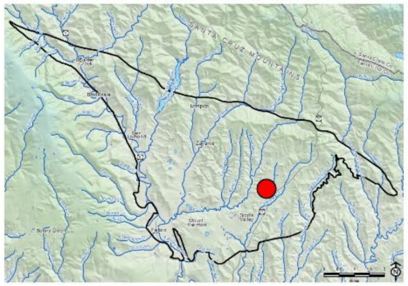
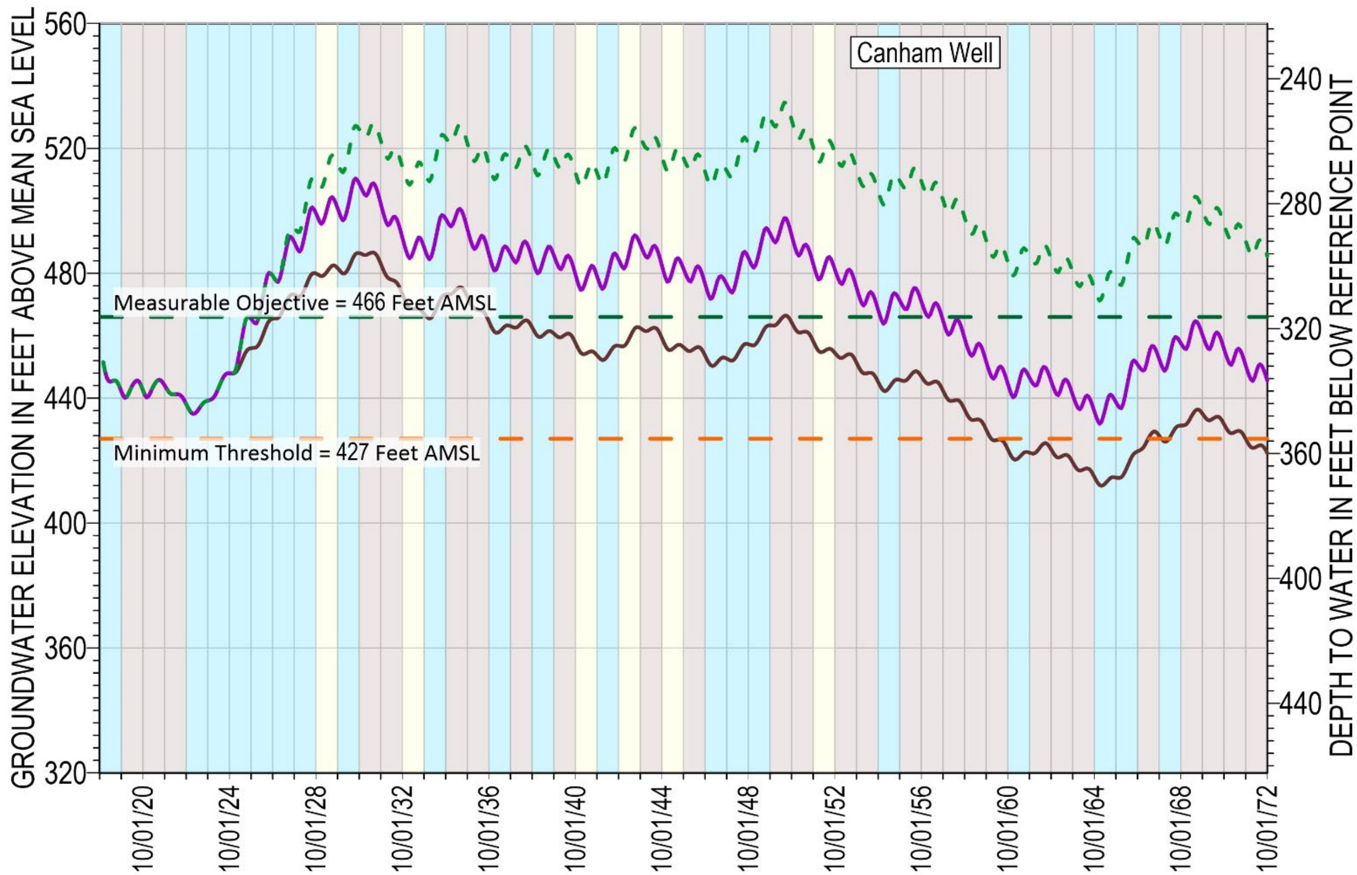


Figure 66. SVWD TW-19 Projected Hydrograph



- • Measured
- Projected Baseline
- Expanded Conjunctive Use with Loch Lomond (540 AFY)
- Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
- Measurable Objective
- Minimum Threshold

Aquifer: Butano
Reference Point Elevation= 782.27 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

- Critically Dry
- Normal
- Dry
- Wet

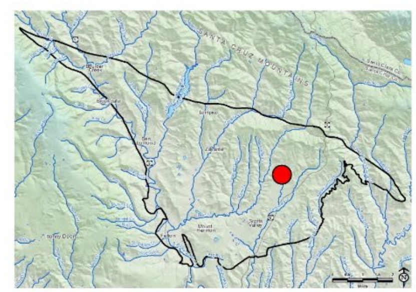


Figure 67. Canham Well Projected Hydrograph

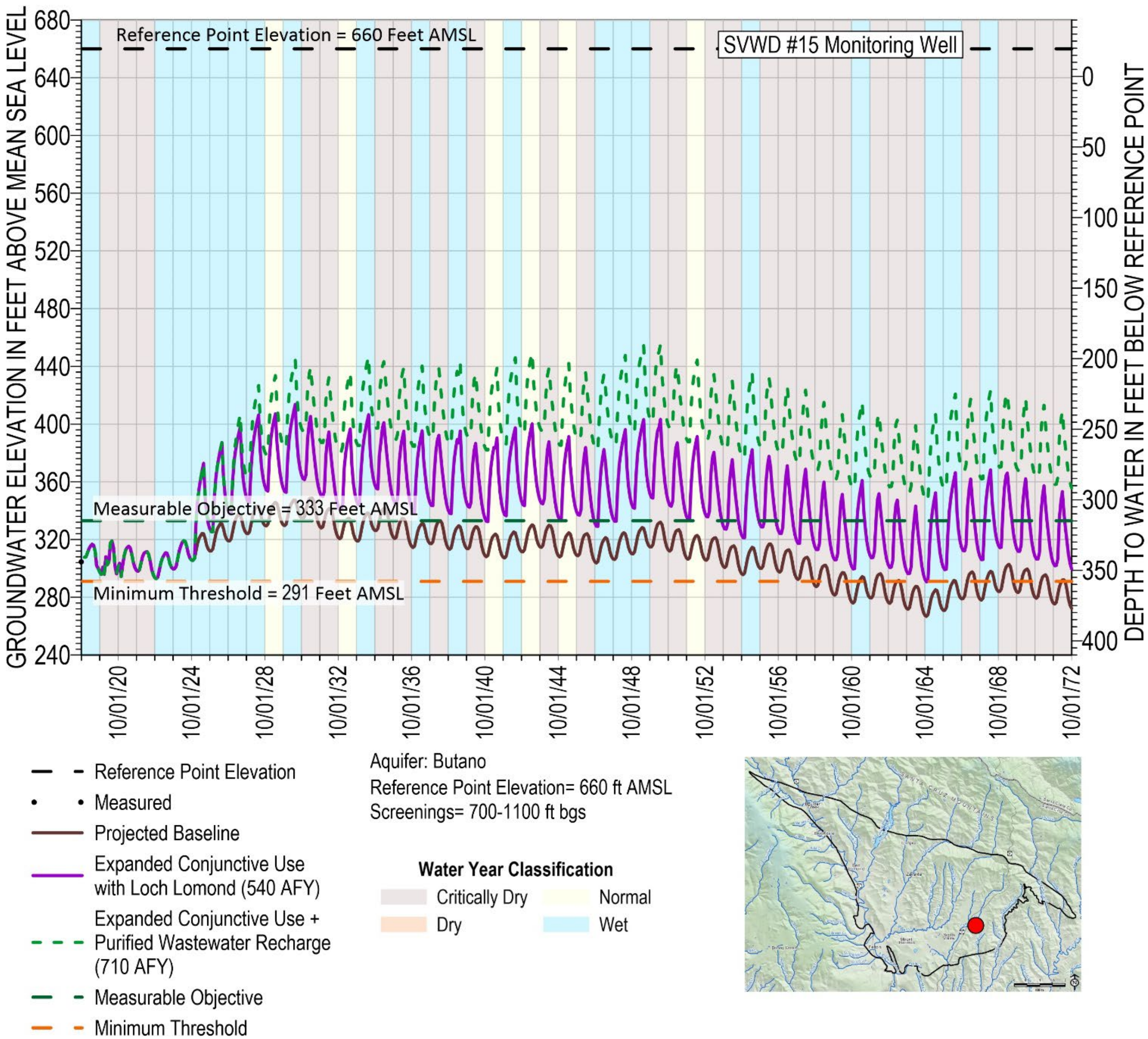
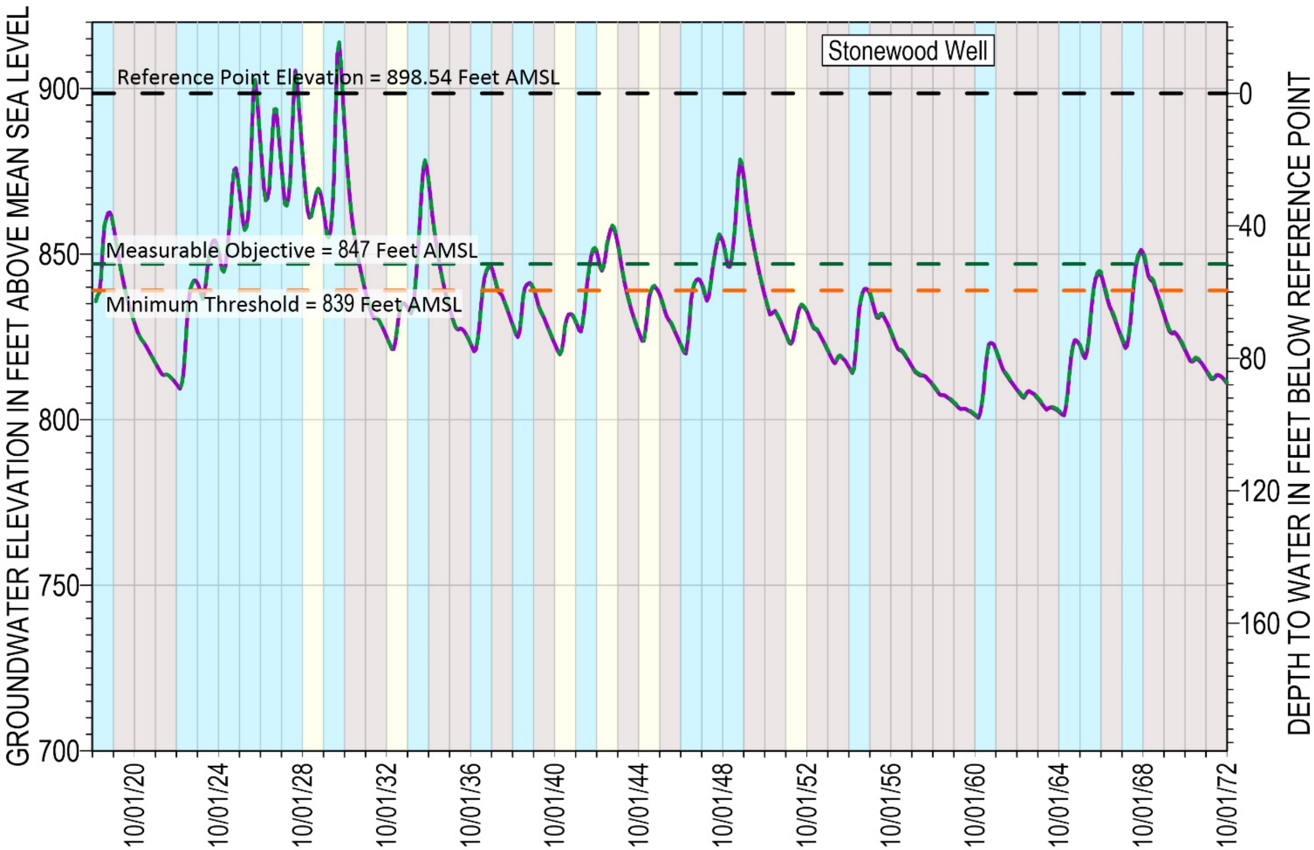


Figure 68. SVWD #15 Monitoring Well Projected Hydrograph



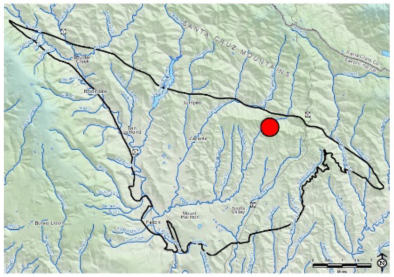


Figure 69. Stonewood Projected Hydrograph

Table 5. Minimum Thresholds and Measurable Objectives Milestones for Groundwater Levels based on GSP Section 3

Aquifer	Well Name	Groundwater Elevation (feet above mean sea level)	
		Minimum Threshold	Measurable Objective
Santa Margarita	SLVWD Quail MW-A	413	416
	SLVWD Quail MW-B	451	474
	SLVWD Olympia #3	304	309
	SLVWD Pasatiempo MW-2	500	516
	SVWD TW-18	462	471
	SV4-MW	381	387
Monterey	SVWD #9	303	360
Lompico	SLVWD Pasatiempo MW-1	336	374
	SVWD #10	288	324
	SVWD #11A	290	319
	SVWD TW-19	314	376
Lompico/Butano	SVWD #15 Monitoring Well	291	333
Butano	SVWD Stonewood Well	839	847
	SVWD Canham Well	427	466

8 CONCLUSIONS

The objectives for updating and improving the structure and inputs of the SMGB model are to improve its use as a suitable tool to support GSP development and to guide groundwater management decisions as the GSP is implemented. Upgrading to MODFLOW6 allowed for more efficient implementation of geological pinch-outs, routing of springs and seeps to the stream network, and organization of model inputs by having separate recharge packages for precipitation and return flow recharge. Model stress period refinement from quarterly to monthly allowed more compatibility with projected climate change datasets. Recharge and runoff calculations were redeveloped to maintain traceable water balance with precipitation and evapotranspiration. Model domain expansion allowed the model to cover the entire SMGB area. Most changes described were made with guidance from EKI recommendations (Section 2.1).

The updated SMGB model is generally able to simulate surface water and groundwater observations with slight improvements from previous model-term trends, but actual quantified values are offset at some locations. The model functionality and calibration is appropriate for estimates of historical, current, and projected water budgets as required for the GSP. As importantly, the model has the framework to run alternative simulations based on projects and management actions. With projected climate change and future pumping included in predictive simulations, various project or management action simulations can be compared to a baseline "no project" condition to quantify groundwater impacts and benefits. The simulation of long-term trends in the updated SMGB model allows for evaluation of alternative simulations at RMPs.

Recommended improvements to the model include reevaluation and recalibration after:

- Surveyed verification of all RPEs
- Several years of streamflow monitoring at 5 newly established gauges discussed in Section 3.3 of the GSP
- Additional stream seepage from accretion studies, new RMPs in data gap areas, and groundwater level data for all model targets.

Given the likelihood that any model calibration is non-unique, we also recommend evaluating predictive uncertainty when using the model for more detailed planning of projects and management actions.

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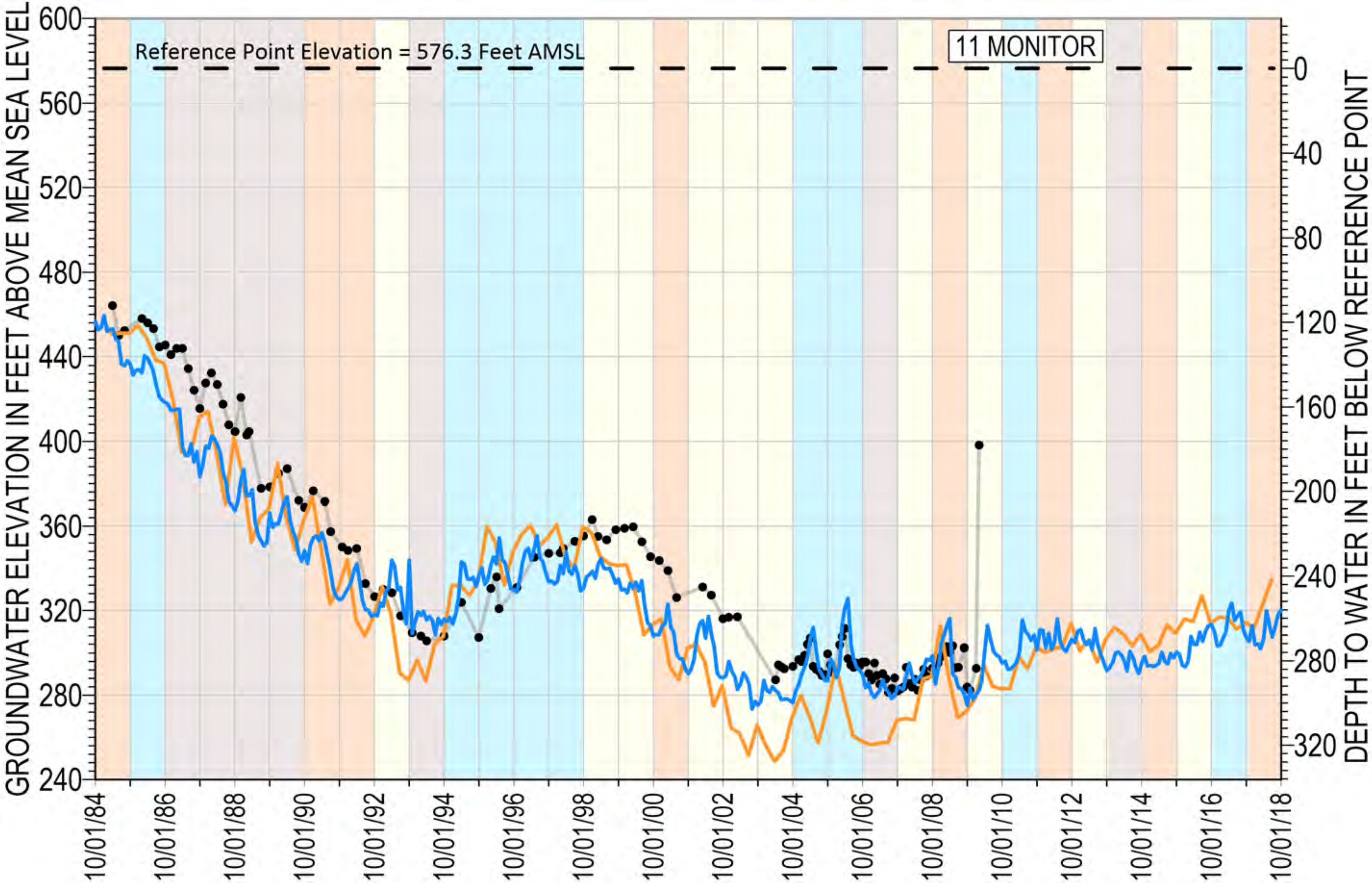
Santa Margarita Basin
Groundwater Model
Updates and Simulations for Groundwater Sustainability Planning

Appendix A
Groundwater Level Target Calibration Hydrographs

Santa Margarita Basin
Groundwater Model
Updates and Simulations for Groundwater Sustainability Planning

Appendix A
Groundwater Level Target Calibration Hydrographs



Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Lompico

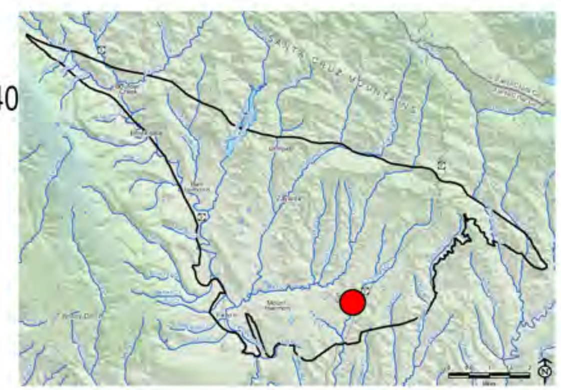
Reference Point Elevation= 576.3 ft AMSL

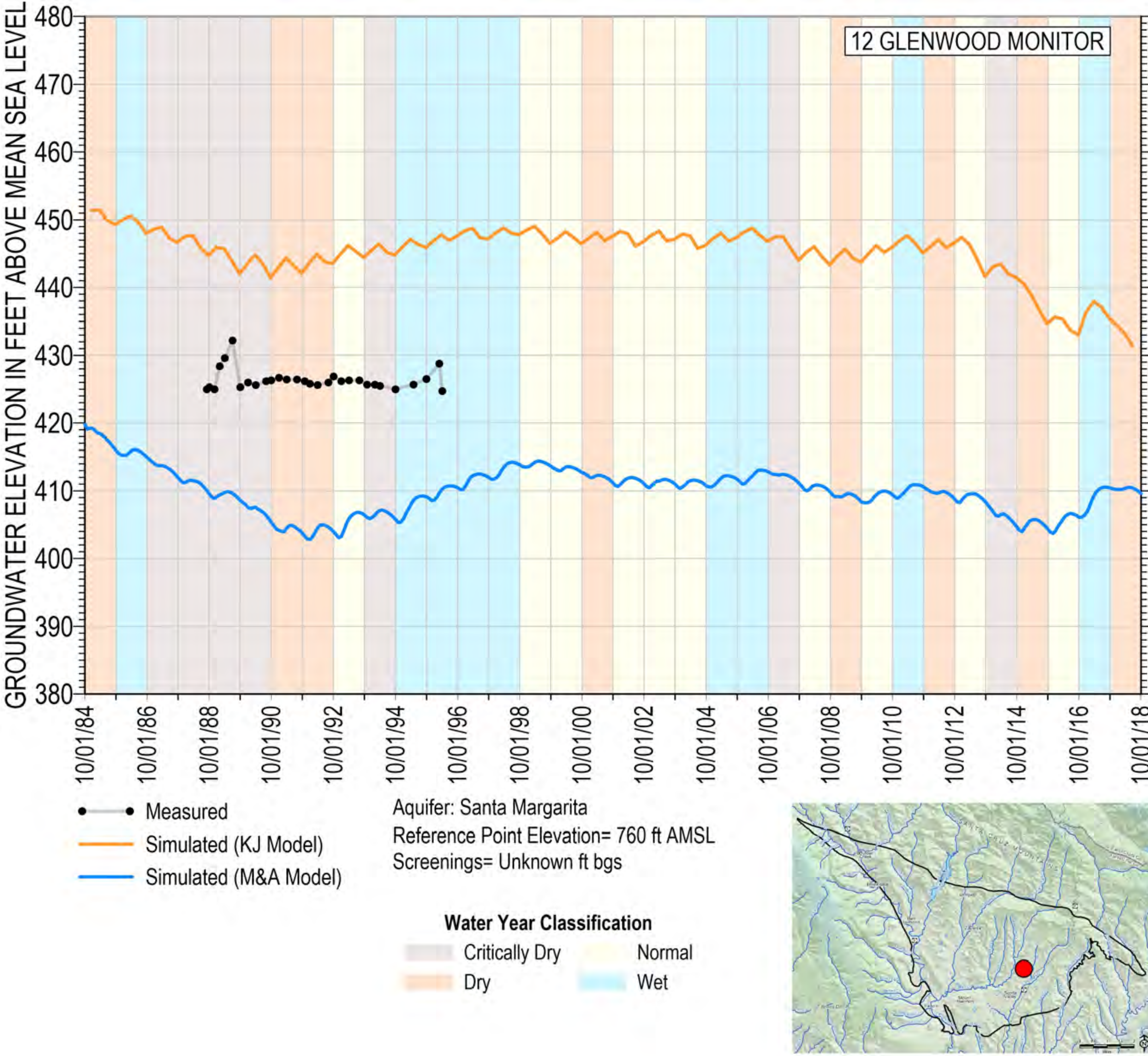
Screenings= 160-170, 280-320, 370-470, 520-540

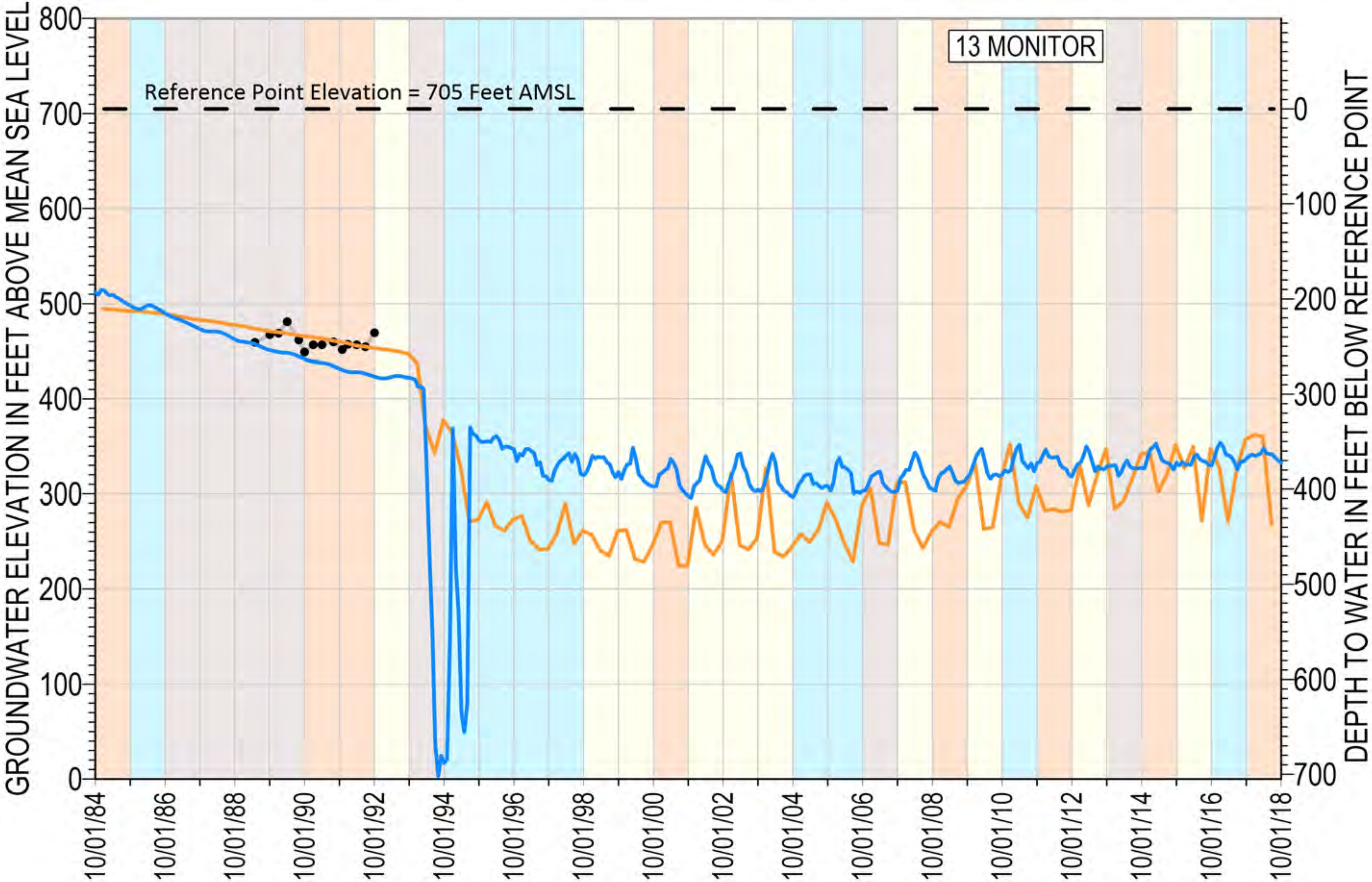
Water Year Classification

Critically Dry | Normal

Dry | Wet




12 GLENWOOD MONITOR
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
480
470
460
450
440
430
420
410
400
390
380
280
290
300
310
320
330
340
350
360
370
380
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 760 ft AMSL
Screenings= Unknown ft bgs
Water Year Classification
Critically Dry
Dry
Normal
Wet



Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Lompico

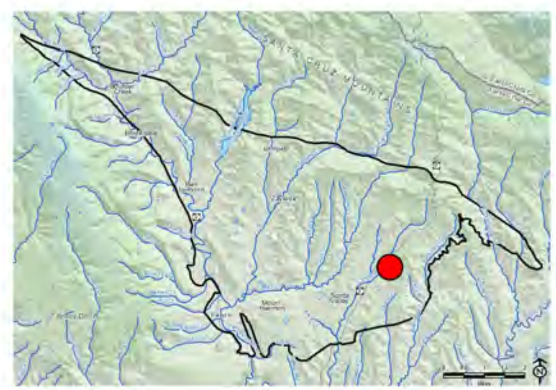
Reference Point Elevation= 705 ft AMSL

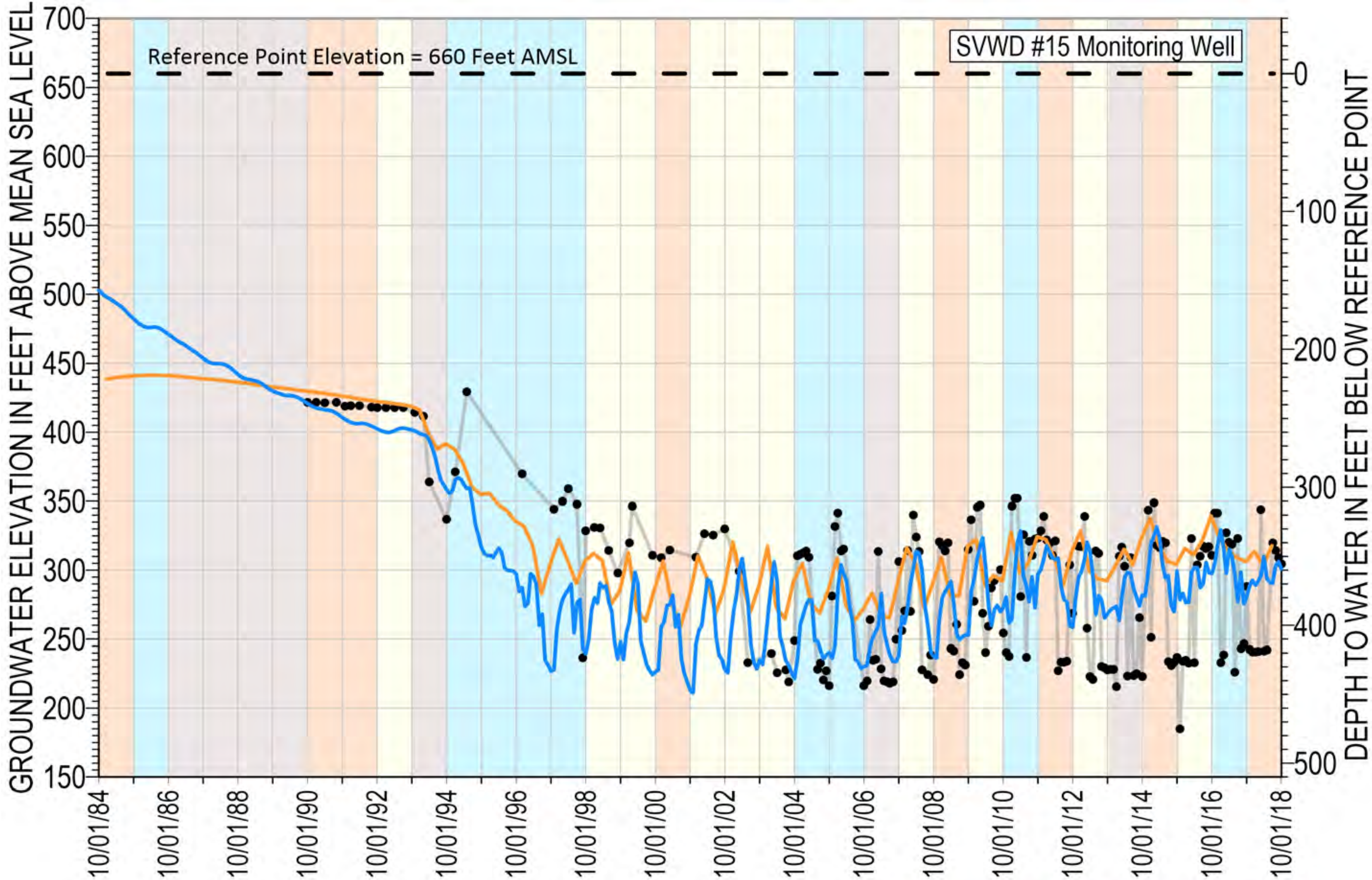
Screenings= 470-510, 590-670 ft bgs

Water Year Classification

Critically Dry | Normal

Dry | Wet





Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Butano

Reference Point Elevation= 660 ft AMSL

Screenings= 700-1100 ft bgs

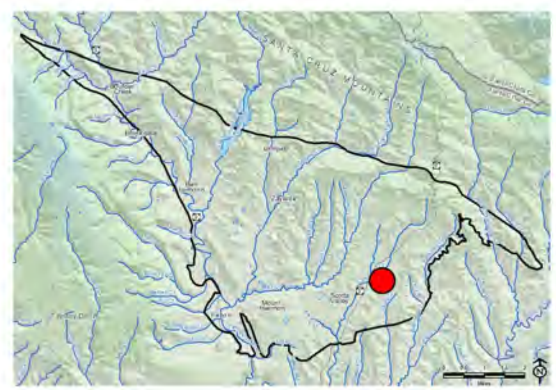
Water Year Classification

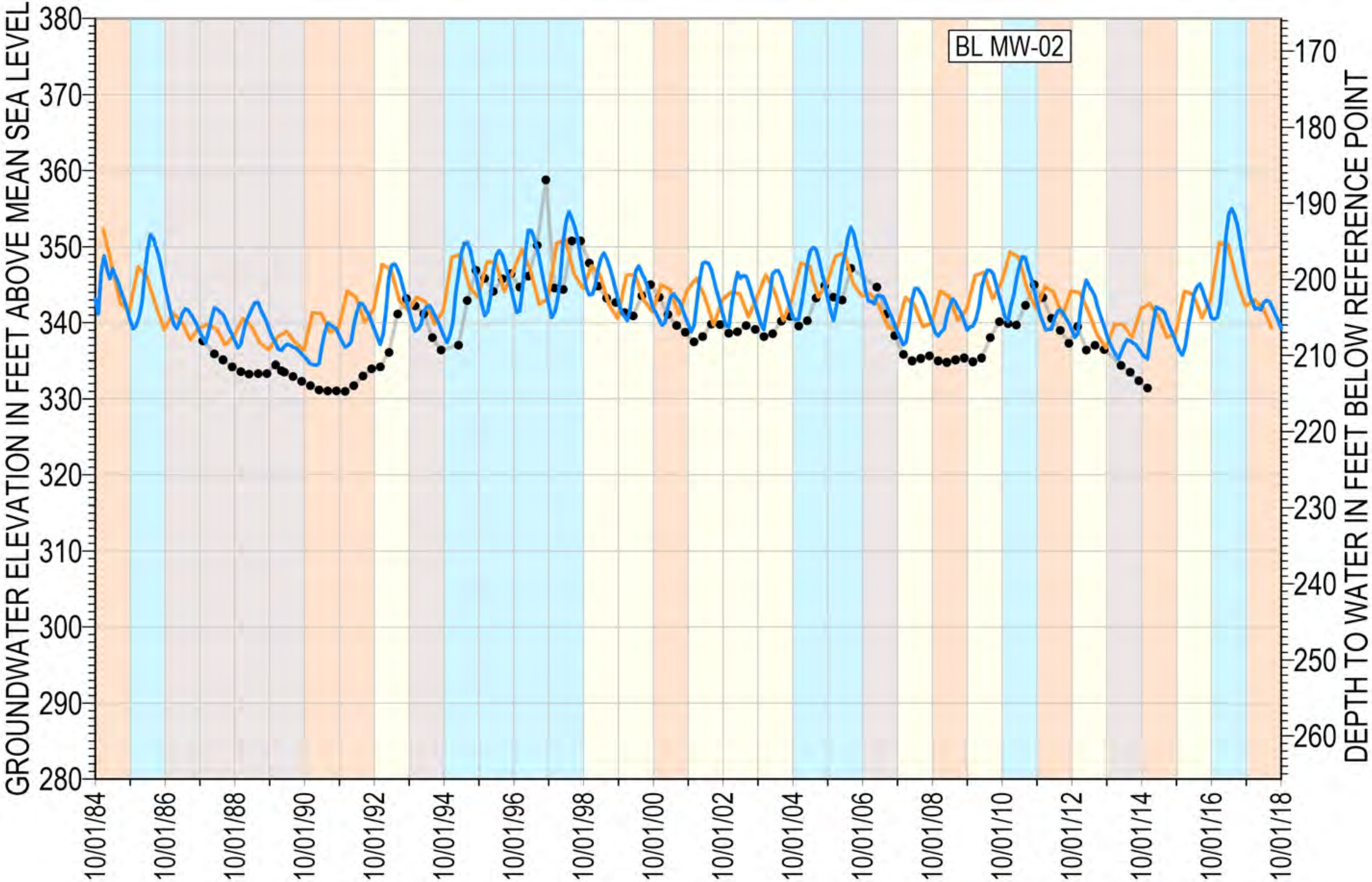
Critically Dry

Dry

Normal

Wet





Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Santa Margarita

Reference Point Elevation= 545.69 ft AMSL

Screenings= 226-256 ft bgs

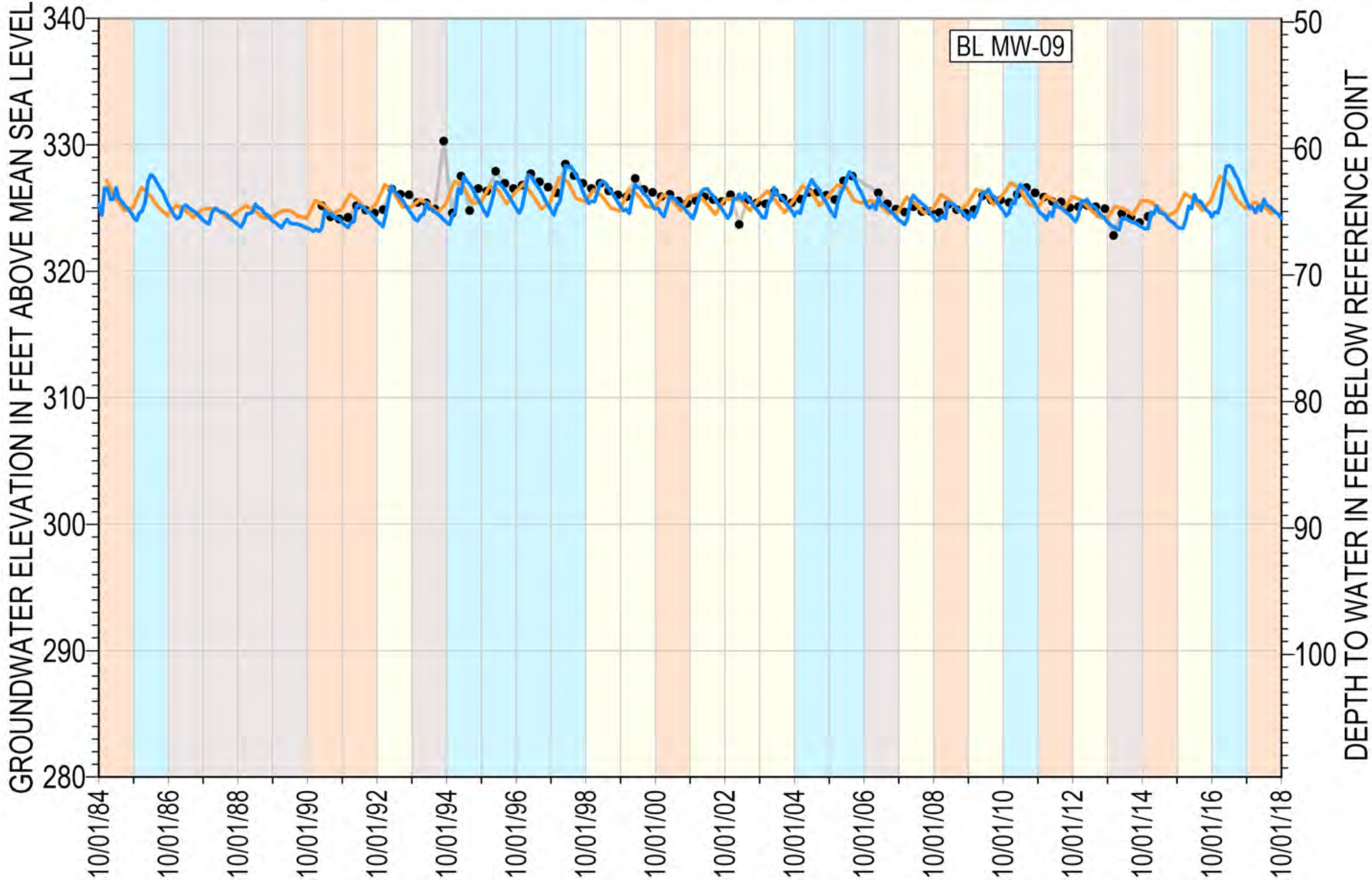
Water Year Classification

Critically Dry

Dry

Normal

Wet

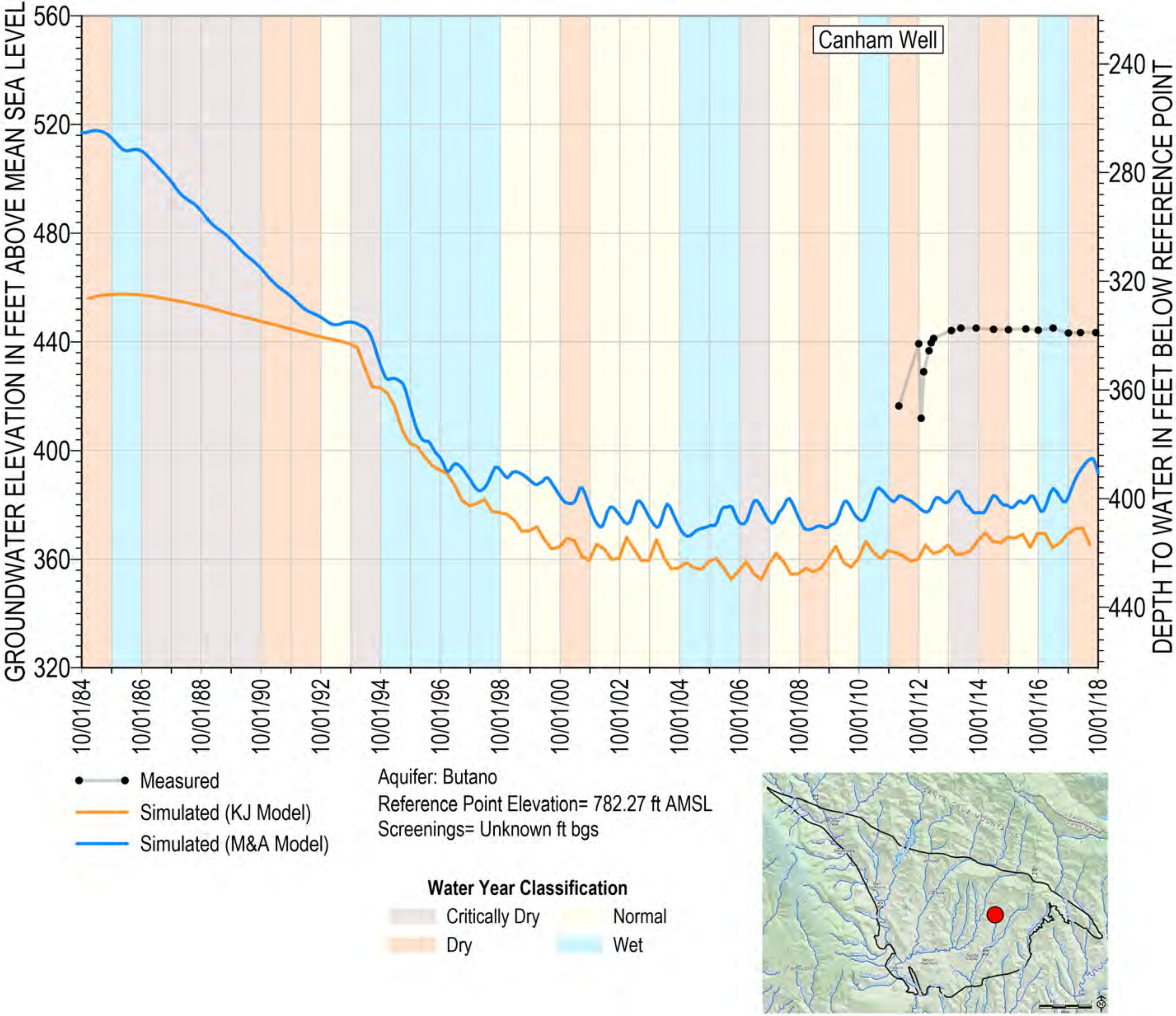


Measured
Simulated (KJ Model)
Simulated (M&A Model)

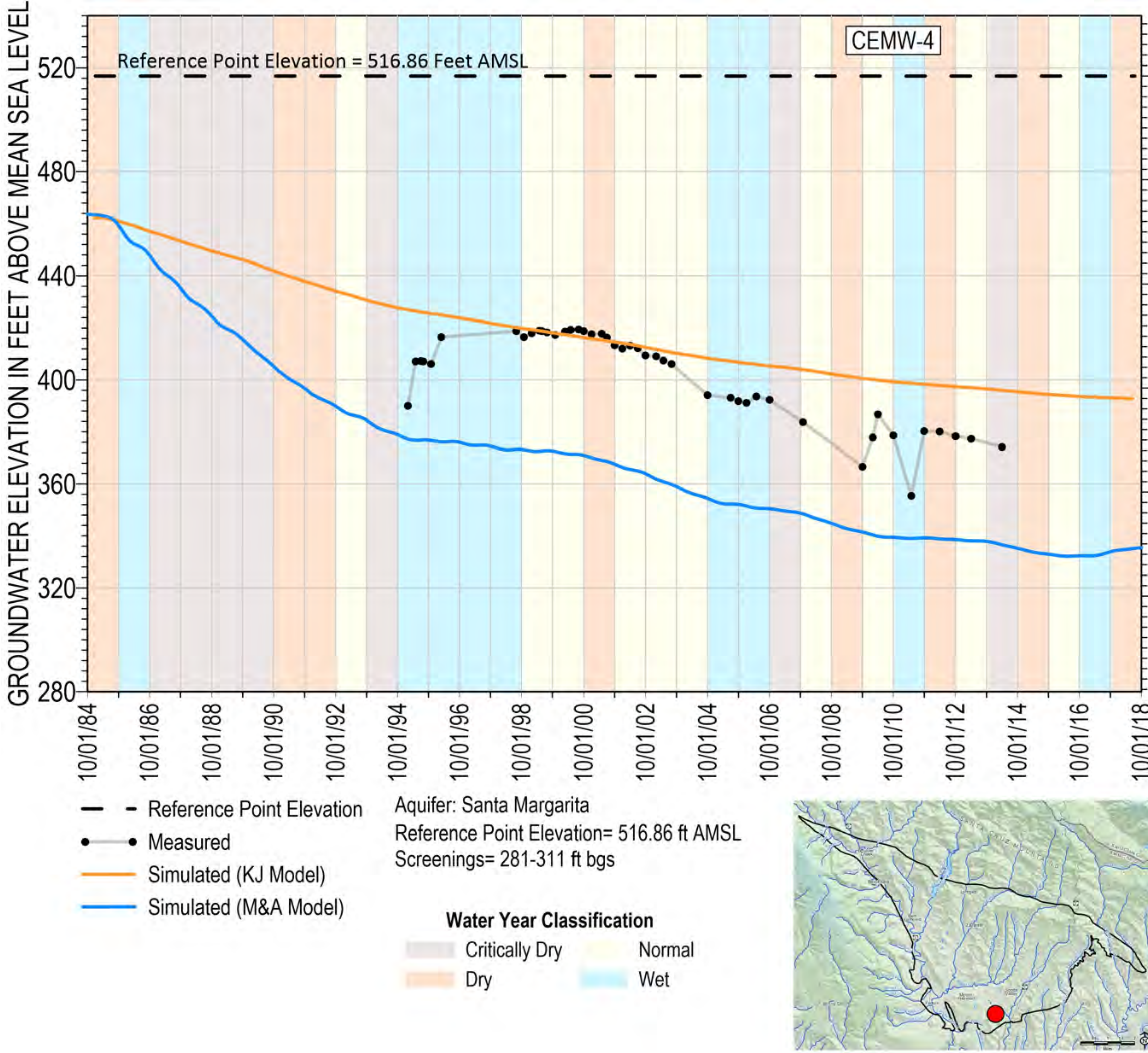
Aquifer: Santa Margarita
Reference Point Elevation= 389.71 ft AMSL
Screenings= 70-90 ft bgs

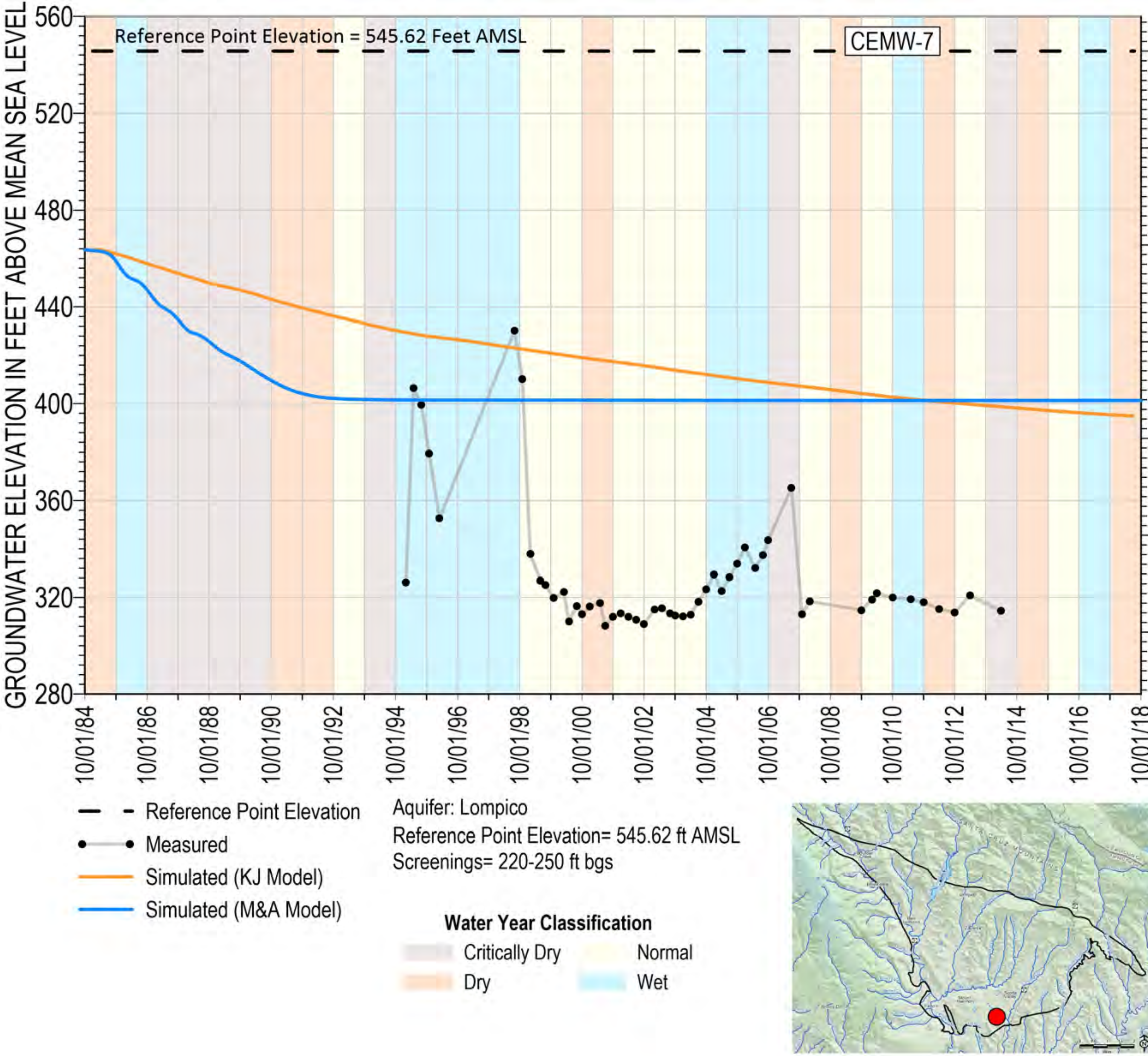
Water Year Classification

Critically Dry
Dry
Normal
Wet

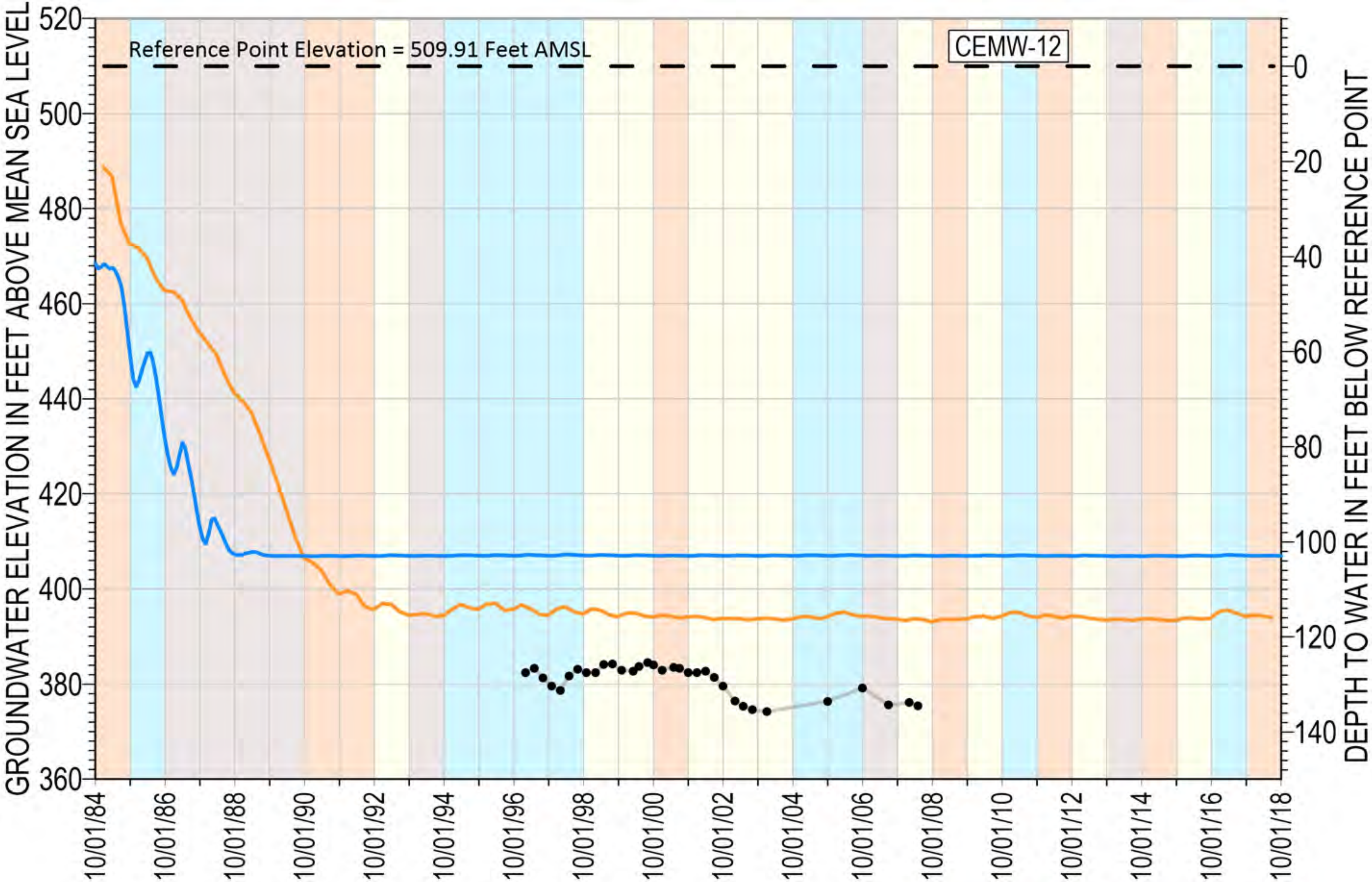


Canham Well
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
520
480
440
400
360
320
240
280
320
360
400
440
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Butano
Reference Point Elevation= 782.27 ft AMSL
Screenings= Unknown ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet


CEMW-4
Reference Point Elevation = 516.86 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
520
480
440
400
360
320
280
0
40
80
120
160
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 516.86 ft AMSL
Screenings= 281-311 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



CEMW-7
Reference Point Elevation = 545.62 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
520
480
440
400
360
320
280
0
40
80
120
160
200
240
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 545.62 ft AMSL
Screenings= 220-250 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

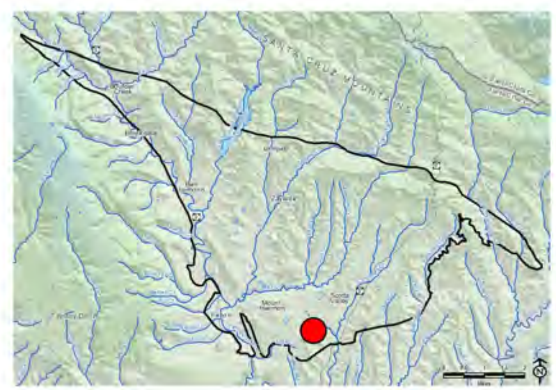


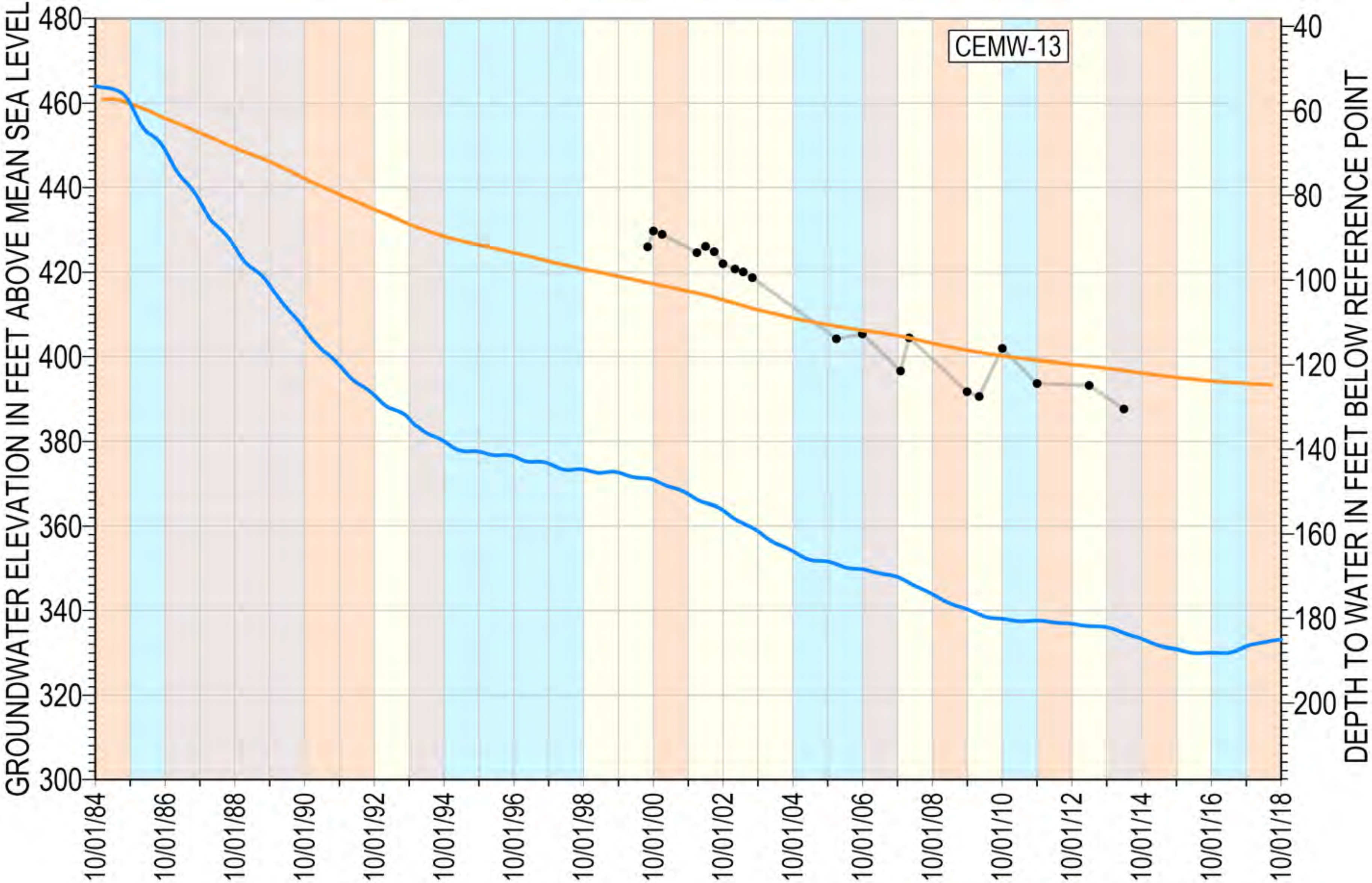
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 509.91 ft AMSL
Screenings= 115-145 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



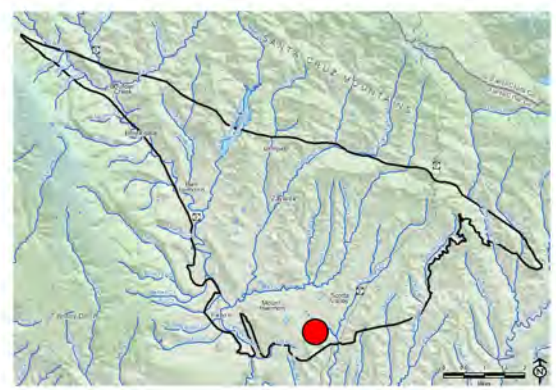


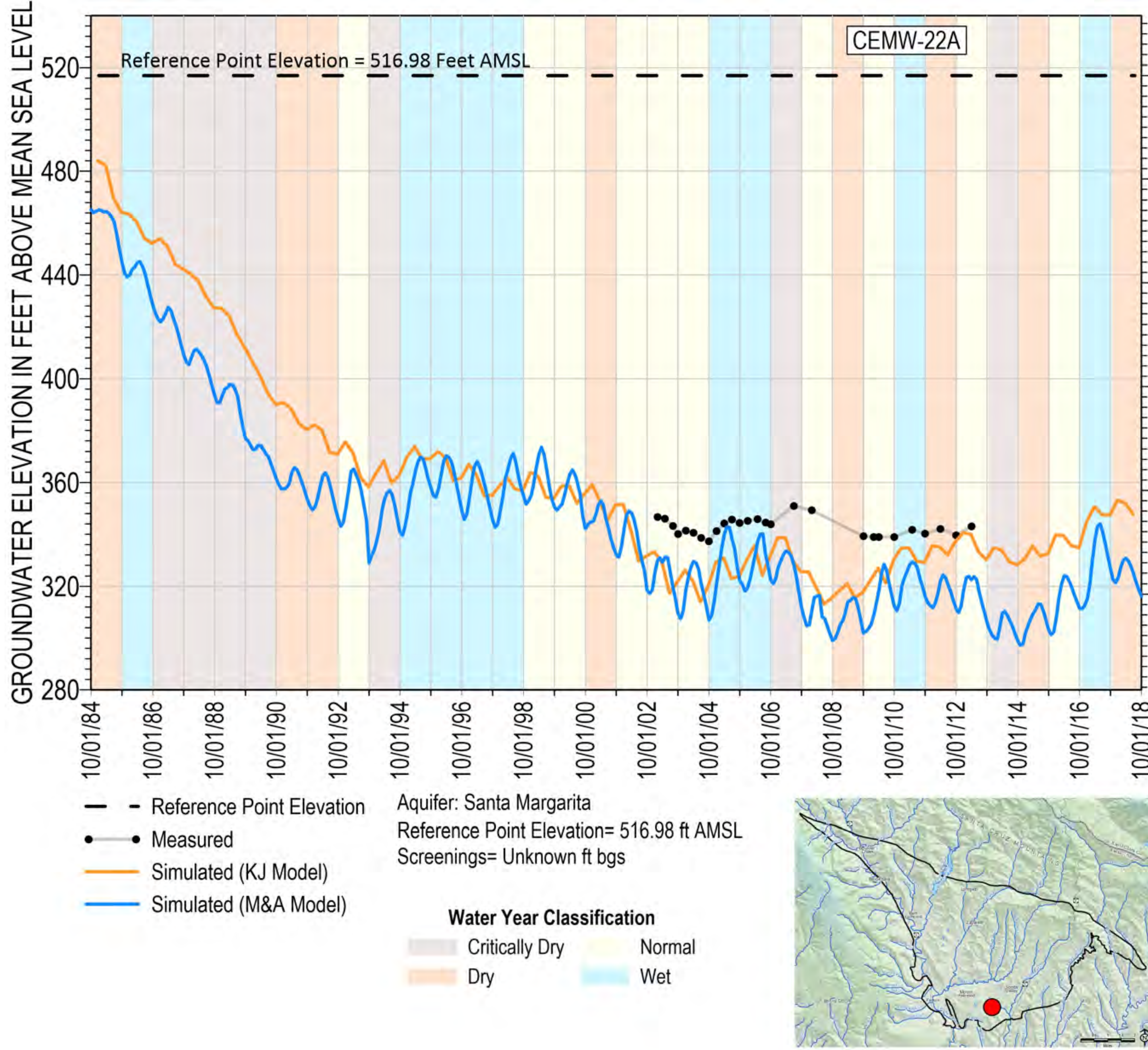
Measured
Simulated (KJ Model)
Simulated (M&A Model)

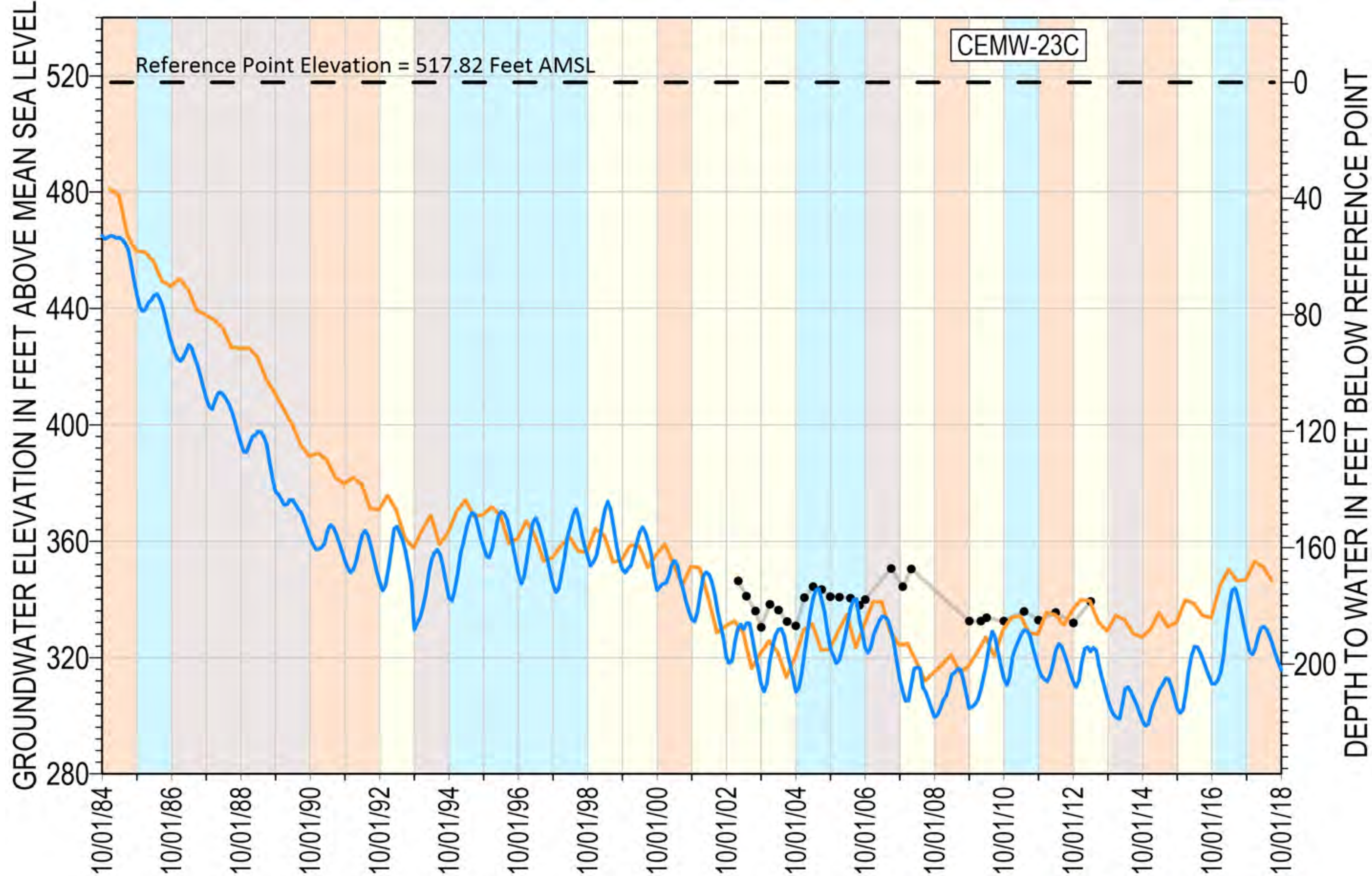
Aquifer: Locatelli
Reference Point Elevation= 518.14 ft AMSL
Screenings= 341-361 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet




CEMW-22A
Reference Point Elevation = 516.98 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
520
480
440
400
360
320
280
0
40
80
120
160
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 516.98 ft AMSL
Screenings= Unknown ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

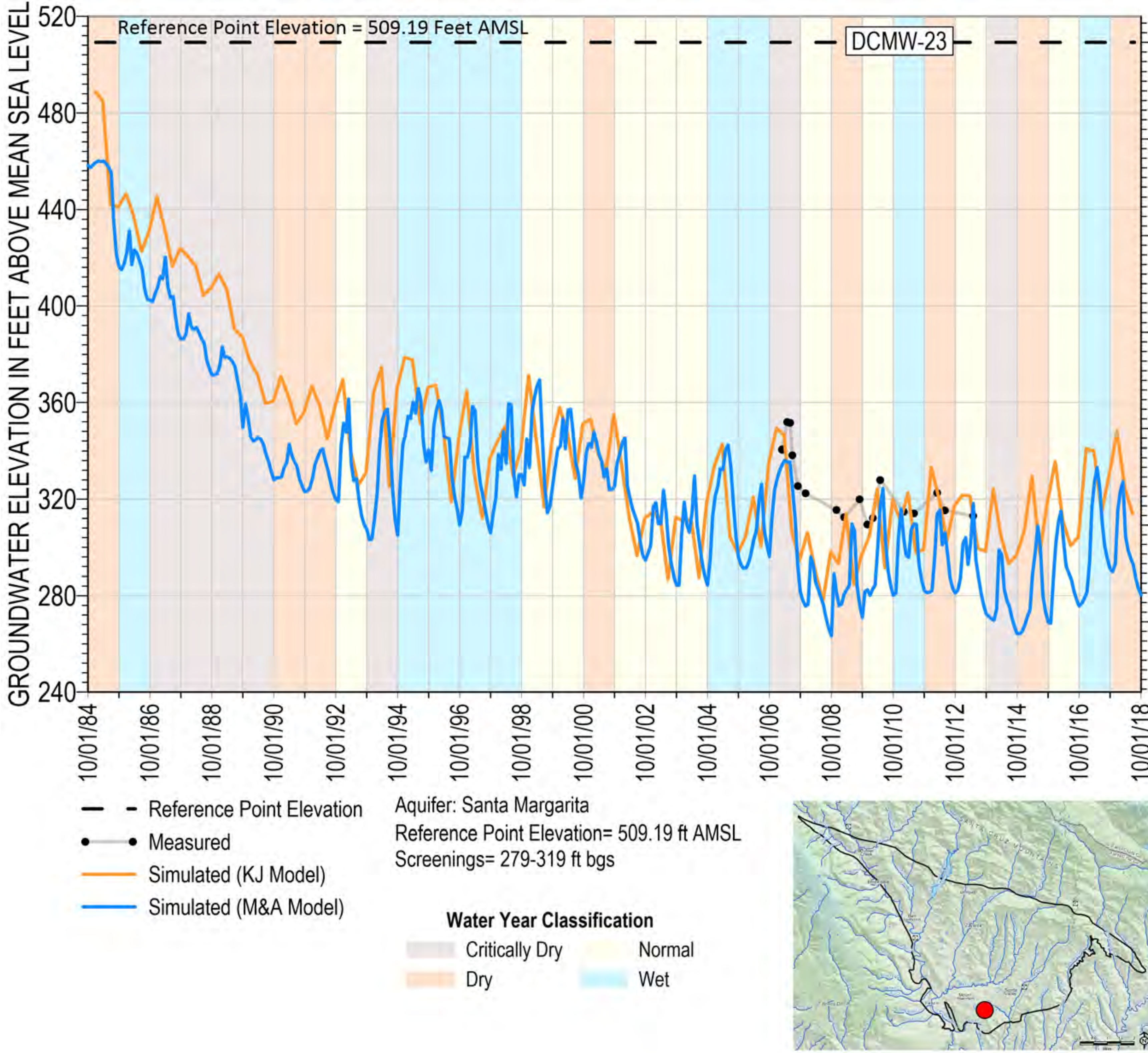


Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

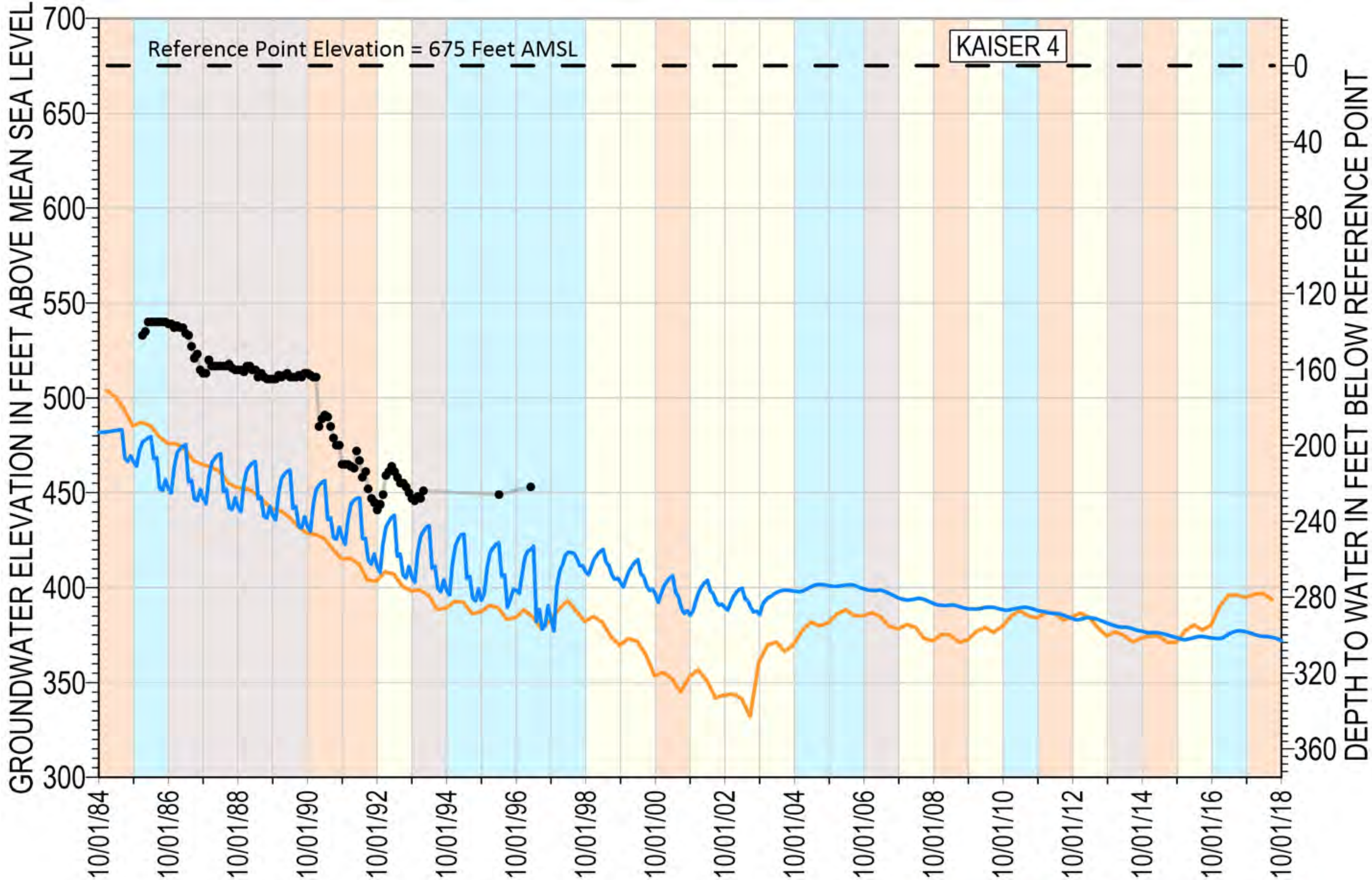
Aquifer: Perched
Reference Point Elevation= 517.82 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



Reference Point Elevation = 509.19 Feet AMSL
DCMW-23
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
520
480
440
400
360
320
280
240
0
40
80
120
160
200
240
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 509.19 ft AMSL
Screenings= 279-319 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

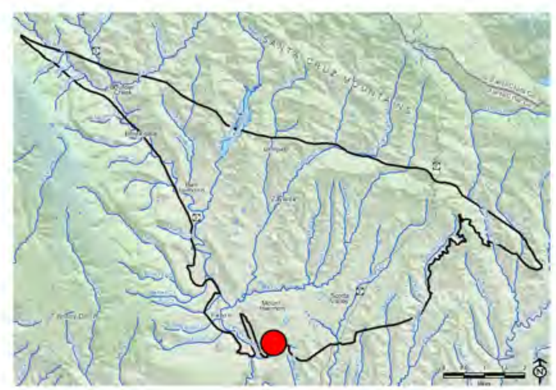


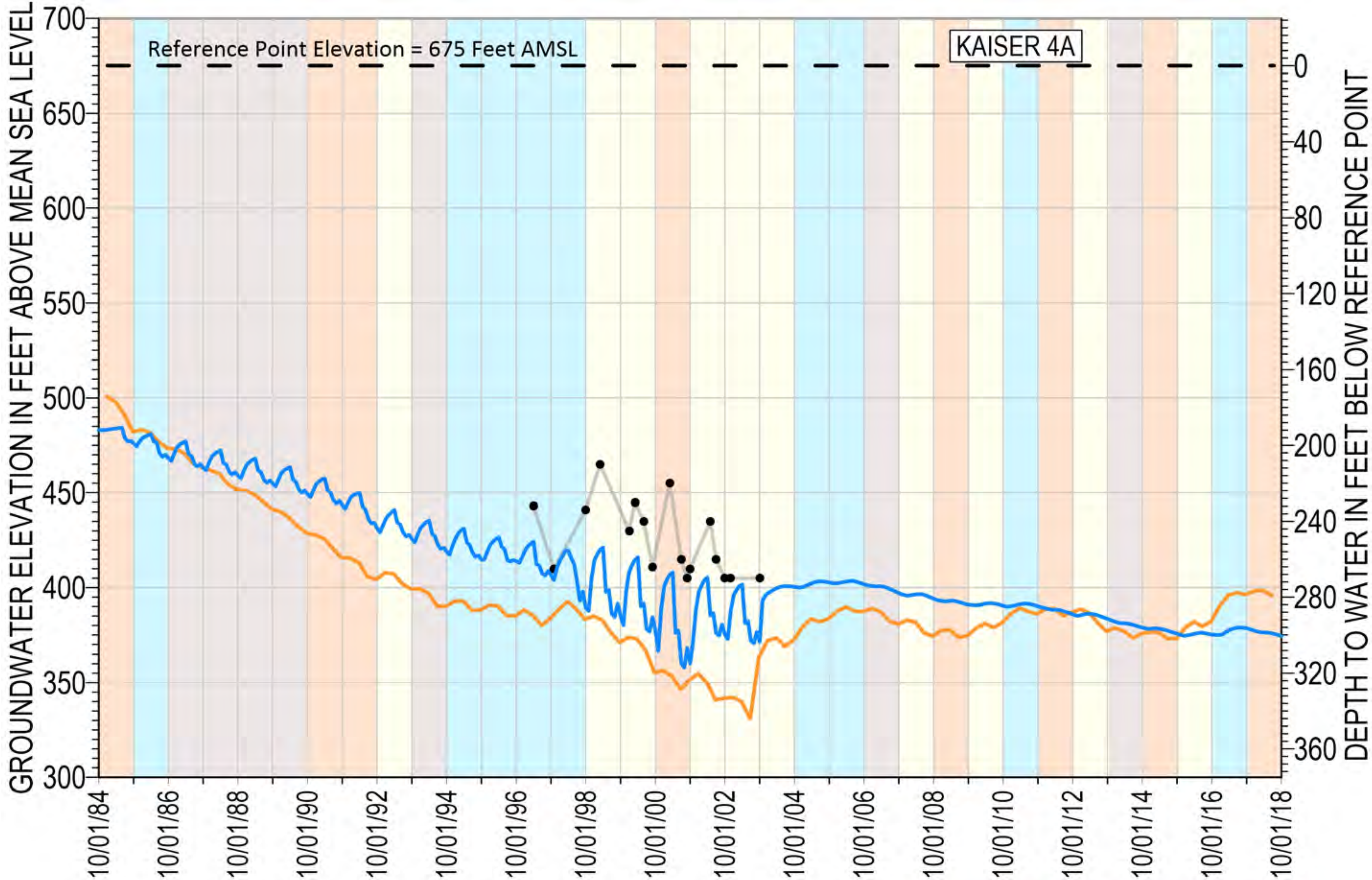
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico
Reference Point Elevation= 675 ft AMSL
Screenings= 197-217, 277-397, 417-477 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



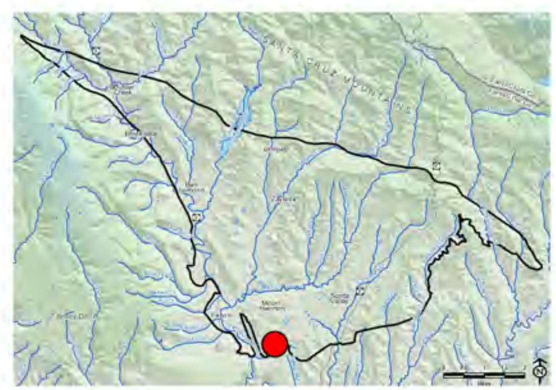


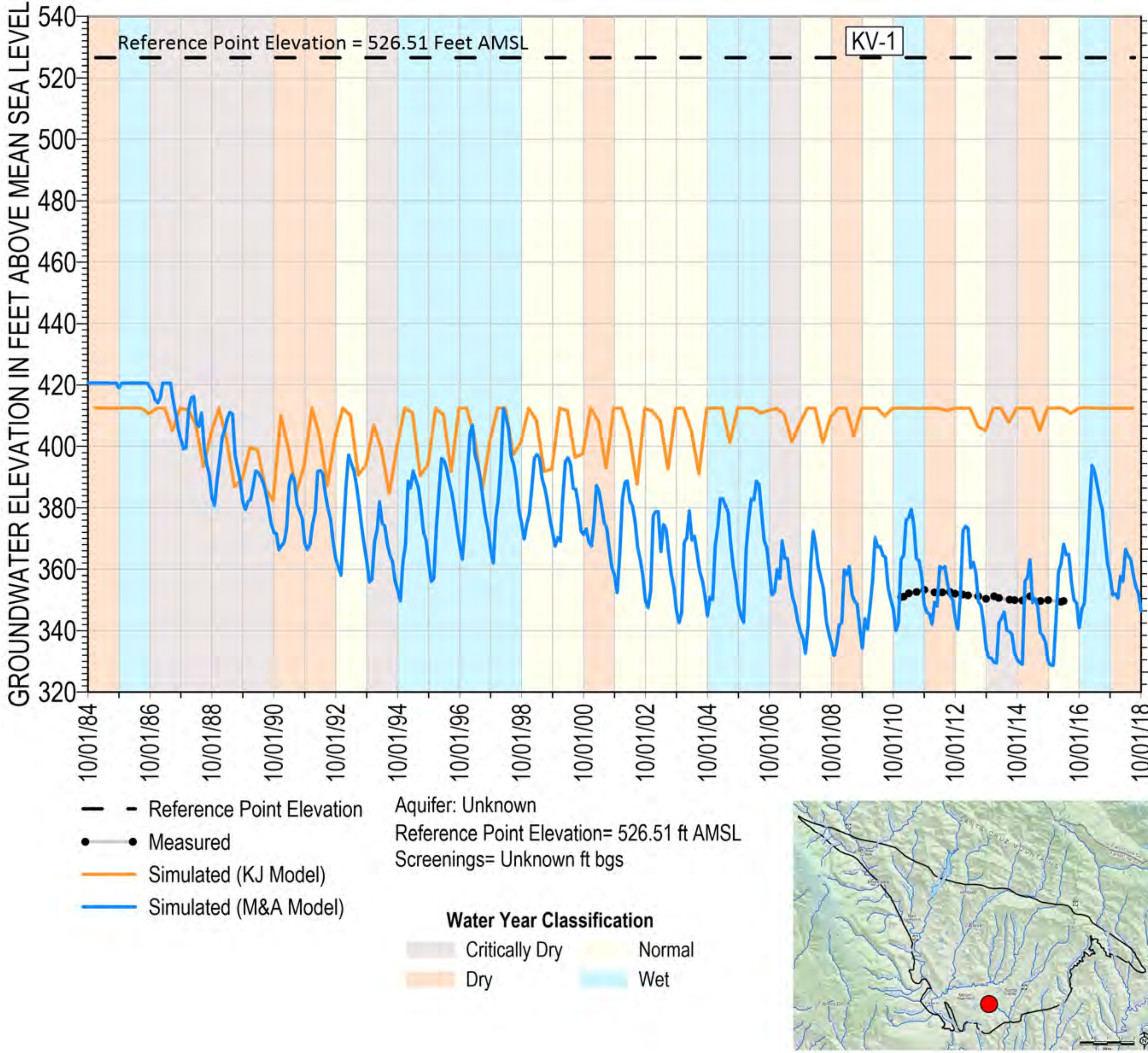
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

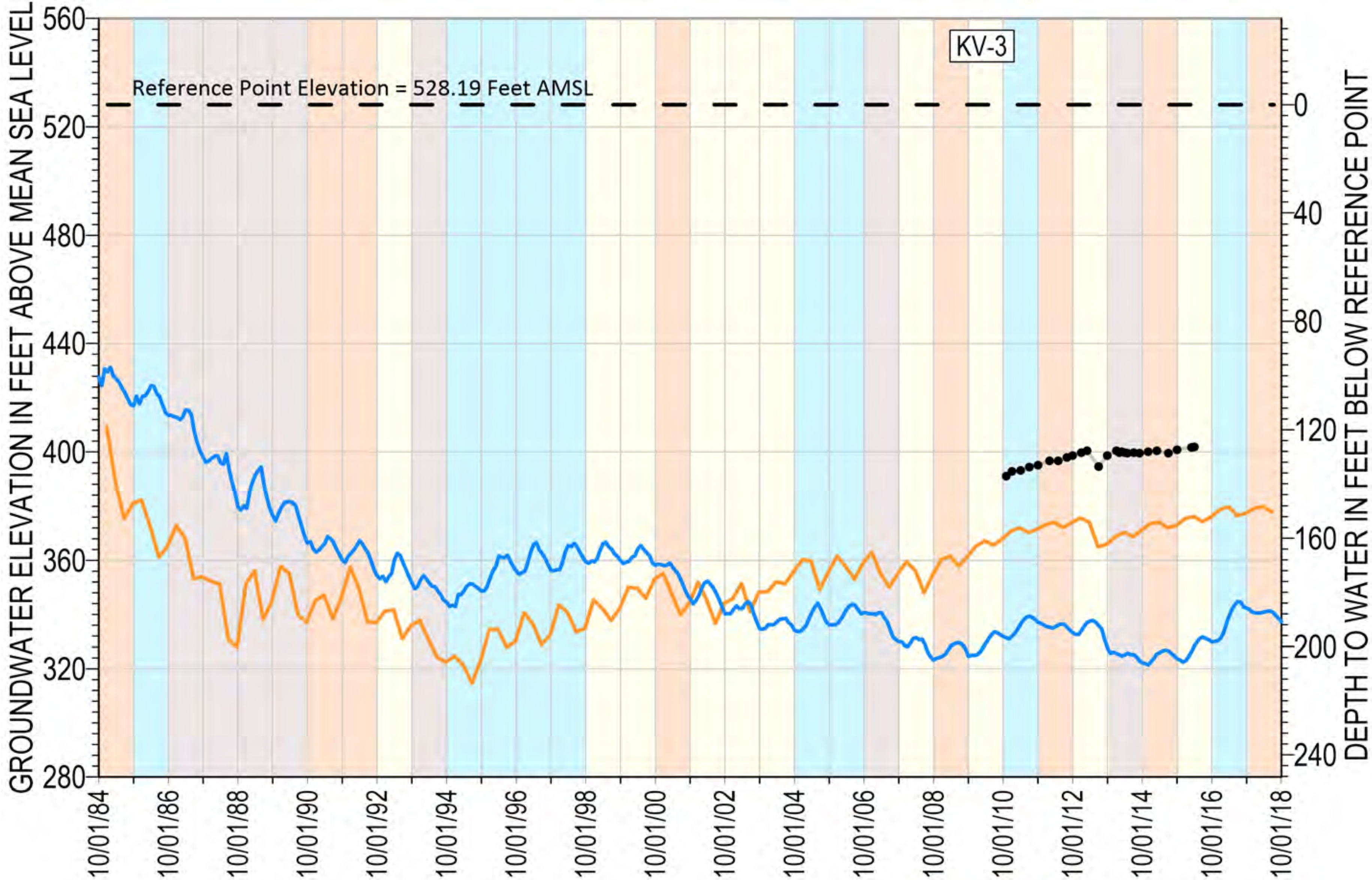
Aquifer: Locatelli
Reference Point Elevation= 675 ft AMSL
Screenings= 249-360, 390-460 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet




KV-1
Reference Point Elevation = 526.51 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
540
520
500
480
460
440
420
400
380
360
340
320
0
40
80
120
160
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Unknown
Reference Point Elevation= 526.51 ft AMSL
Screenings= Unknown ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Unknown

Reference Point Elevation= 528.19 ft AMSL

Screenings= Unknown ft bgs

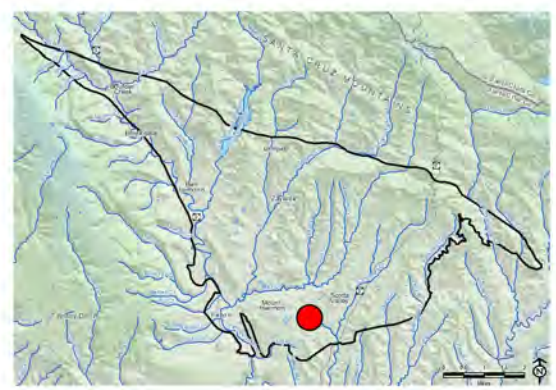
Water Year Classification

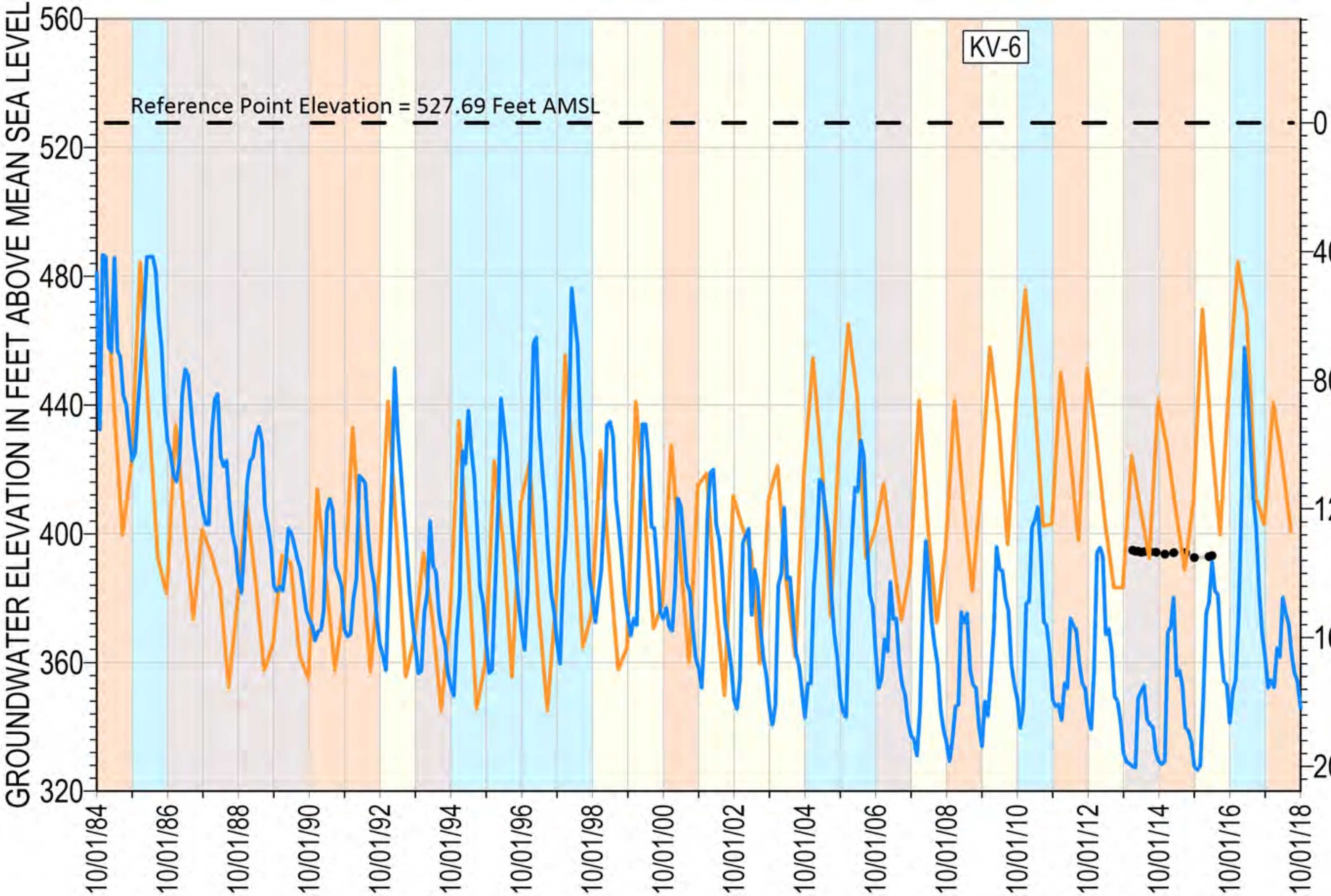
Critically Dry

Normal

Dry

Wet



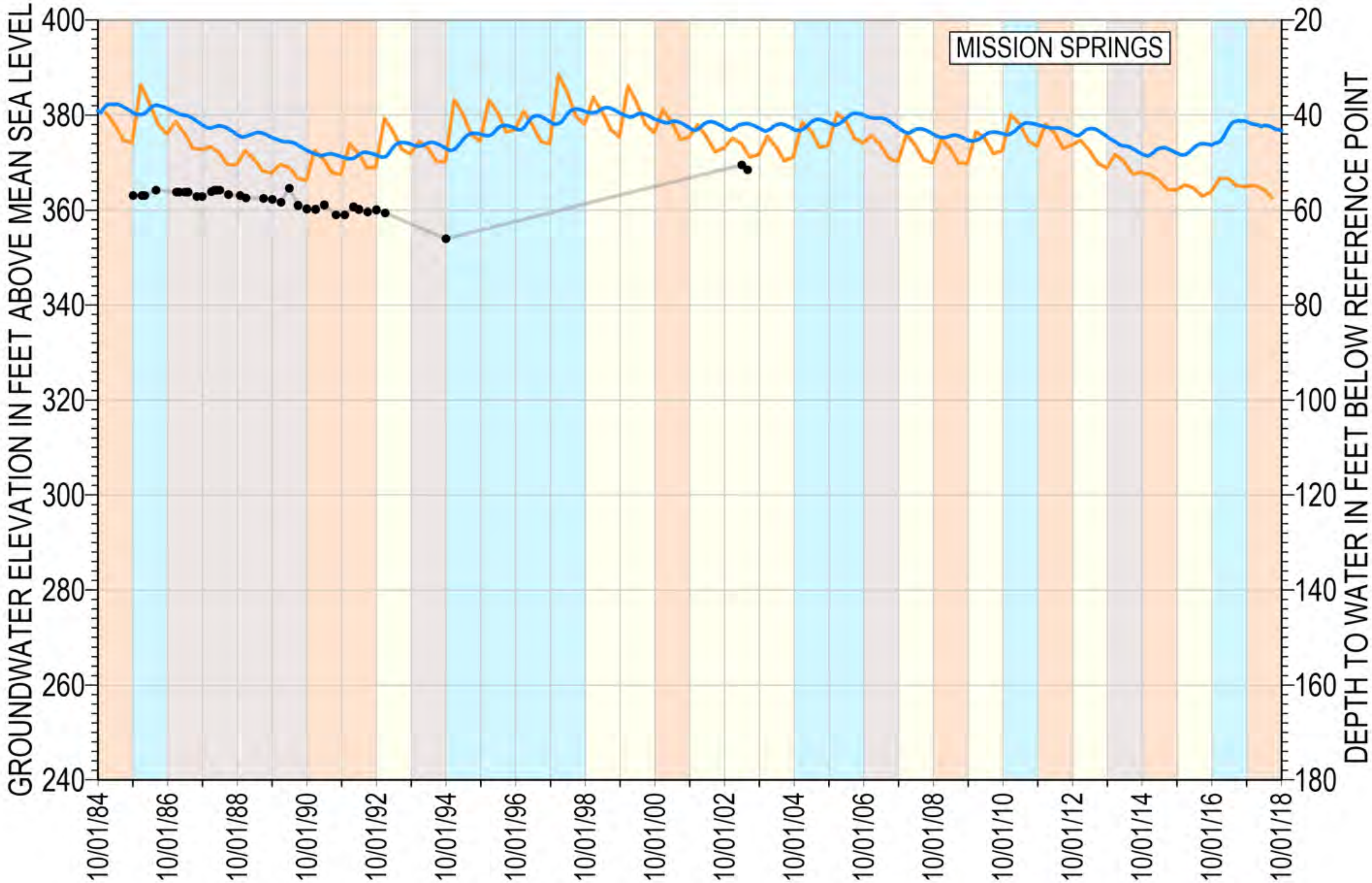


Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Unknown
Reference Point Elevation= 527.69 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Santa Margarita

Reference Point Elevation= 420 ft AMSL

Screenings= 159-179, 189-257 ft bgs

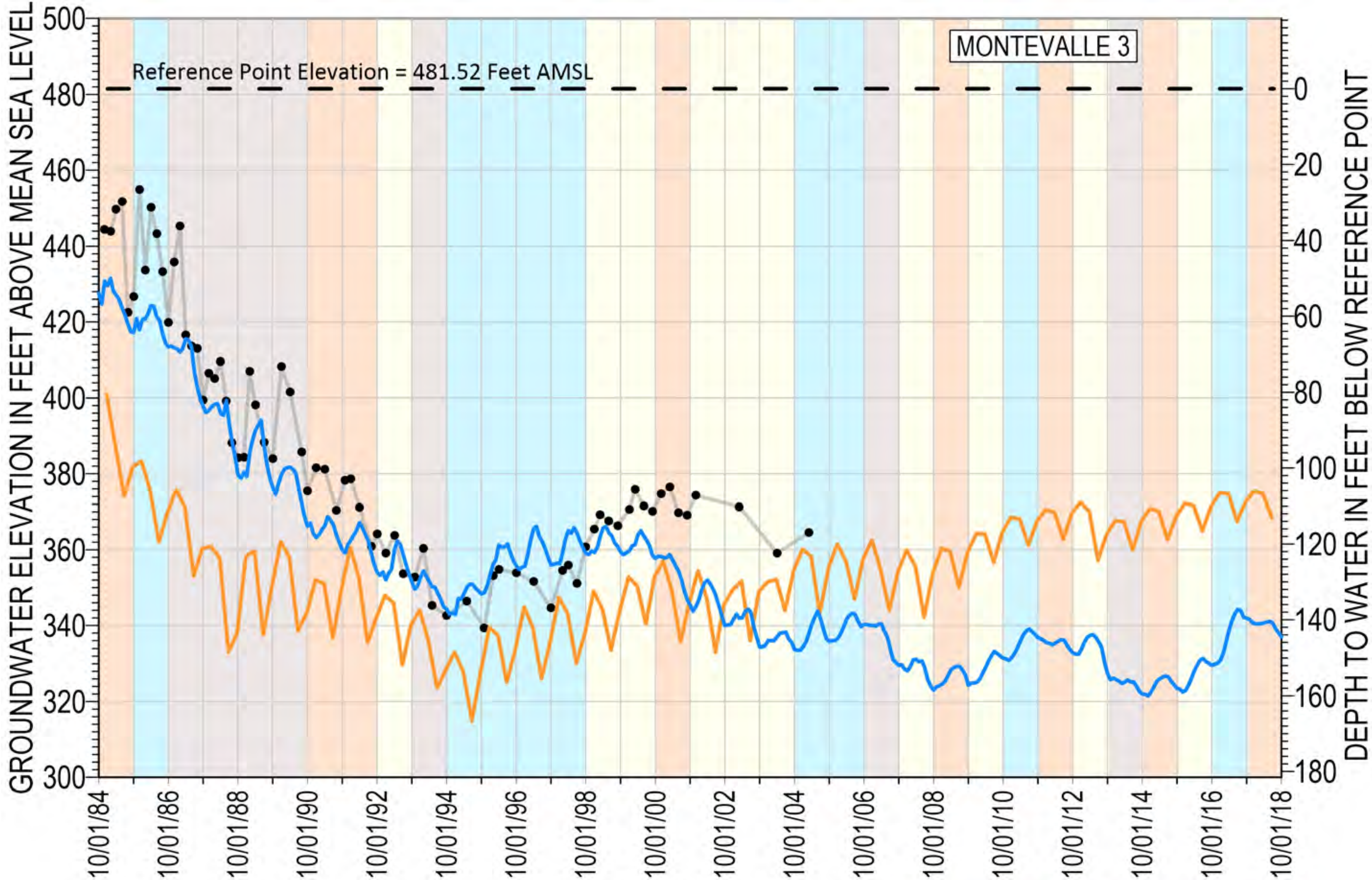
Water Year Classification

Critically Dry

Normal

Dry

Wet



Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Santa Margarita,Monterey

Reference Point Elevation= 481.52 ft AMSL

Screenings= 105-145, 210-225, 340-375 ft bgs

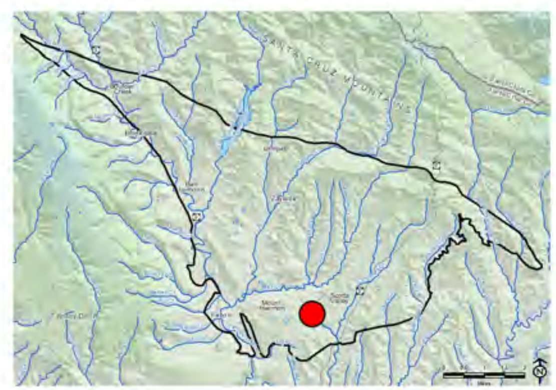
Water Year Classification

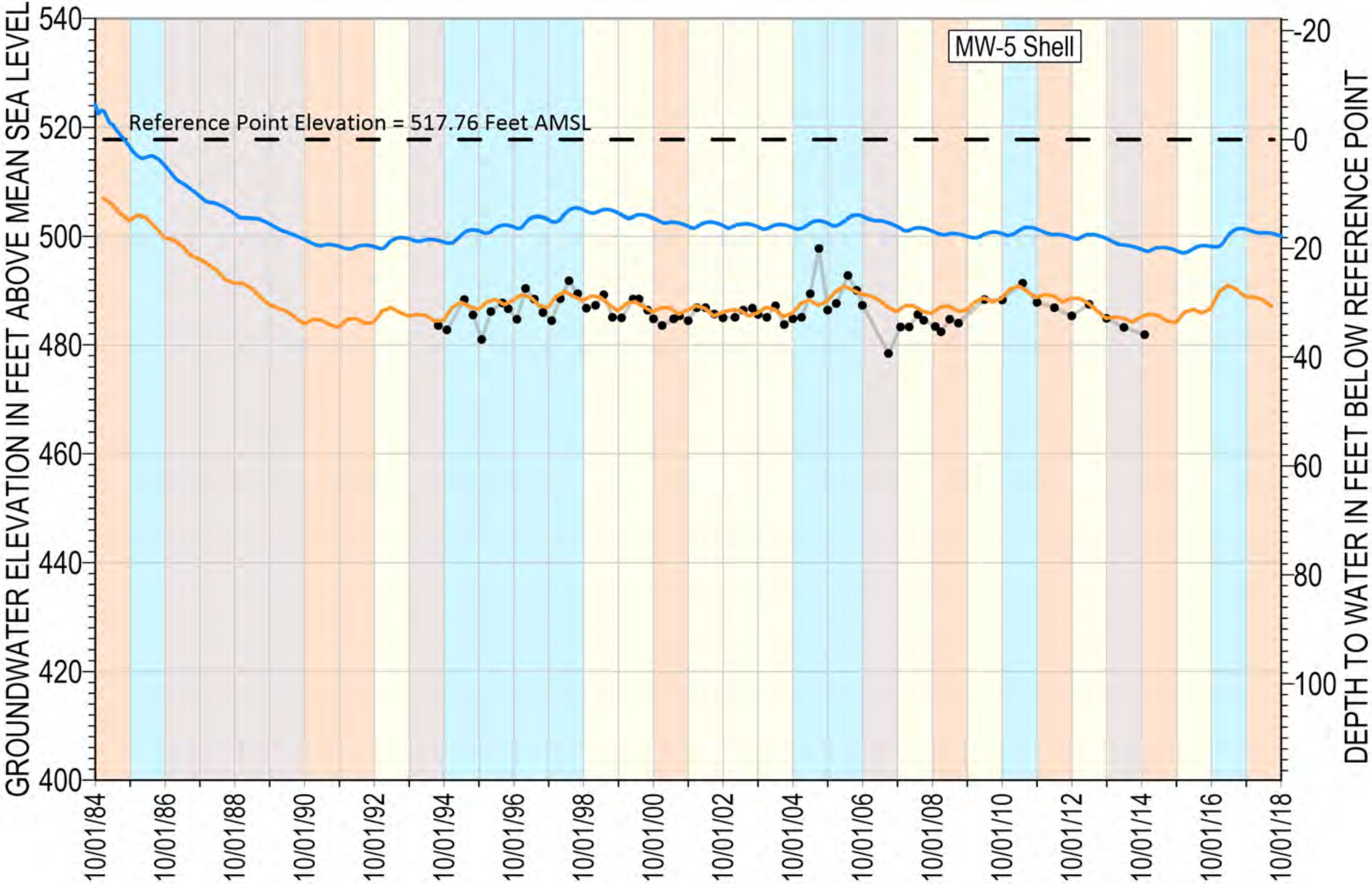
Critically Dry

Normal

Dry

Wet





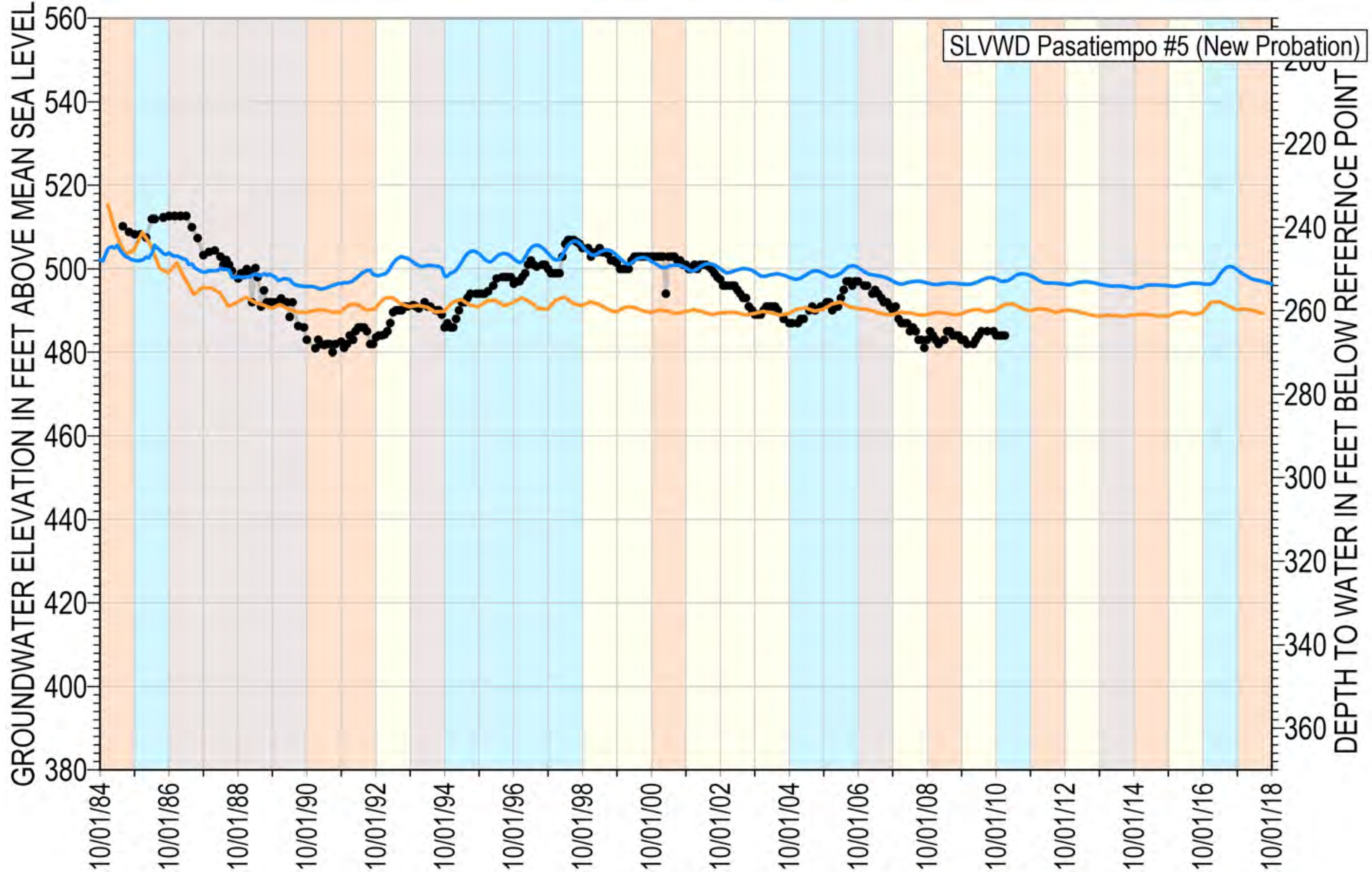
Aquifer: Perched

Reference Point Elevation= 517.76 ft AMSL

Screenings= Unknown ft bgs

Water Year Classification

Critically Dry, Normal, Dry, Wet

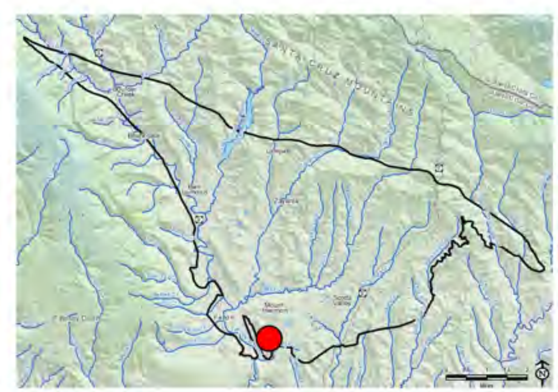


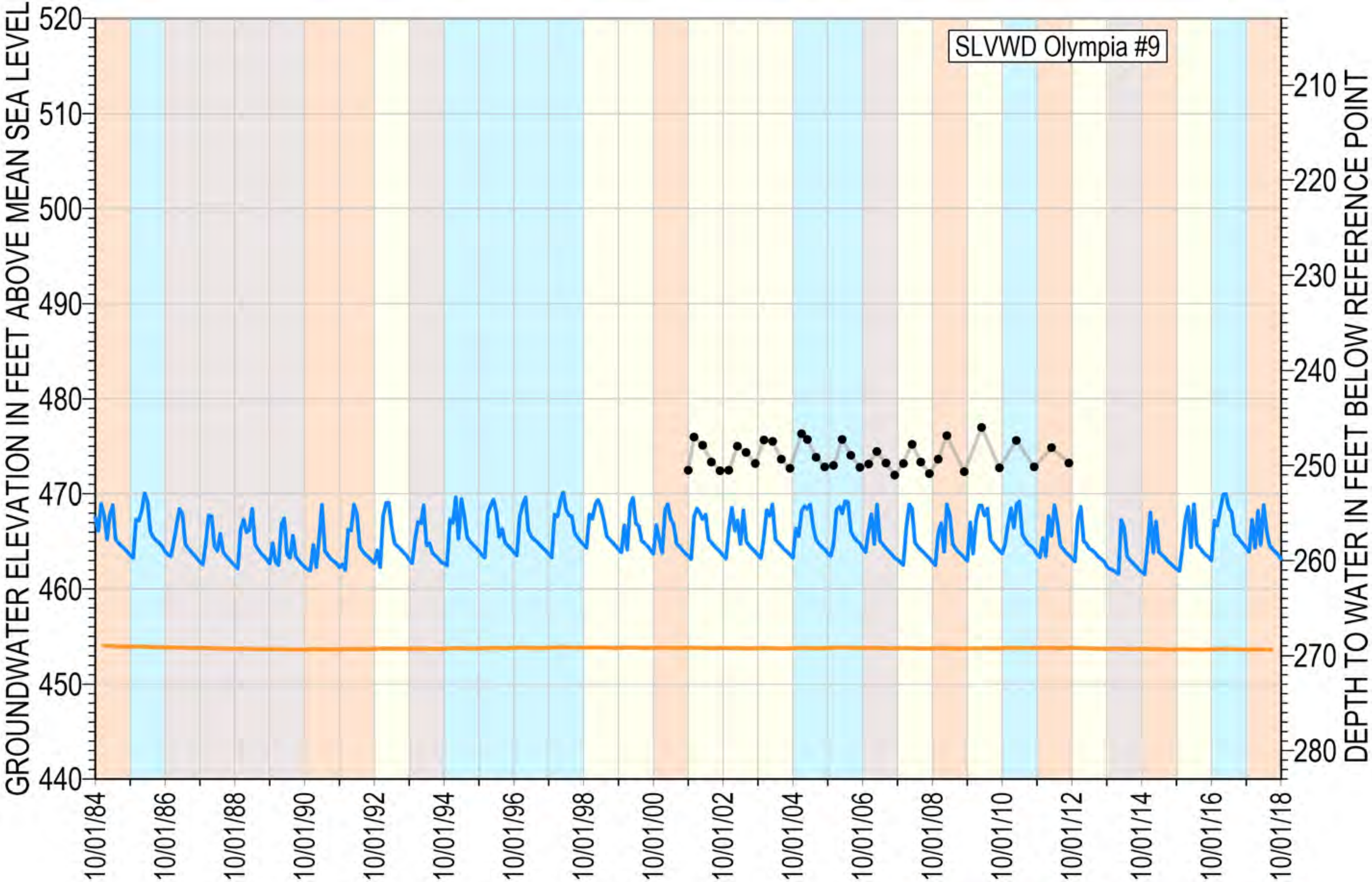
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita,Monterey
Reference Point Elevation= 750 ft AMSL
Screenings= 265-290, 343-363, 380-394 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



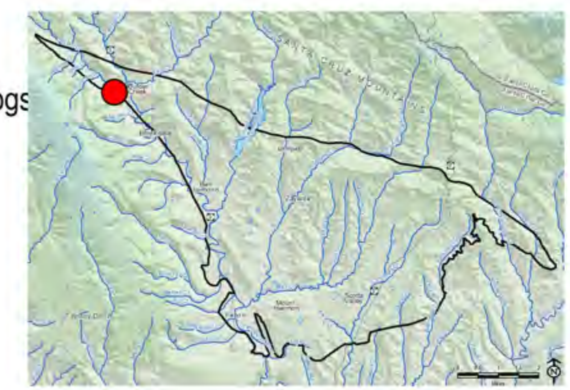


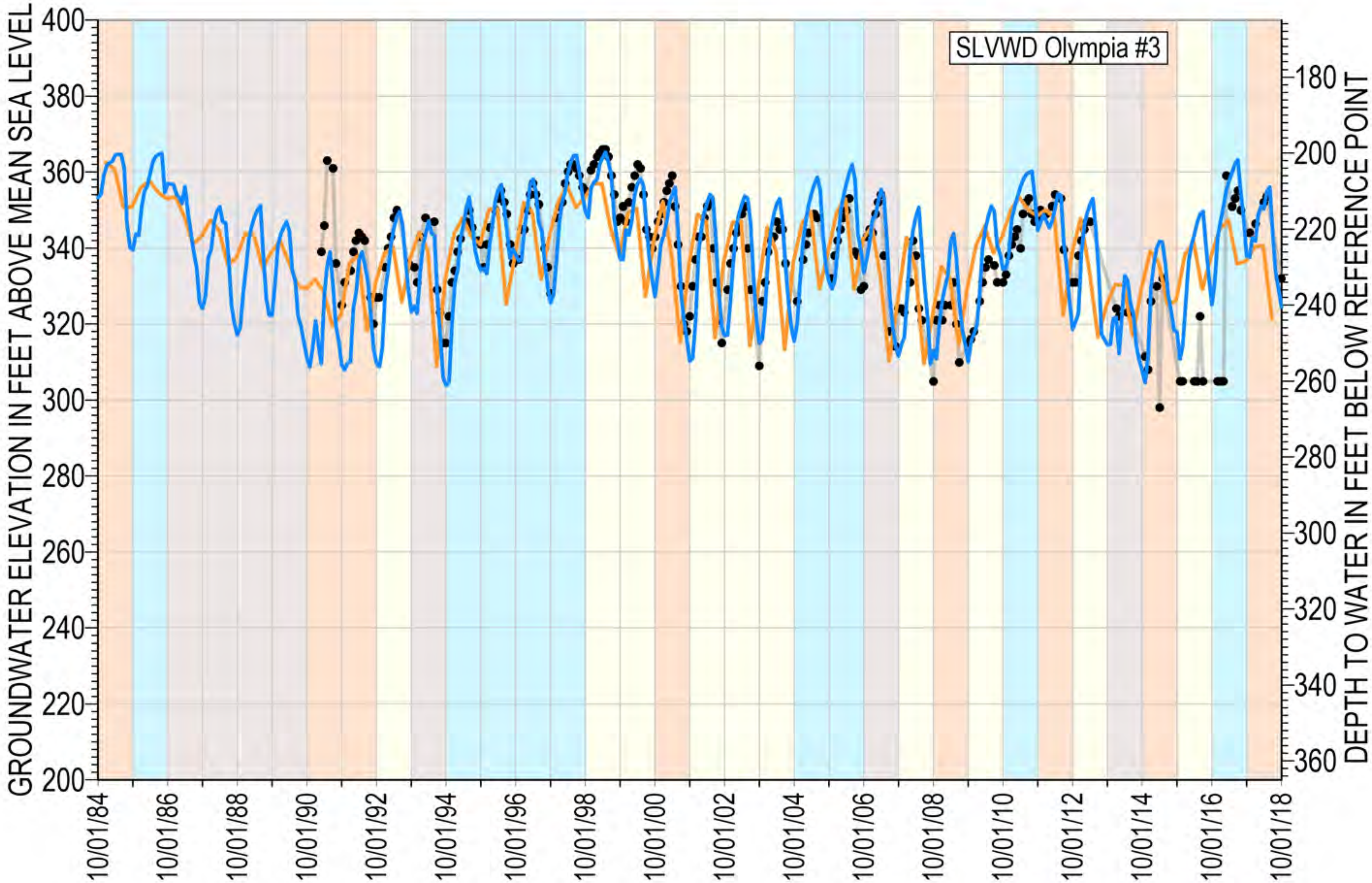
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico,Butano
Reference Point Elevation= 723 ft AMSL
Screenings= 705-784, 805-1063, 1084-1455 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



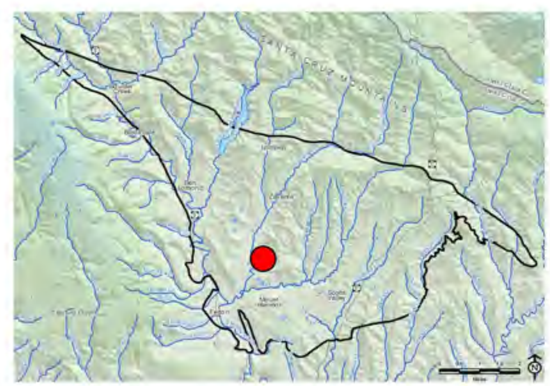


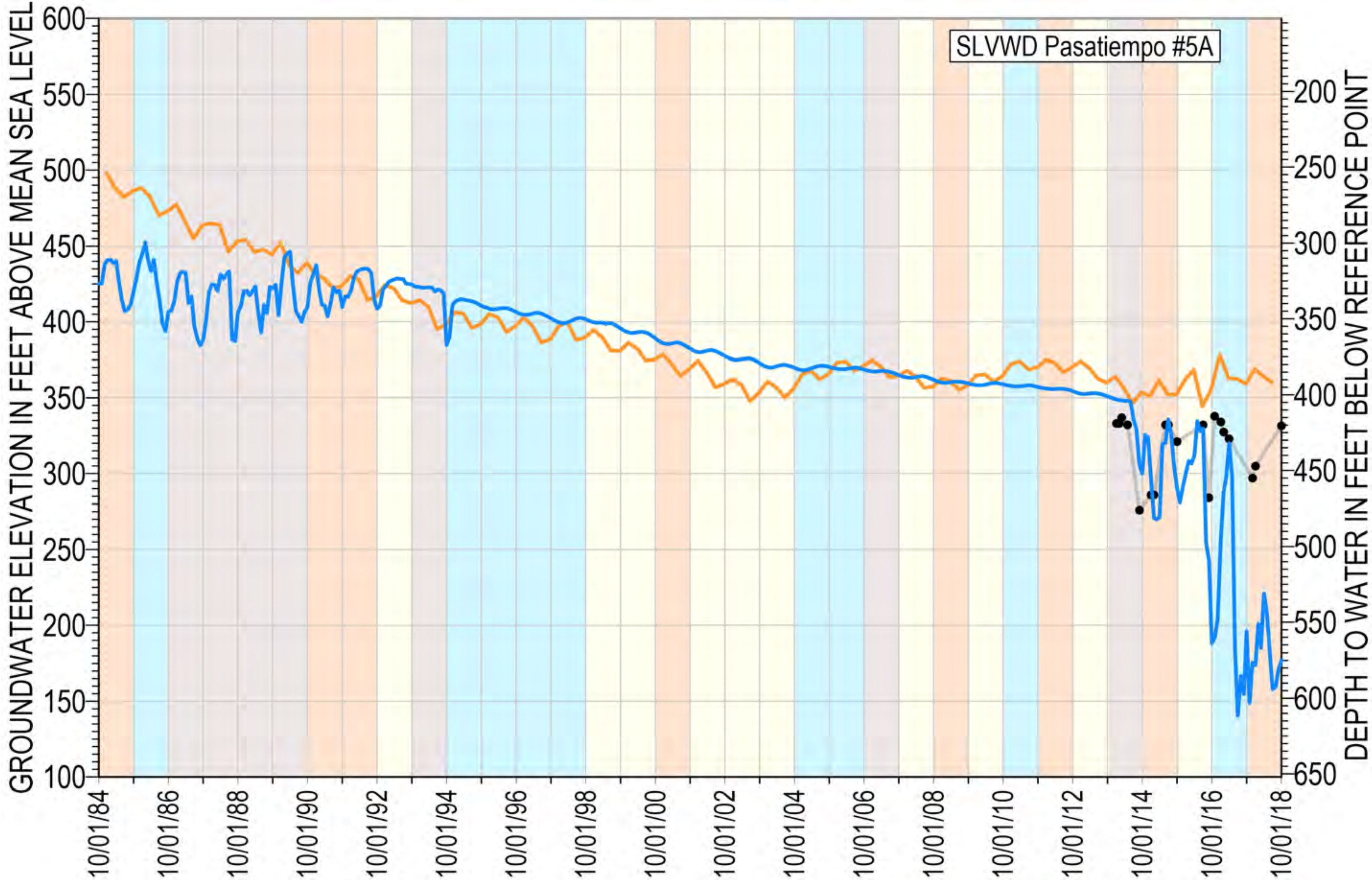
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 565 ft AMSL
Screenings= 230-308 ft bgs

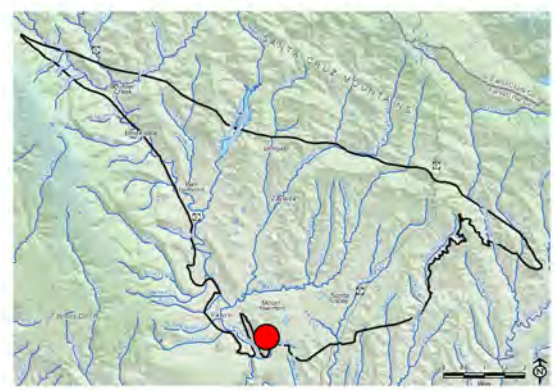
Water Year Classification

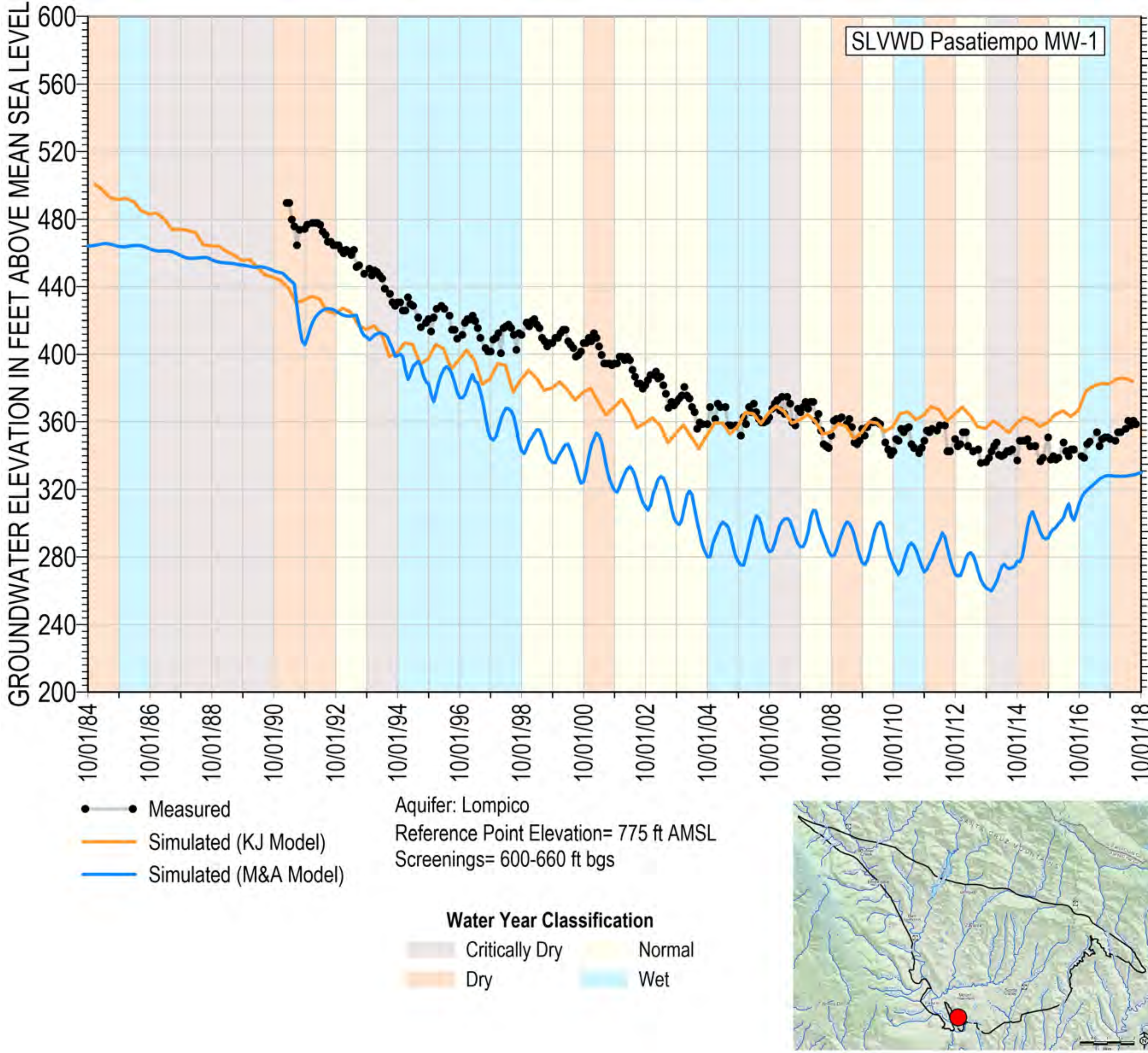
Critically Dry
Normal
Dry
Wet



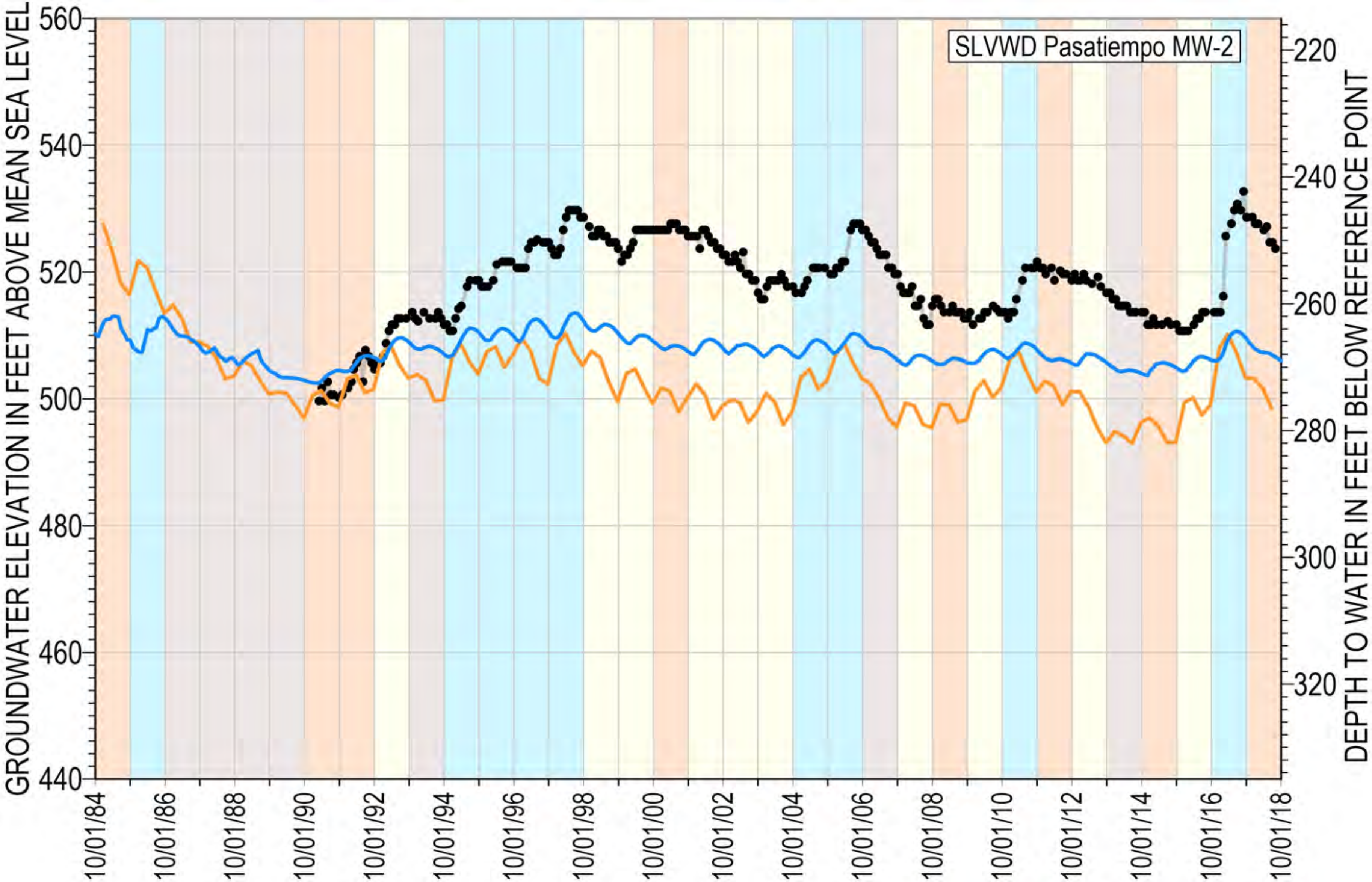


Aquifer: Lompico
Reference Point Elevation= 752 ft AMSL
Screenings= 400-700 ft bgs





SLVWD Pasatiempo MW-1
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
560
520
480
440
400
360
320
280
240
200
200
240
280
320
360
400
440
480
520
560
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 775 ft AMSL
Screenings= 600-660 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

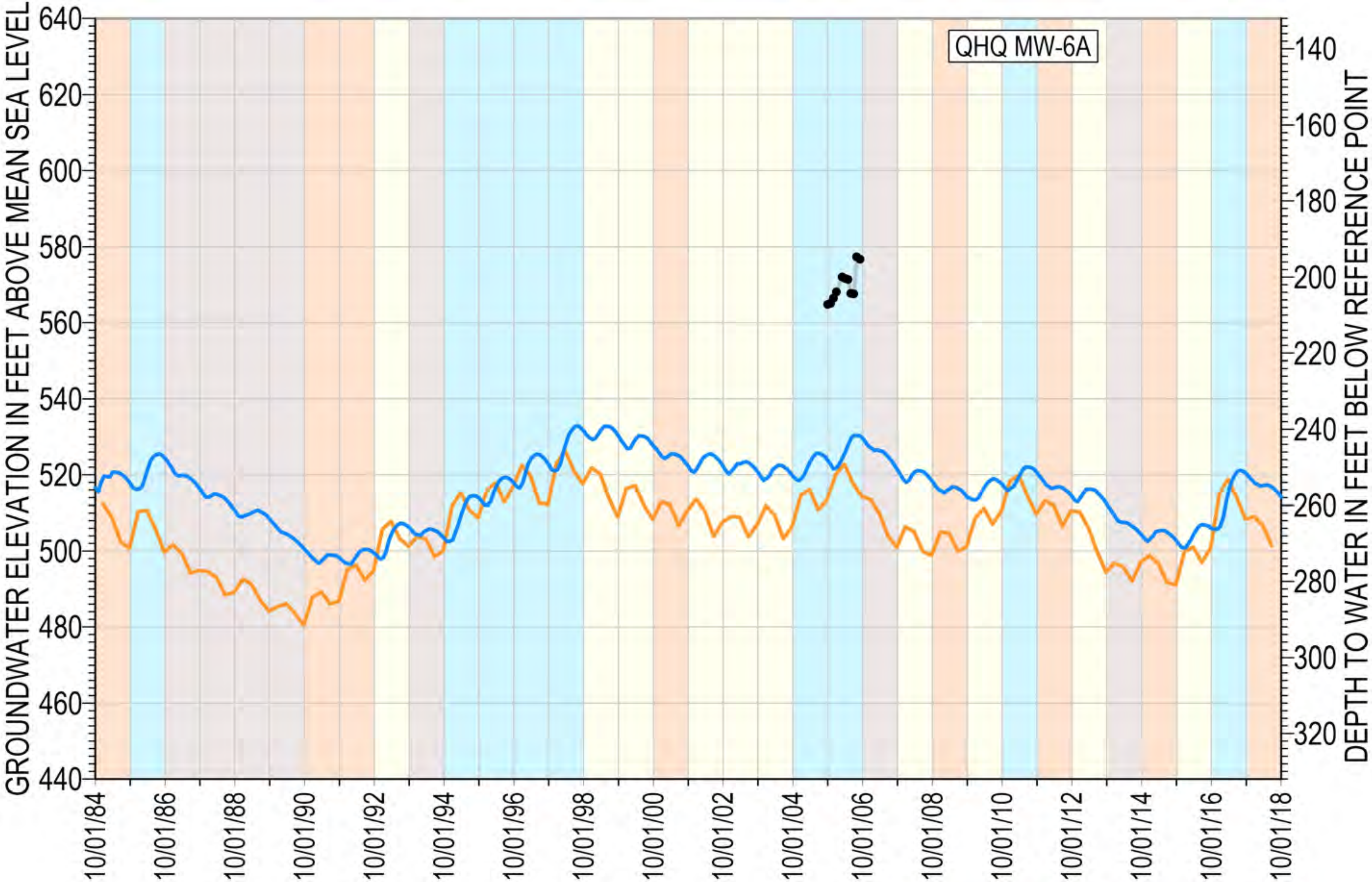


Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 775 ft AMSL
Screenings= 280-340 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

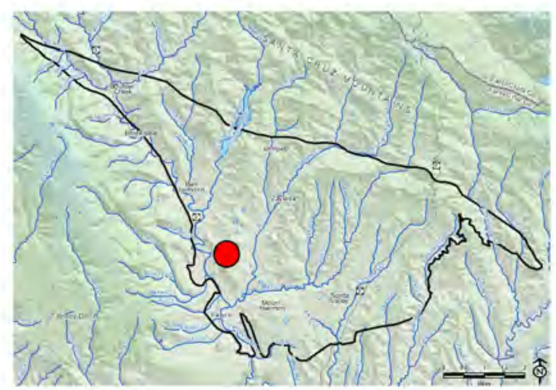


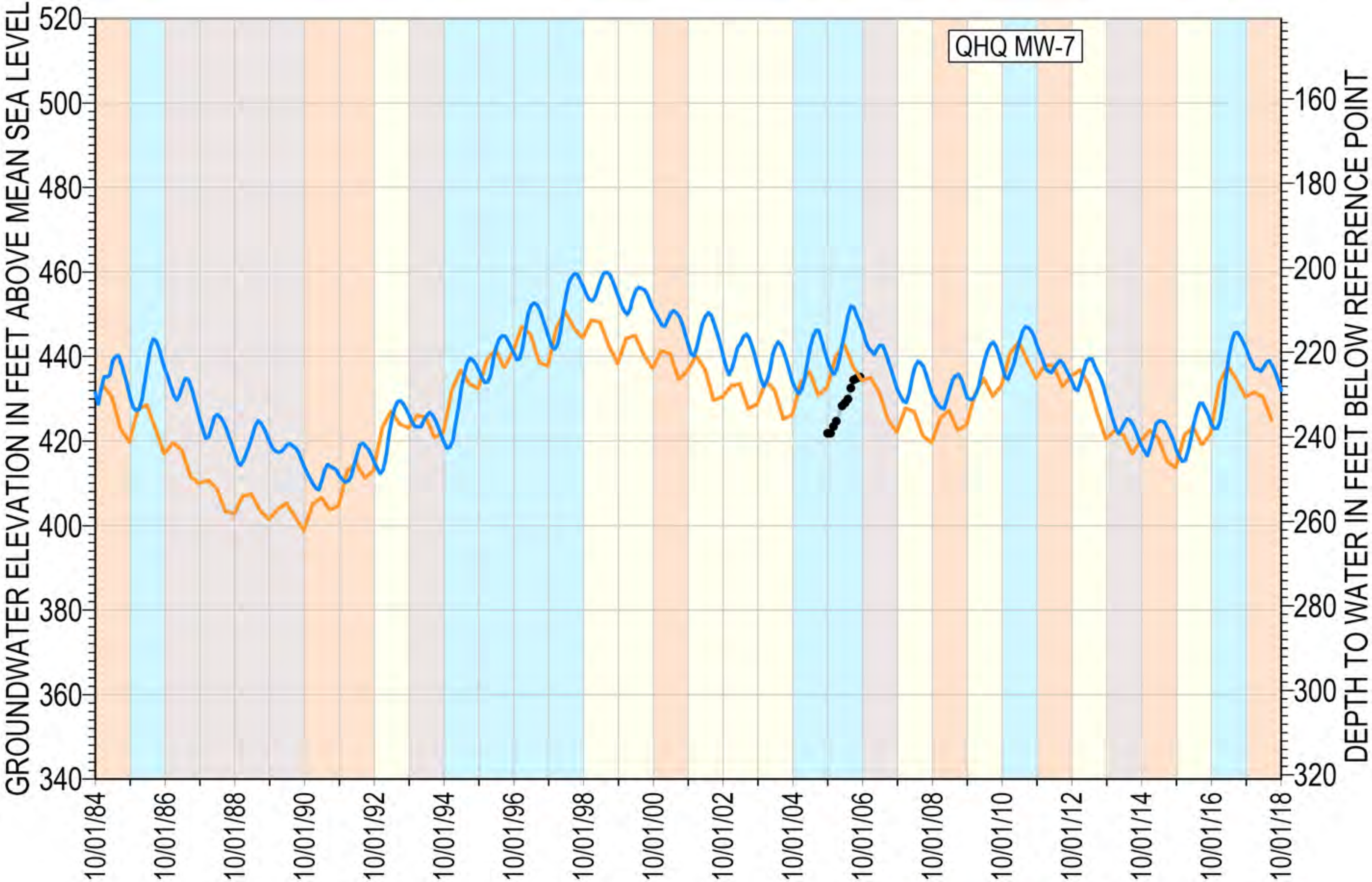
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 772 ft AMSL
Screenings= 229-234 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



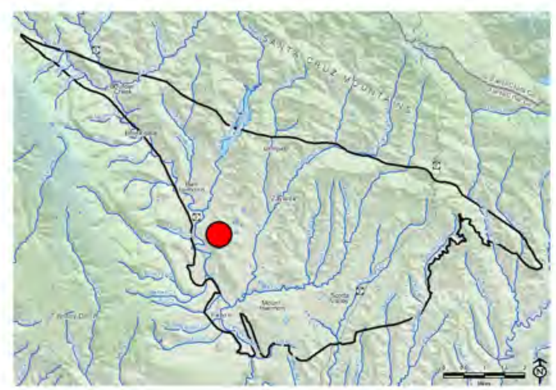


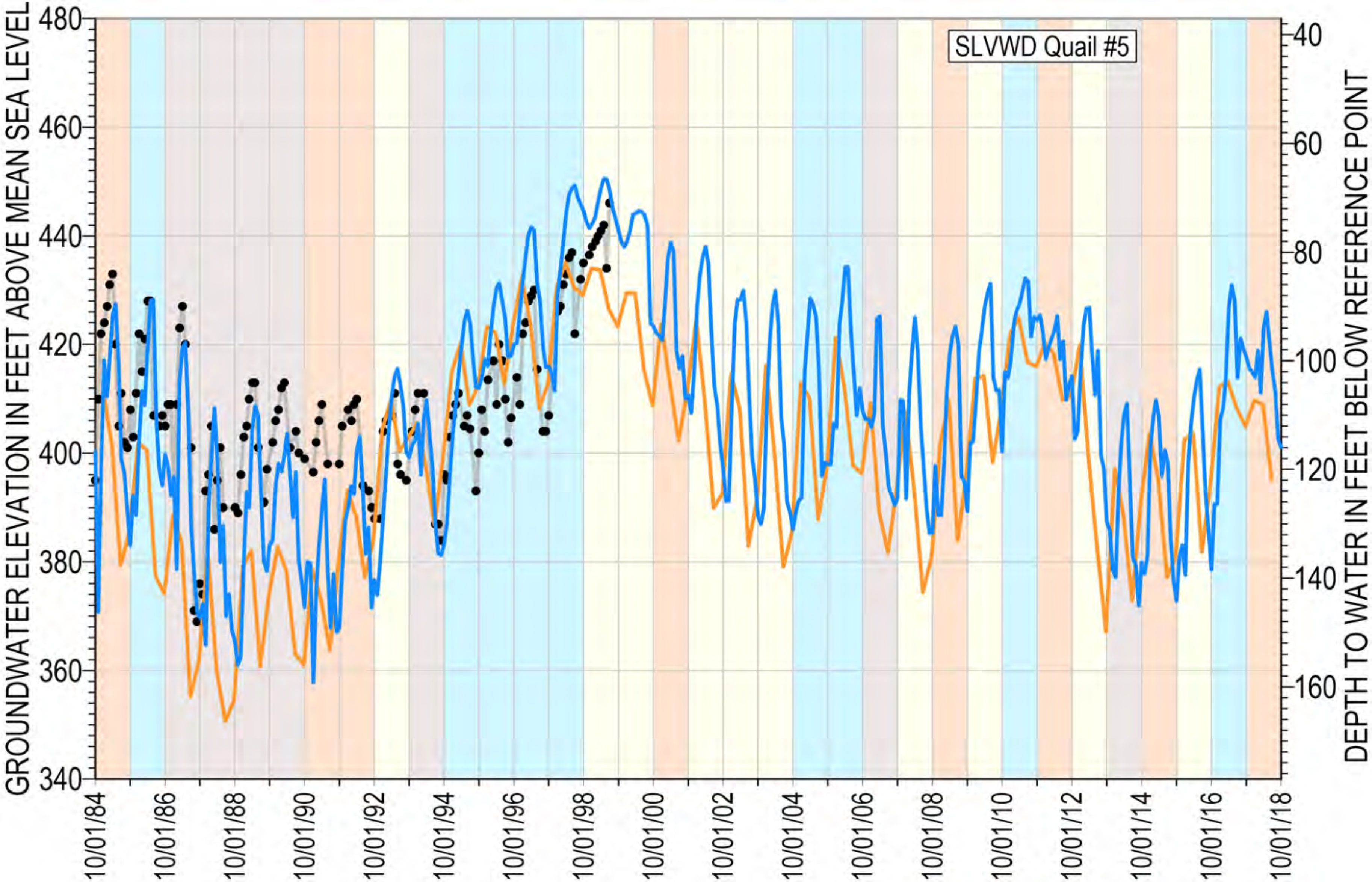
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 661 ft AMSL
Screenings= 153-203 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



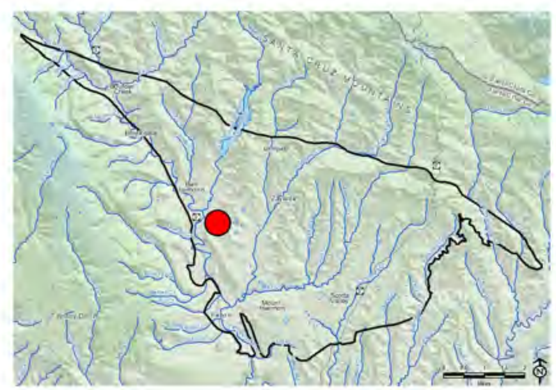


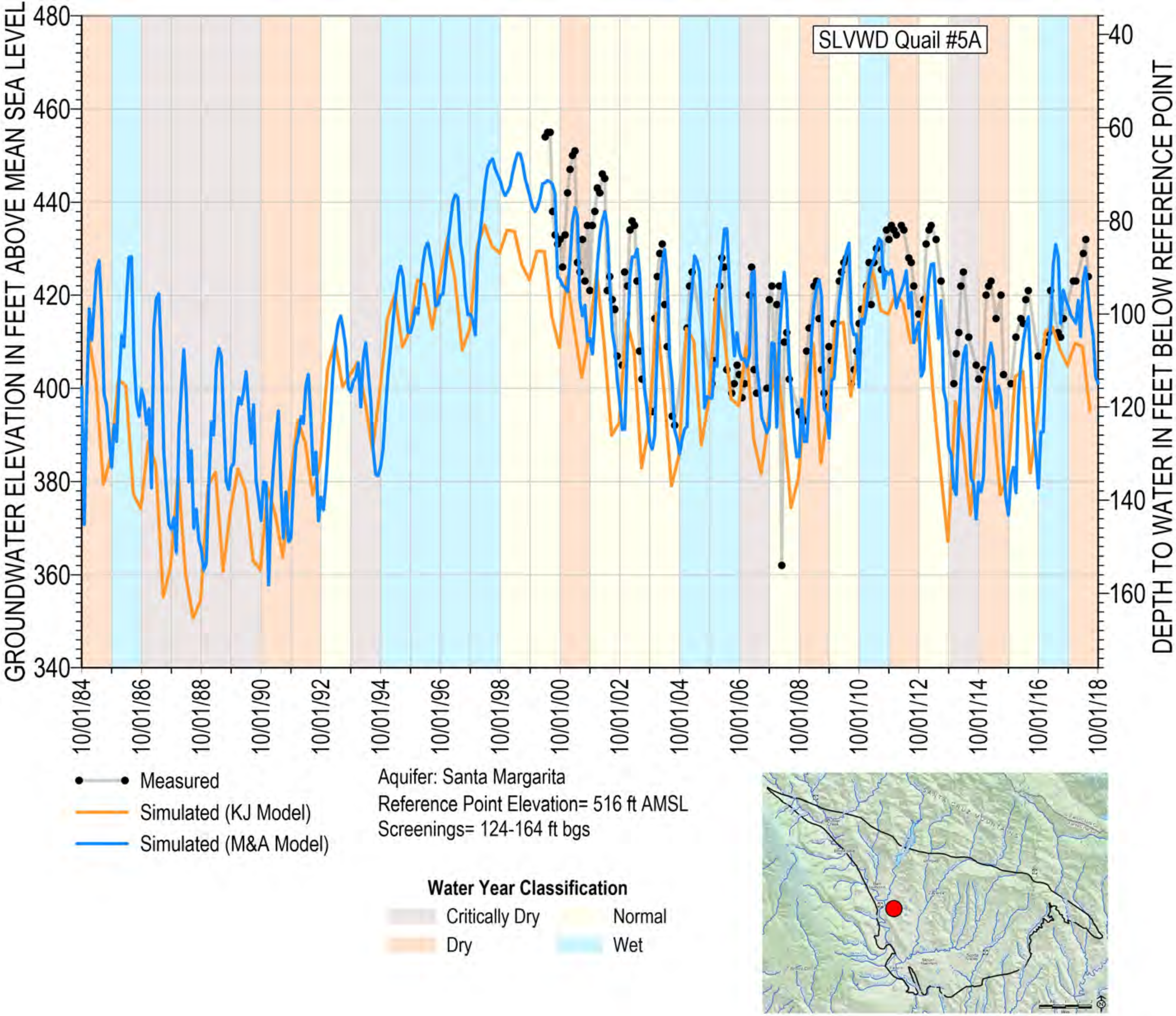
Measured
Simulated (KJ Model)
Simulated (M&A Model)

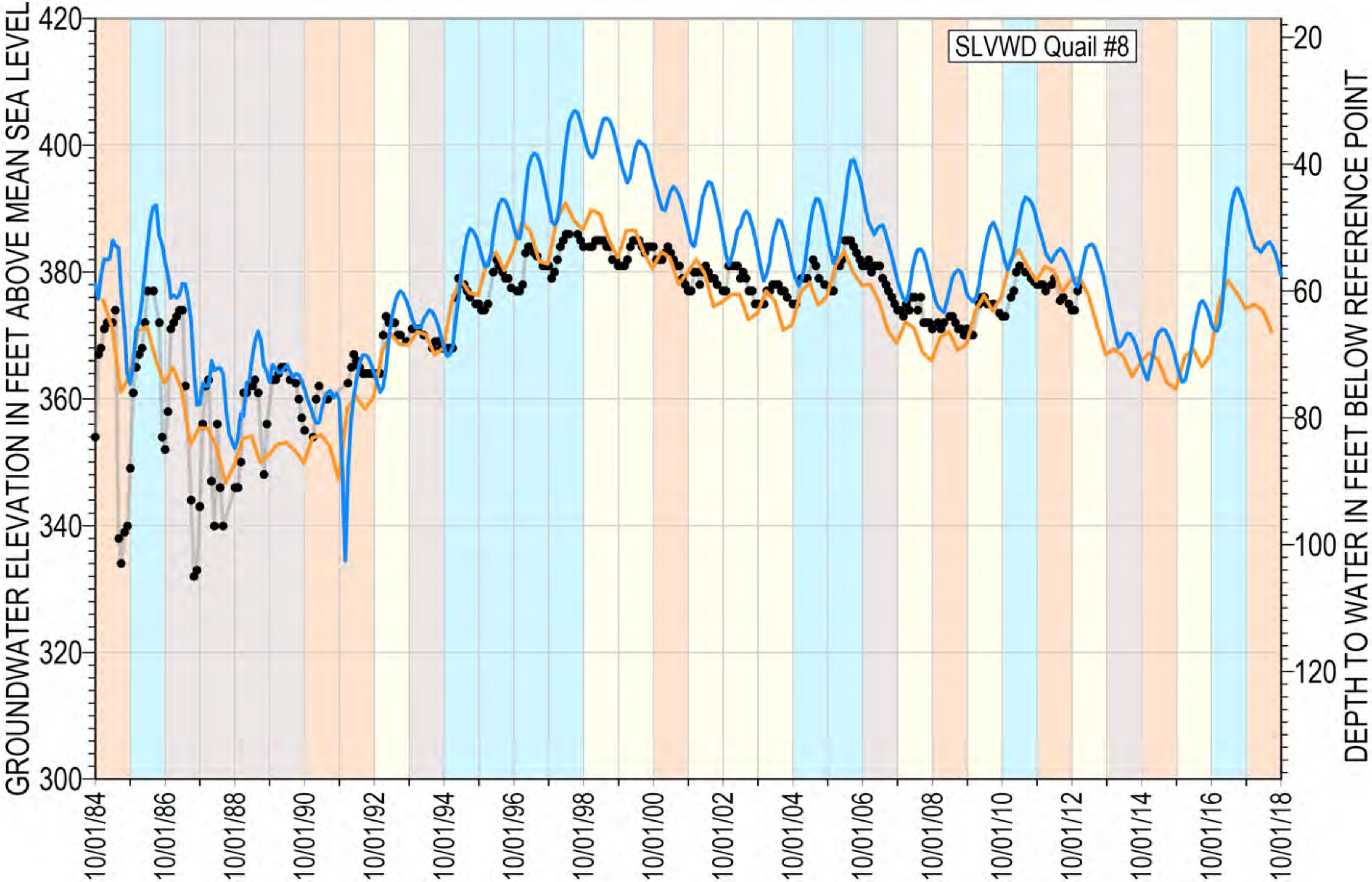
Aquifer: Santa Margarita
Reference Point Elevation= 517 ft AMSL
Screenings= 130-170 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet




SLVWD Quail #5A
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
480
460
440
420
400
380
360
340
40
60
80
100
120
140
160
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 516 ft AMSL
Screenings= 124-164 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

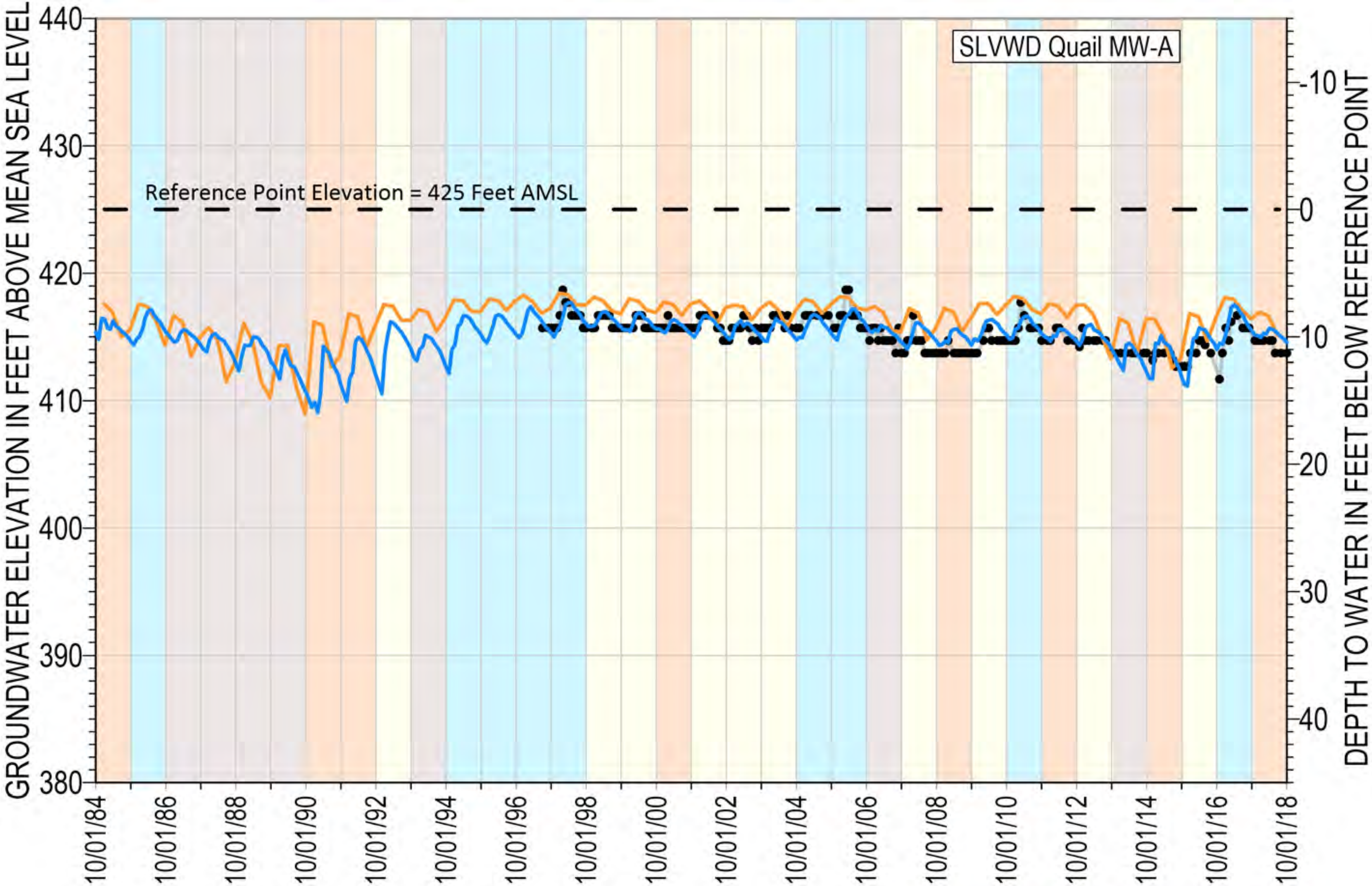


Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 437 ft AMSL
Screenings= 100-130 ft bgs

Water Year Classification

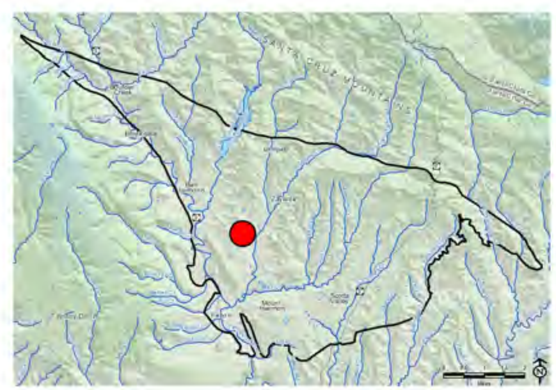
Critically Dry
Normal
Dry
Wet

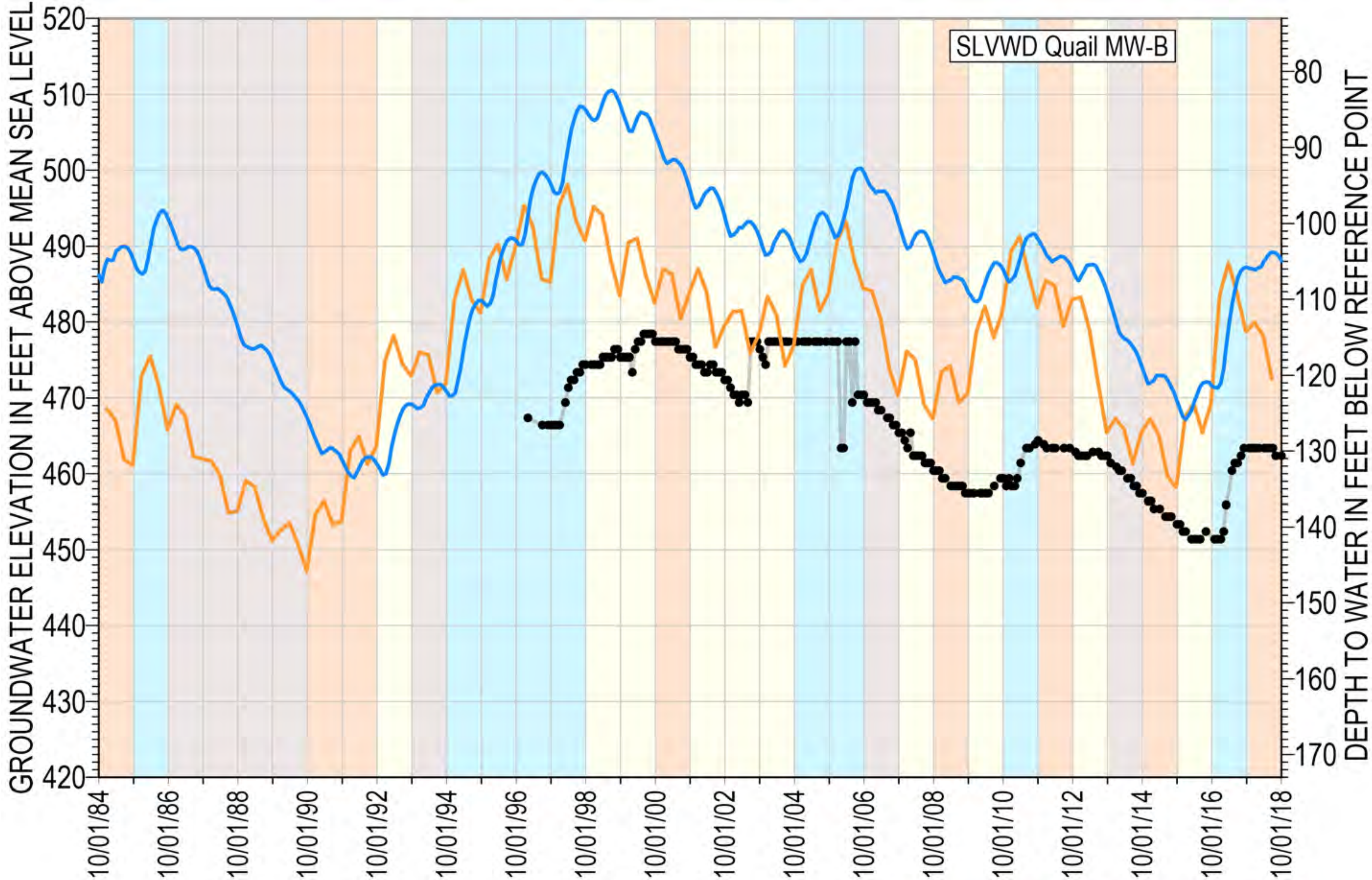


Aquifer: Santa Margarita
Reference Point Elevation= 425 ft AMSL
Screenings= 38-88 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



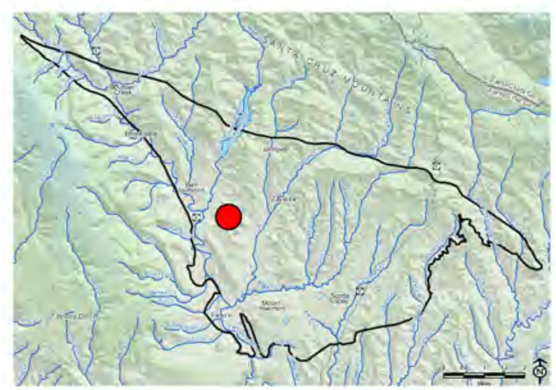


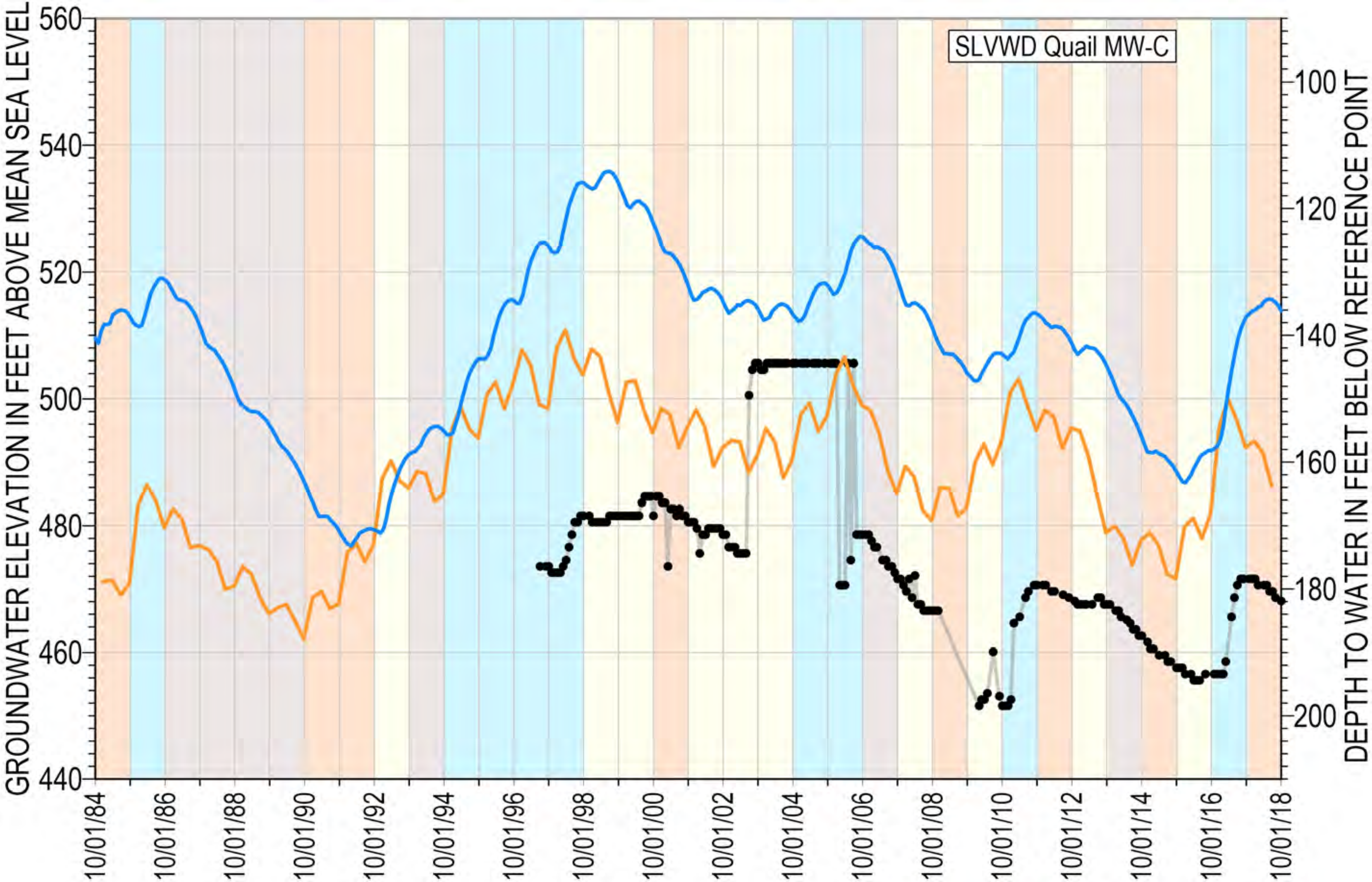
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 593 ft AMSL
Screenings= 95-195 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



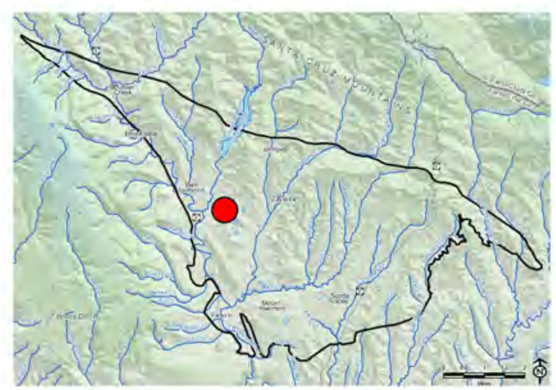


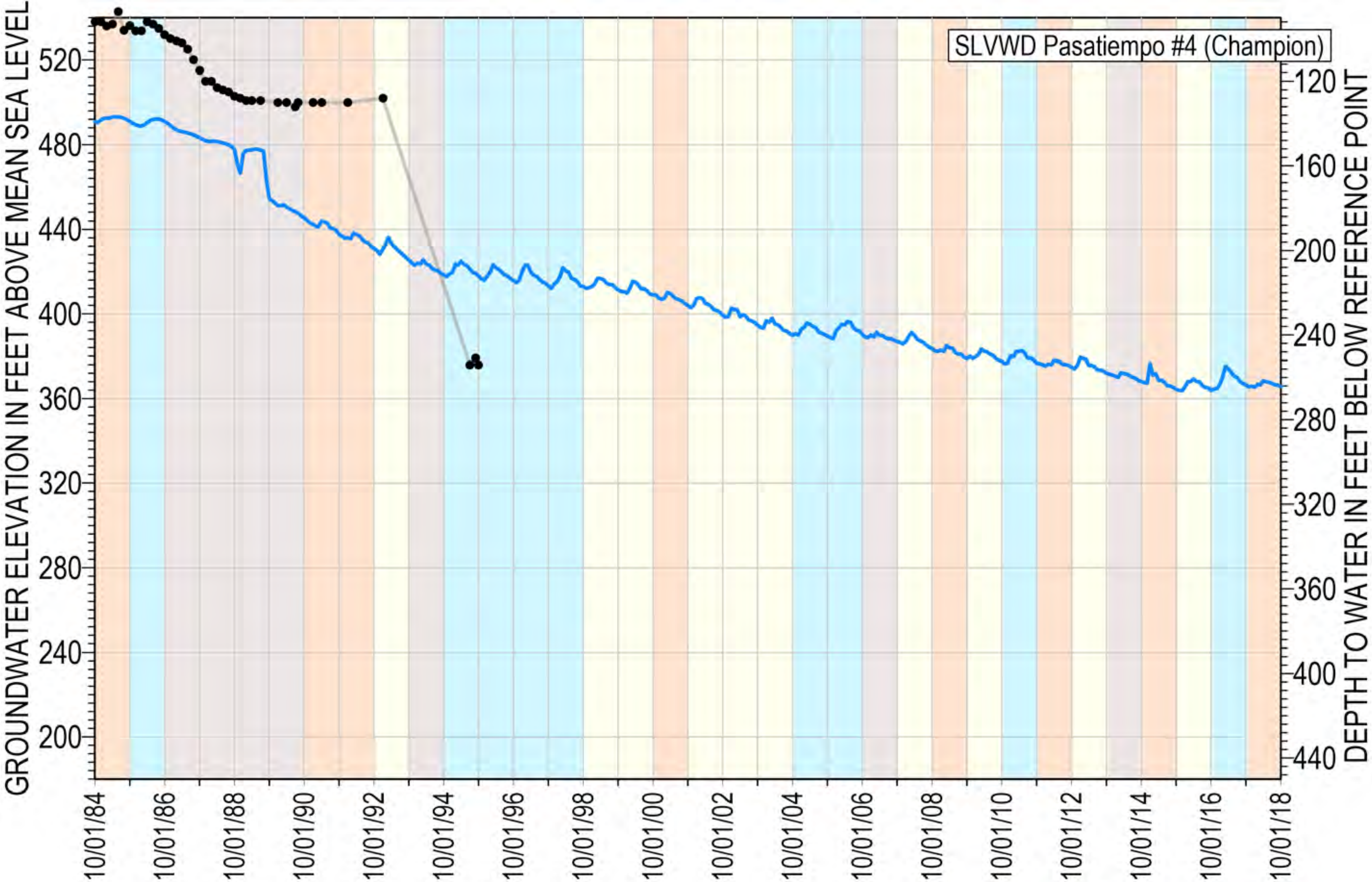
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 650 ft AMSL
Screenings= 120-220 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



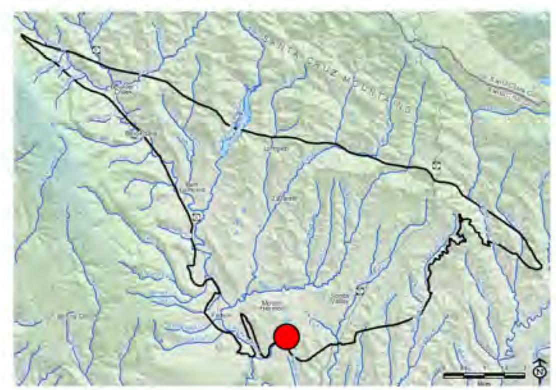


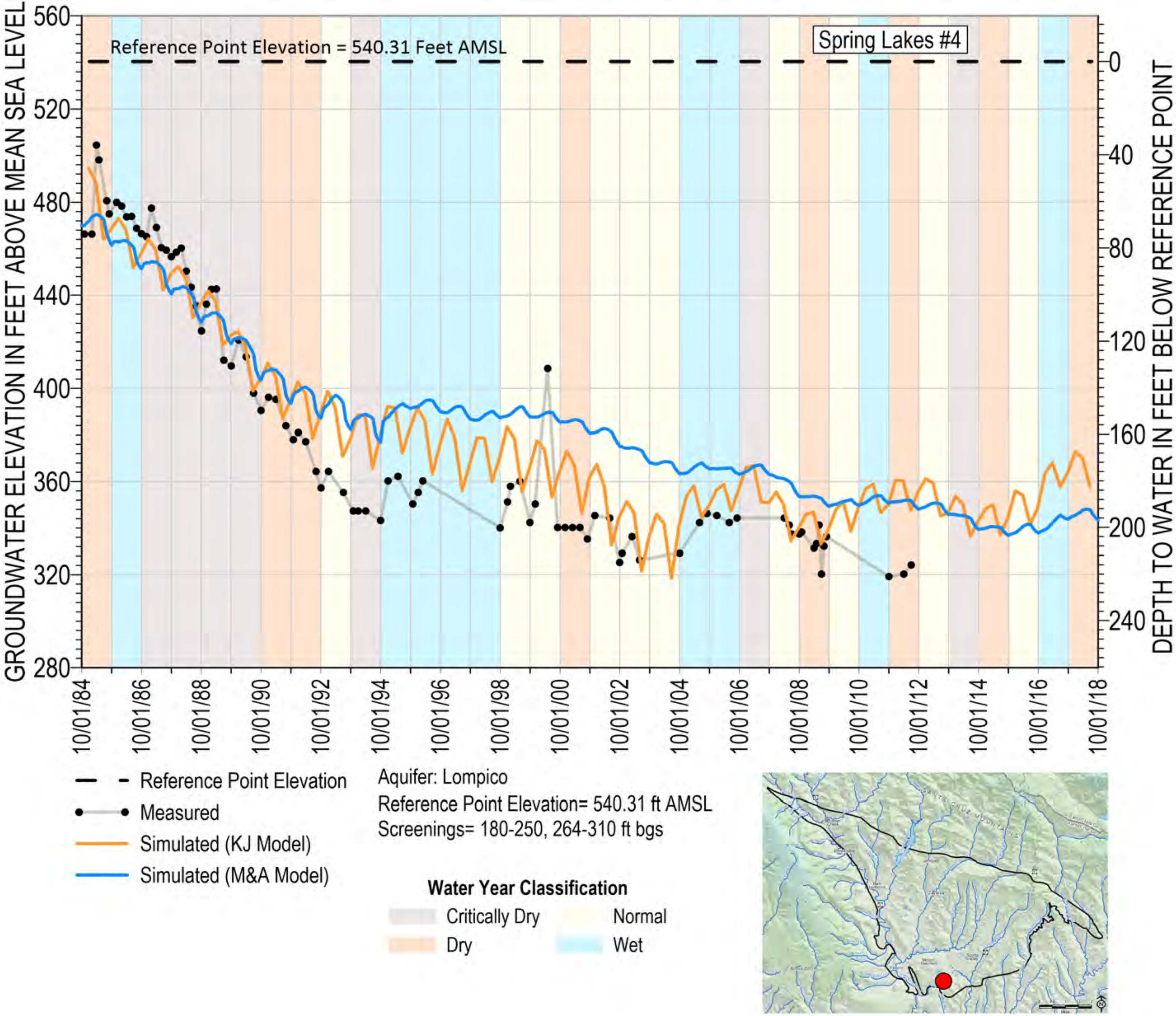
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 630 ft AMSL
Screenings= 100-105, 120-140 ft bgs

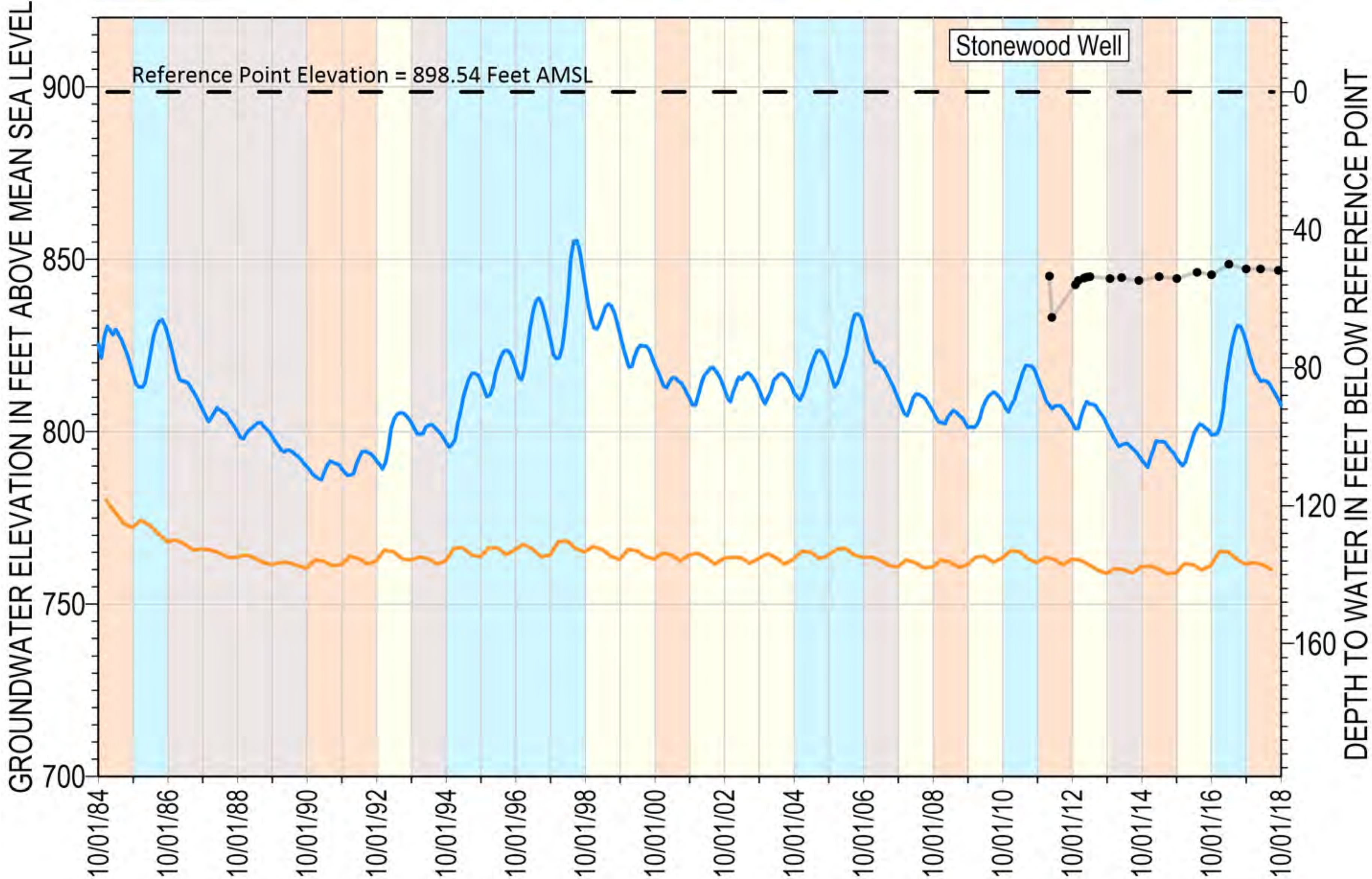
Water Year Classification

Critically Dry
Dry
Normal
Wet





Spring Lakes #4
Reference Point Elevation = 540.31 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
520
480
440
400
360
320
280
0
40
80
120
160
200
240
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 540.31 ft AMSL
Screenings= 180-250, 264-310 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

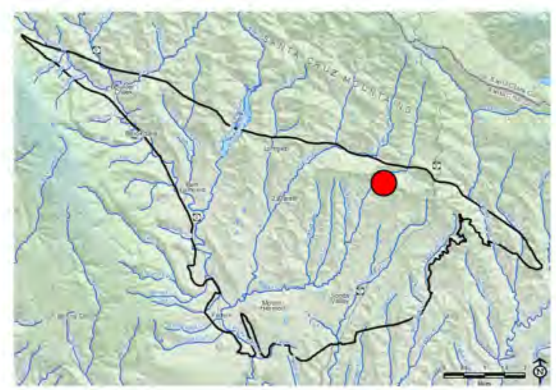


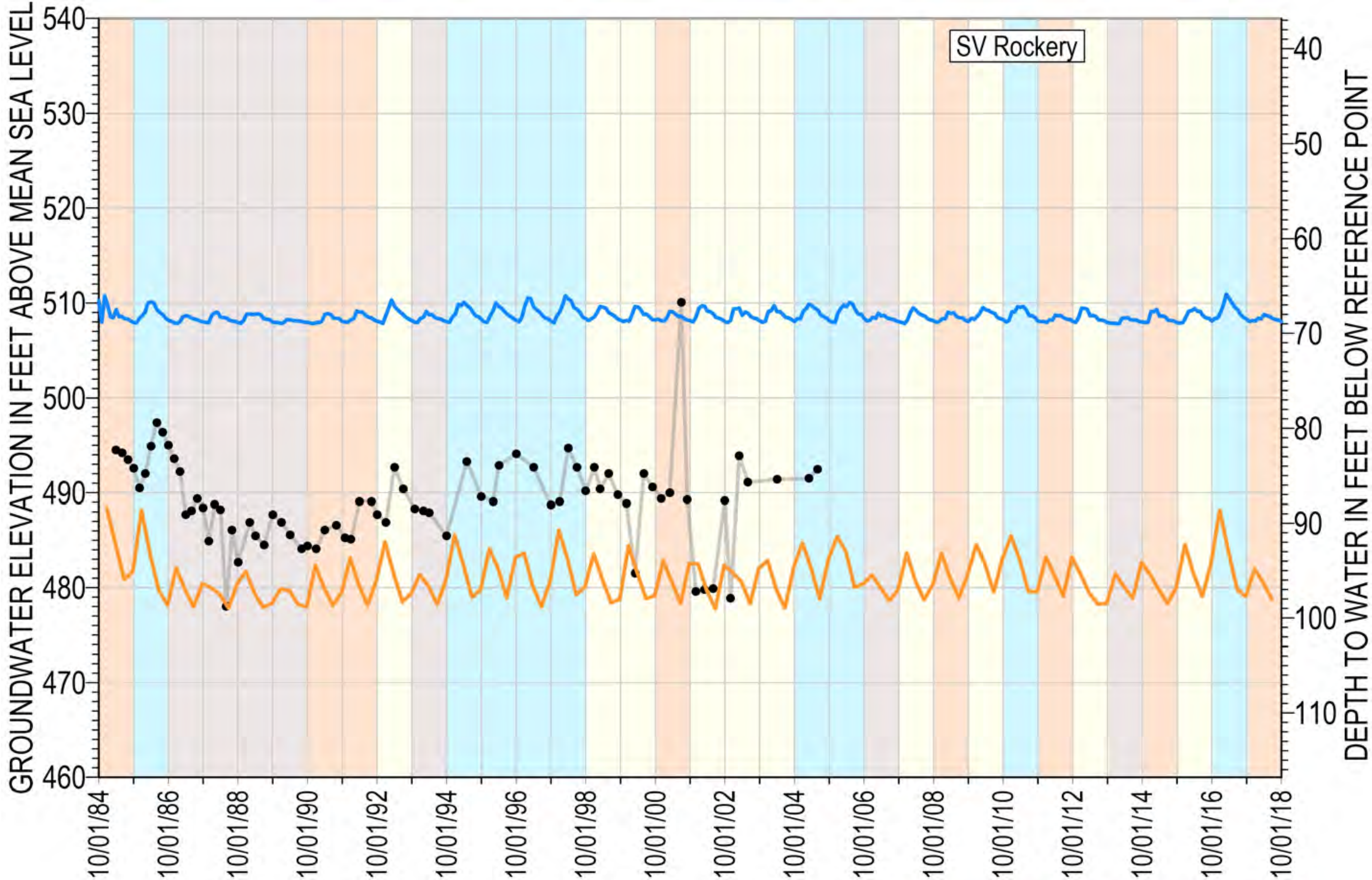
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Butano
Reference Point Elevation= 898.54 ft AMSL
Screenings= 799-859 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



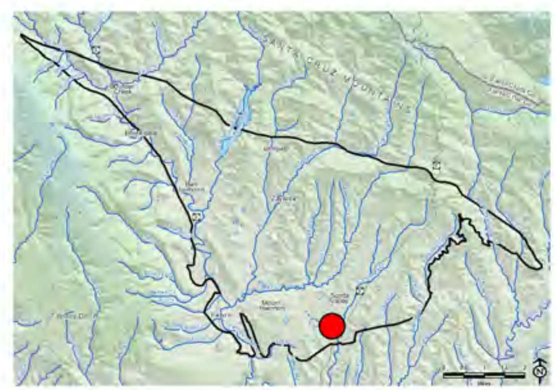


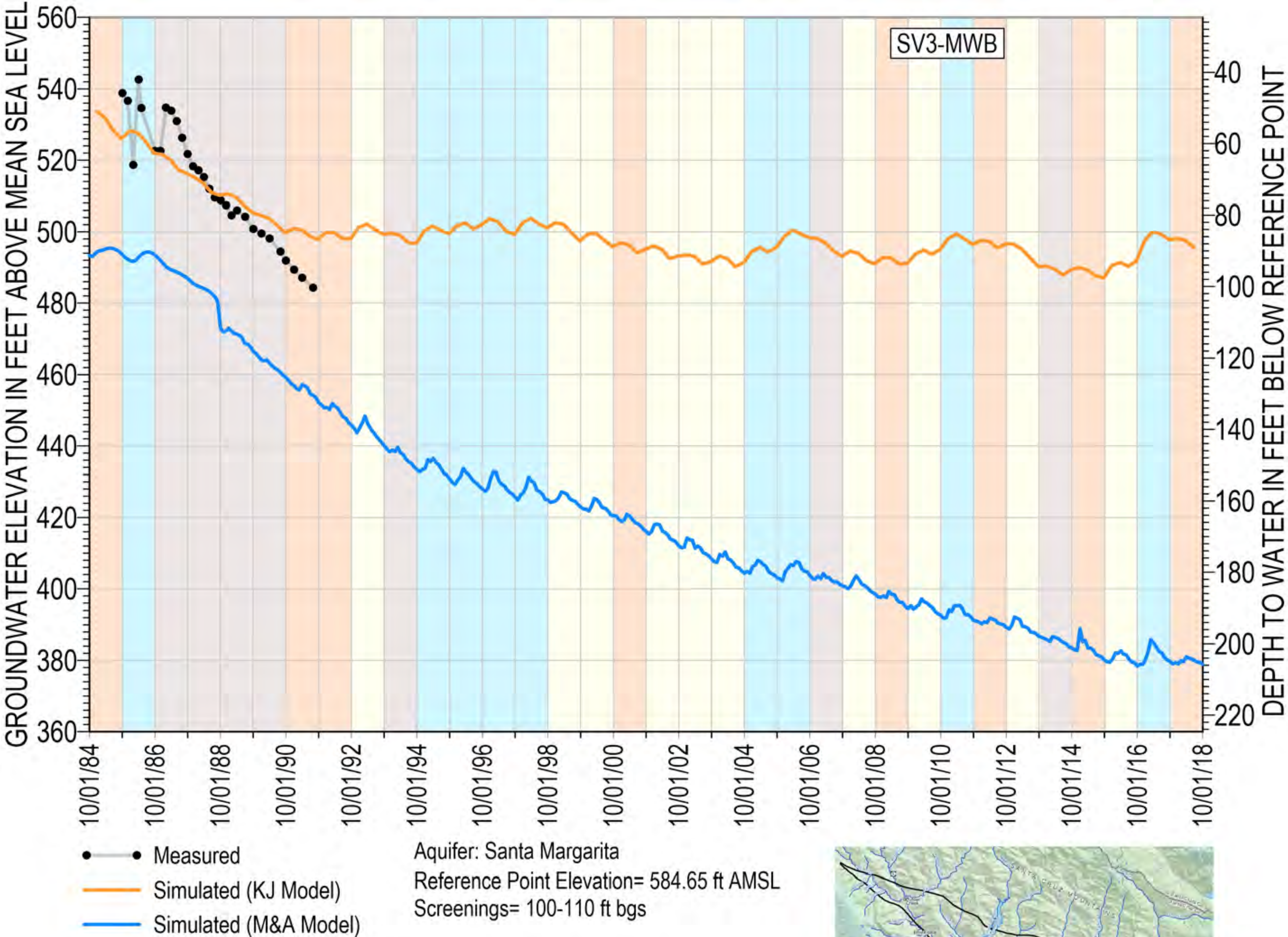
Measured
Simulated (KJ Model)
Simulated (M&A Model)

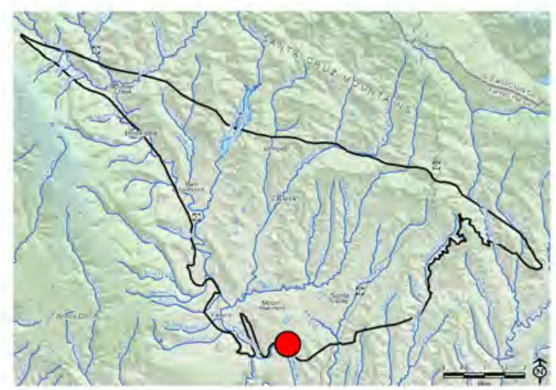
Aquifer: Santa Margarita
Reference Point Elevation= 576.8 ft AMSL
Screenings= 70-76, 115-121 ft bgs

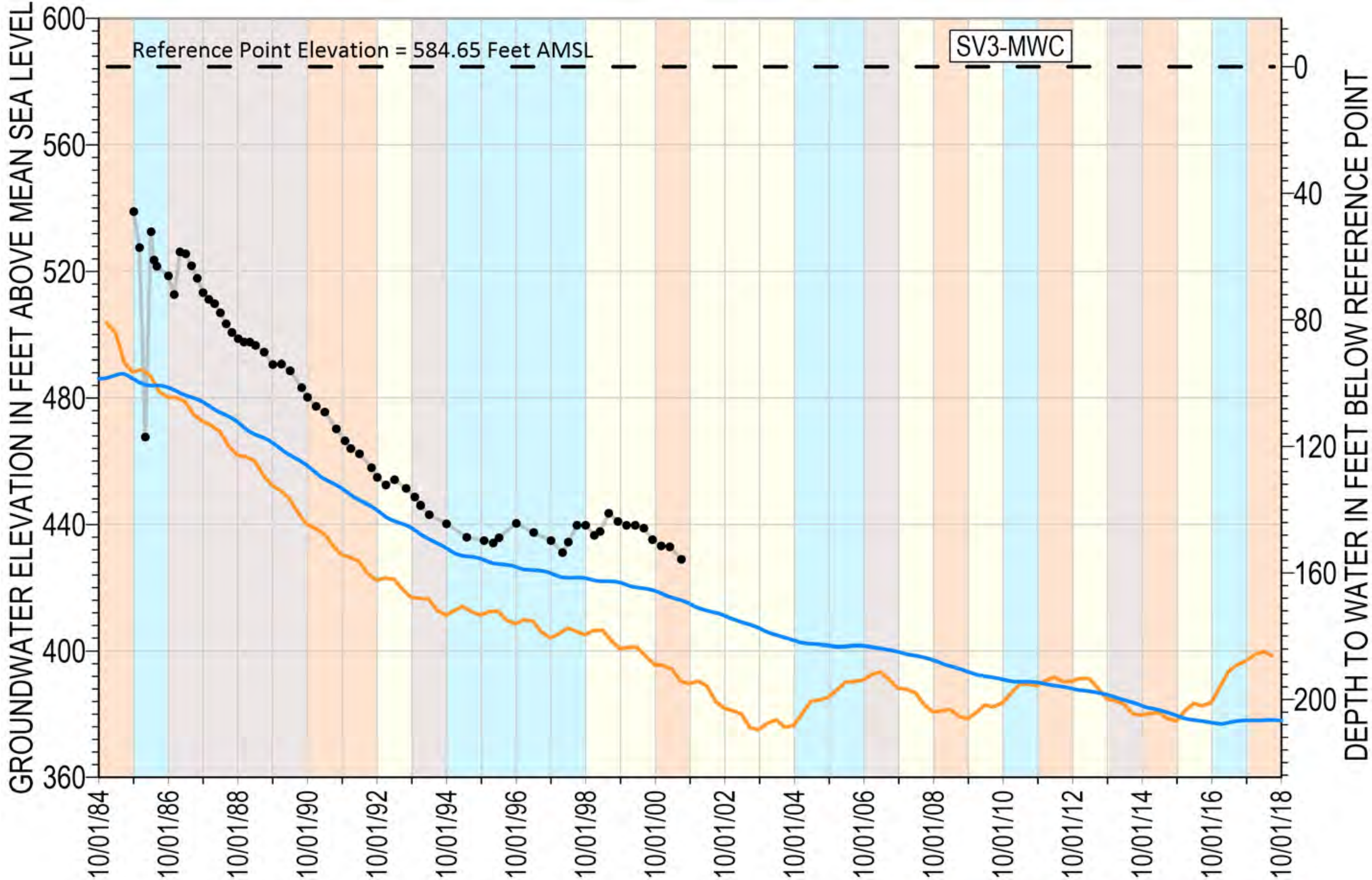
Water Year Classification

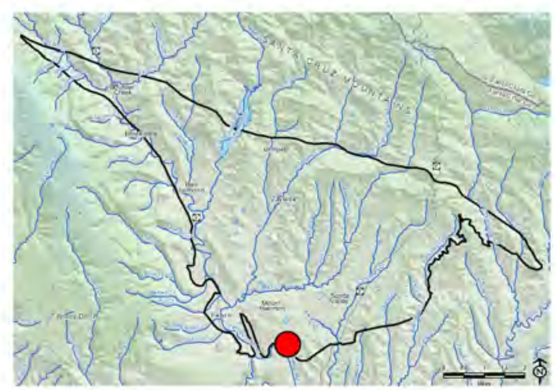
Critically Dry
Normal
Dry
Wet

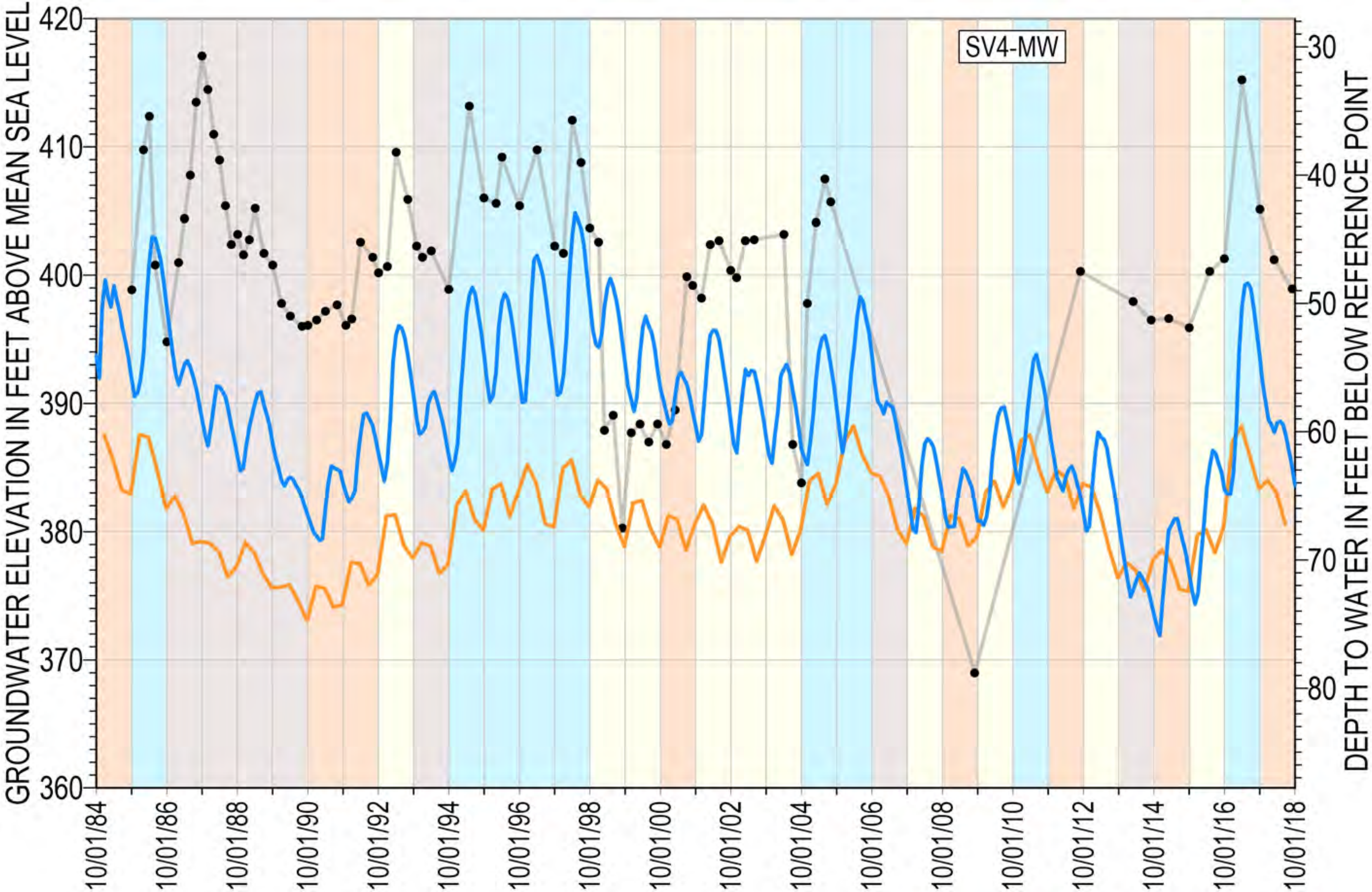



SV3-MWB
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
540
520
500
480
460
440
420
400
380
360
40
60
80
100
120
140
160
180
200
220
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 584.65 ft AMSL
Screenings= 100-110 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet




SV3-MWC
Reference Point Elevation = 584.65 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
560
520
480
440
400
360
0
40
80
120
160
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 584.65 ft AMSL
Screenings= 150-160 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet





Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Santa Margarita

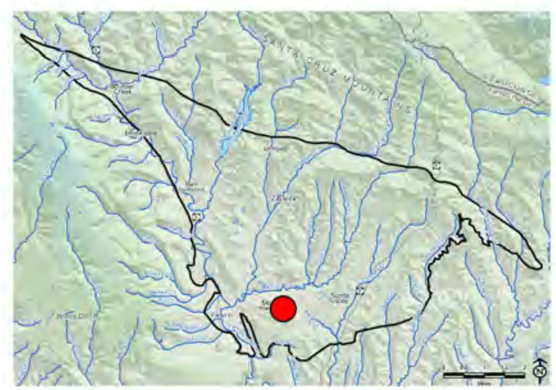
Reference Point Elevation= 447.79 ft AMSL

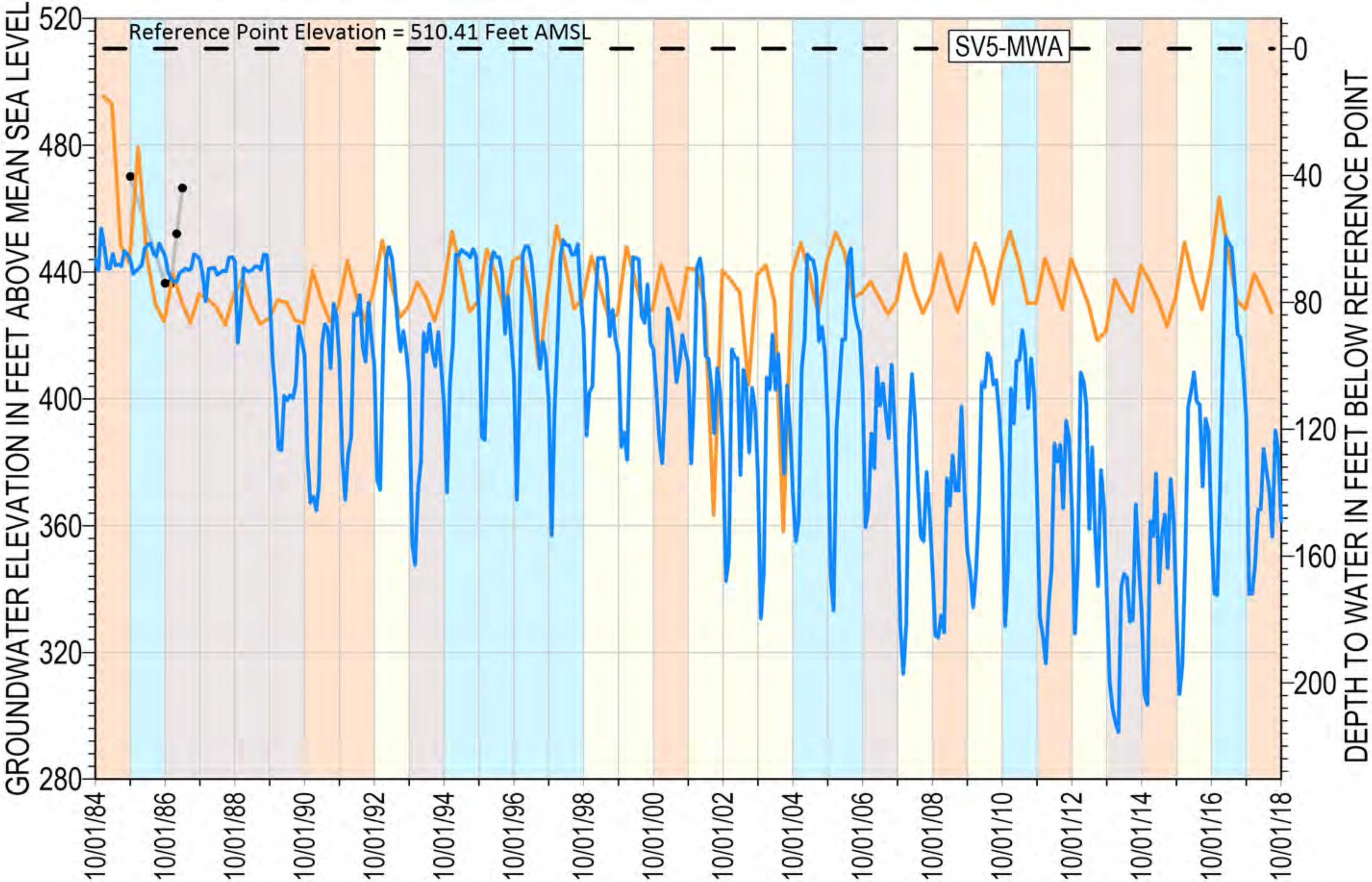
Screenings= 50-60 ft bgs

Water Year Classification

Critically Dry | Normal

Dry | Wet



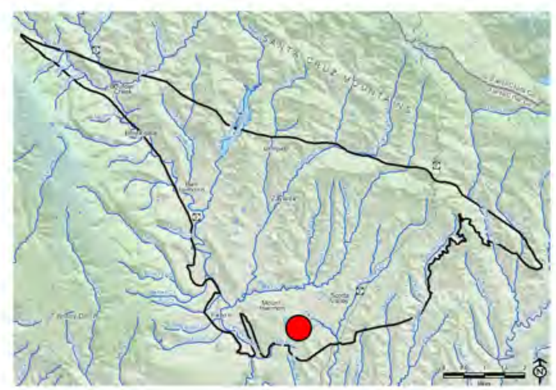


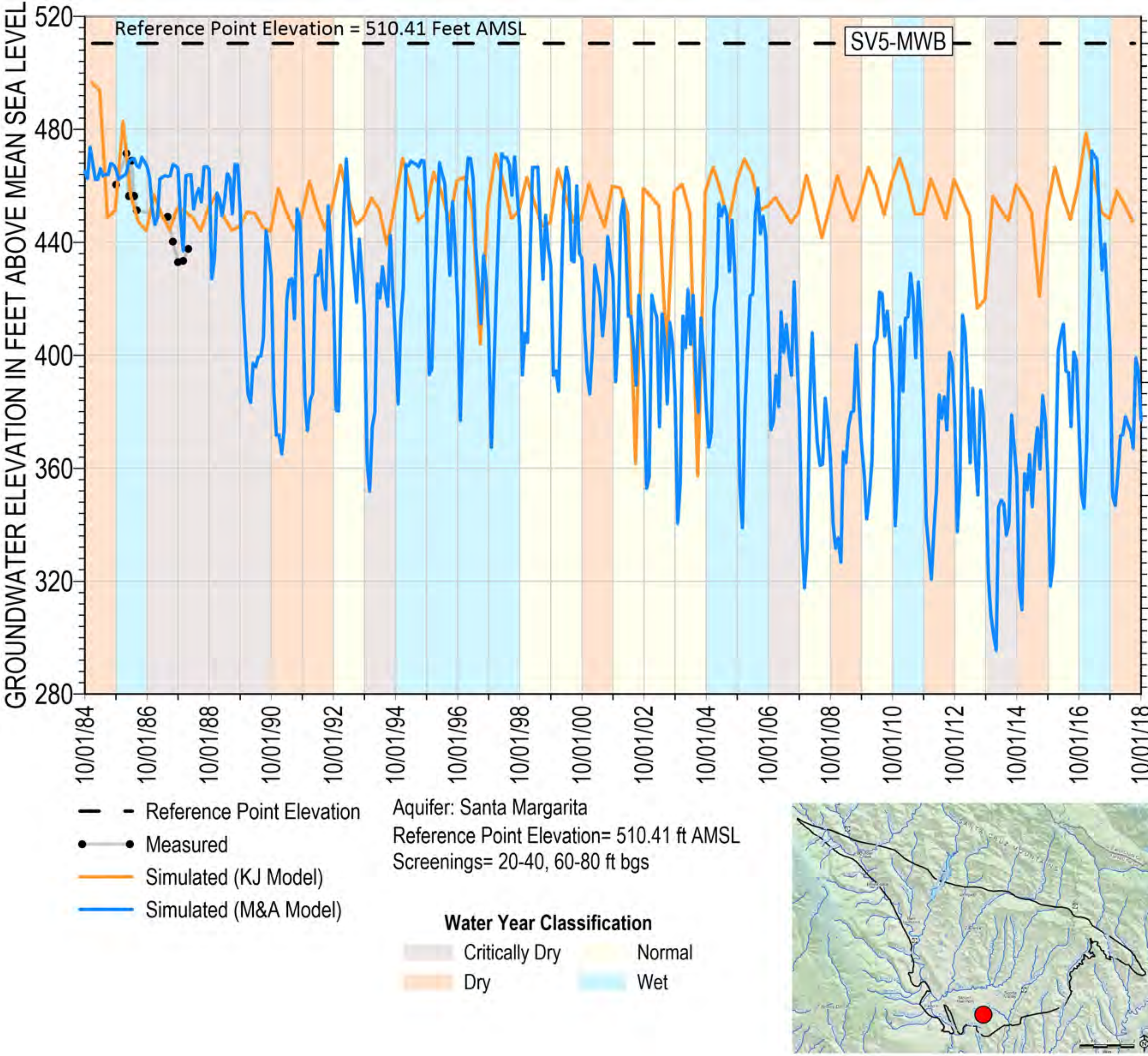
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita
Reference Point Elevation= 510.41 ft AMSL
Screenings= Unknown ft bgs

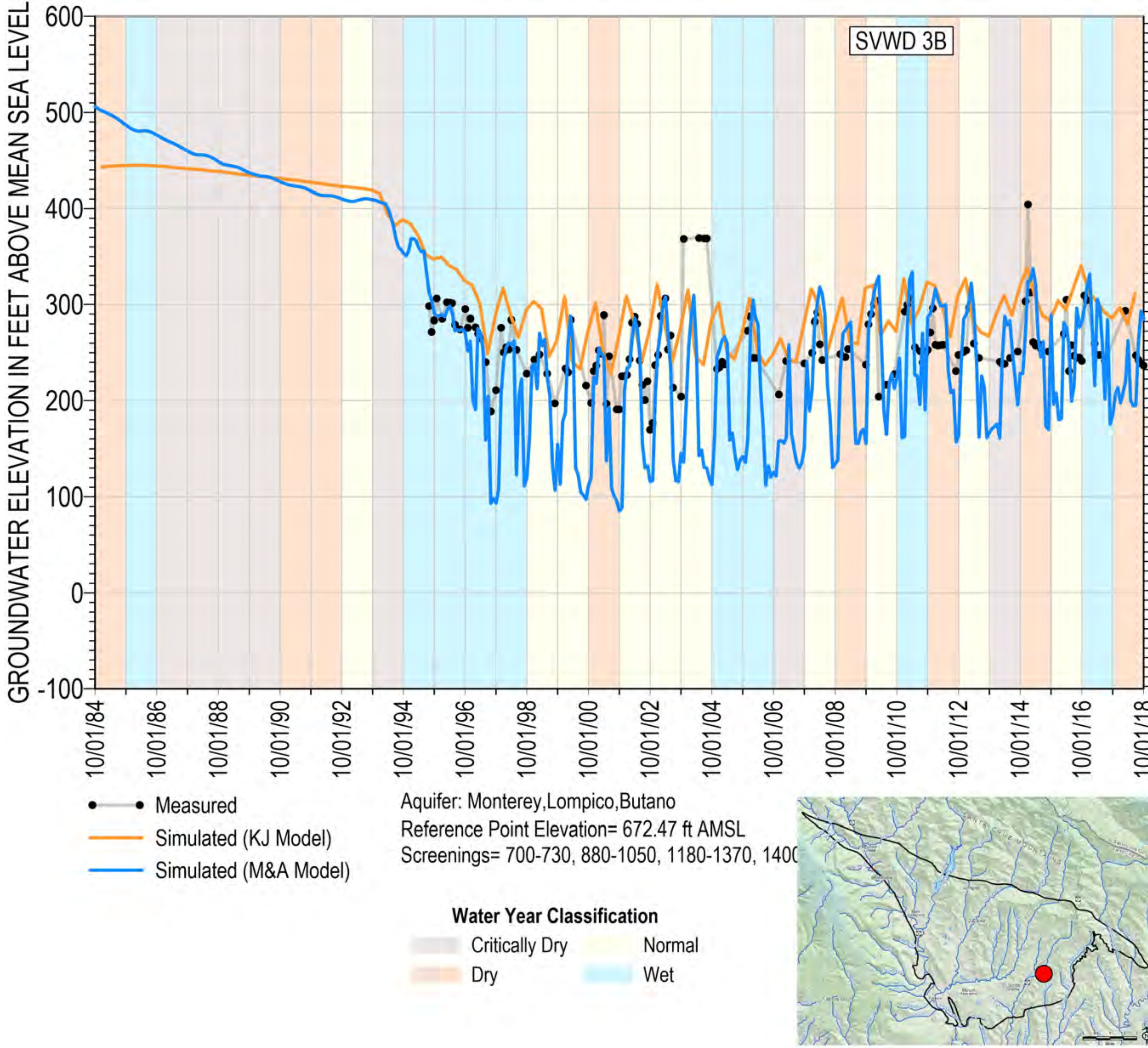
Water Year Classification

Critically Dry
Dry
Normal
Wet

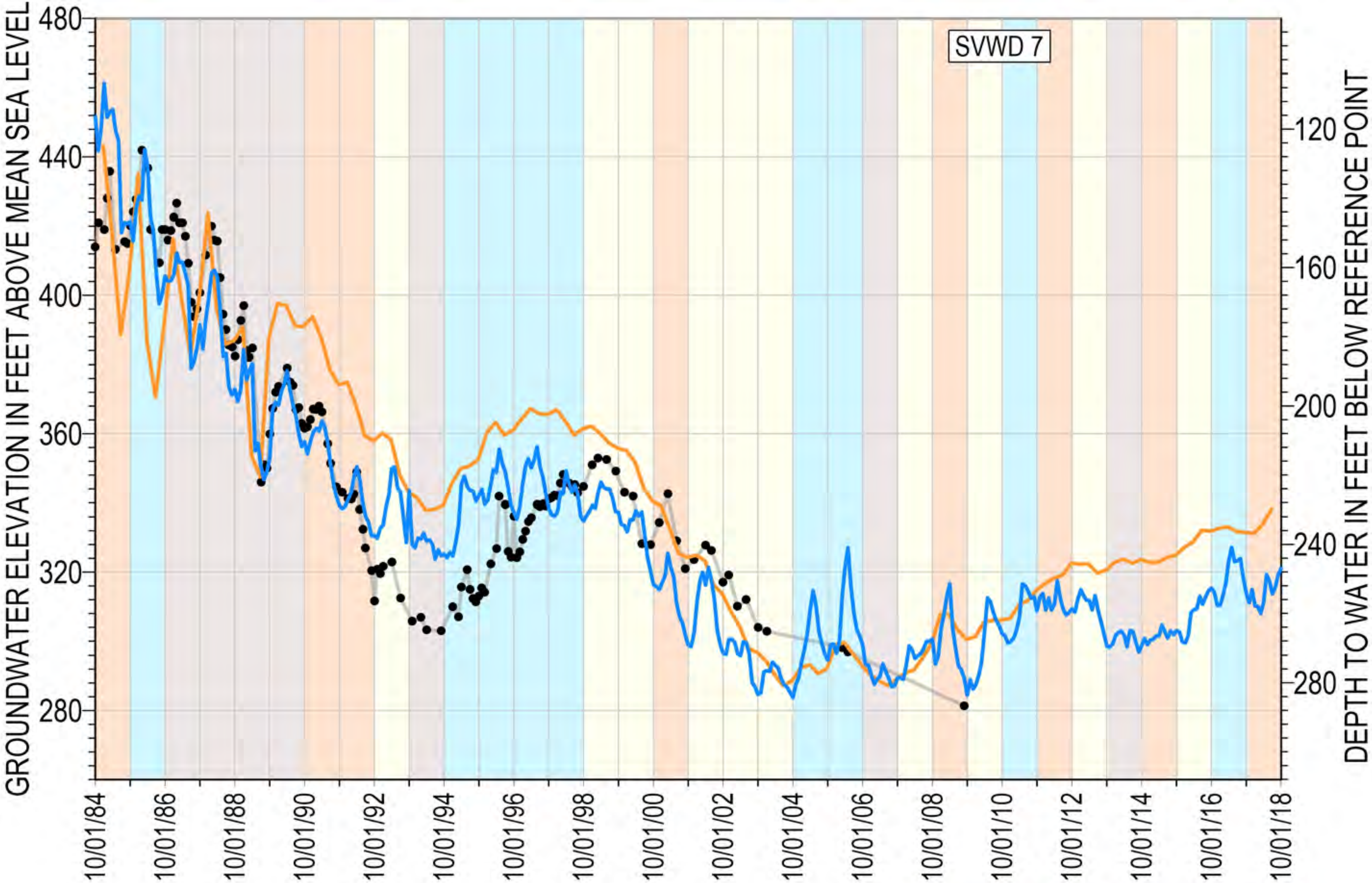




Reference Point Elevation = 510.41 Feet AMSL
SV5-MWB
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
520
480
440
400
360
320
280
0
40
80
120
160
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 510.41 ft AMSL
Screenings= 20-40, 60-80 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



SVWD 3B
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
500
400
300
200
100
0
-100
100
200
300
400
500
600
700
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Monterey,Lompico,Butano
Reference Point Elevation= 672.47 ft AMSL
Screenings= 700-730, 880-1050, 1180-1370, 1400
Water Year Classification
Critically Dry
Dry
Normal
Wet

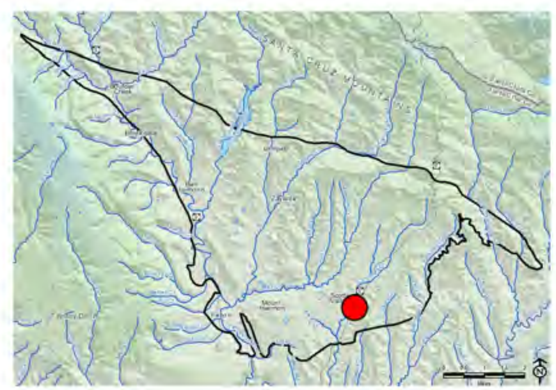


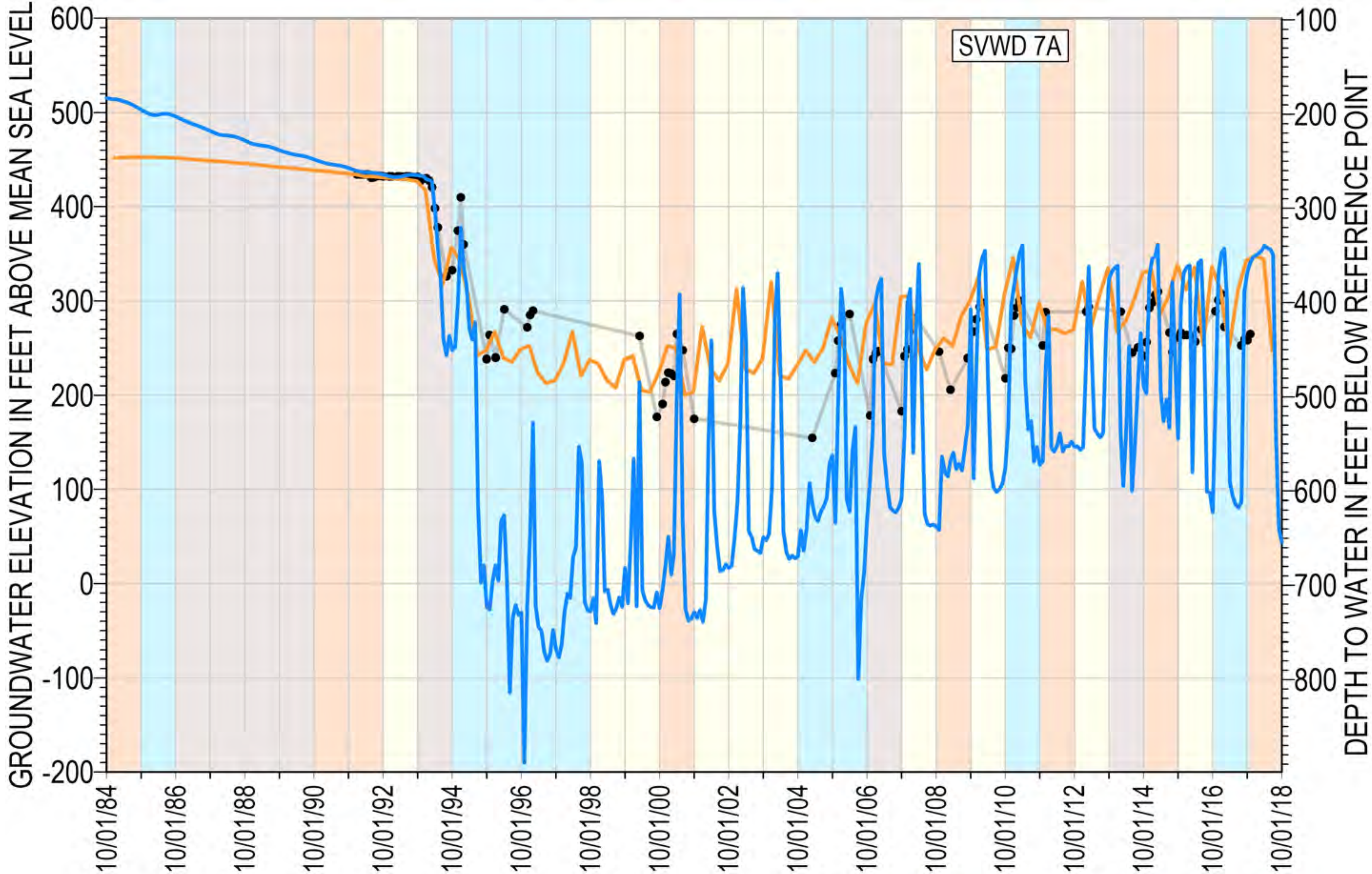
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico
Reference Point Elevation= 568.05 ft AMSL
Screenings= 200-240, 250-270, 292-332 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



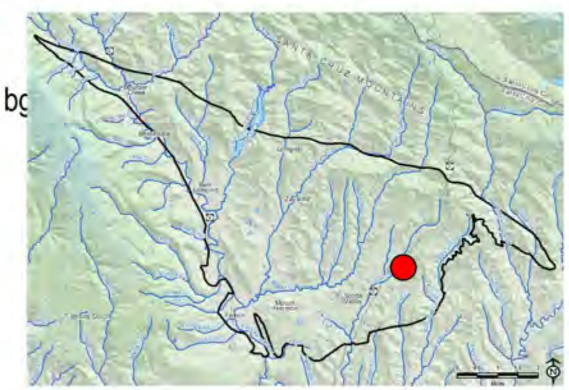


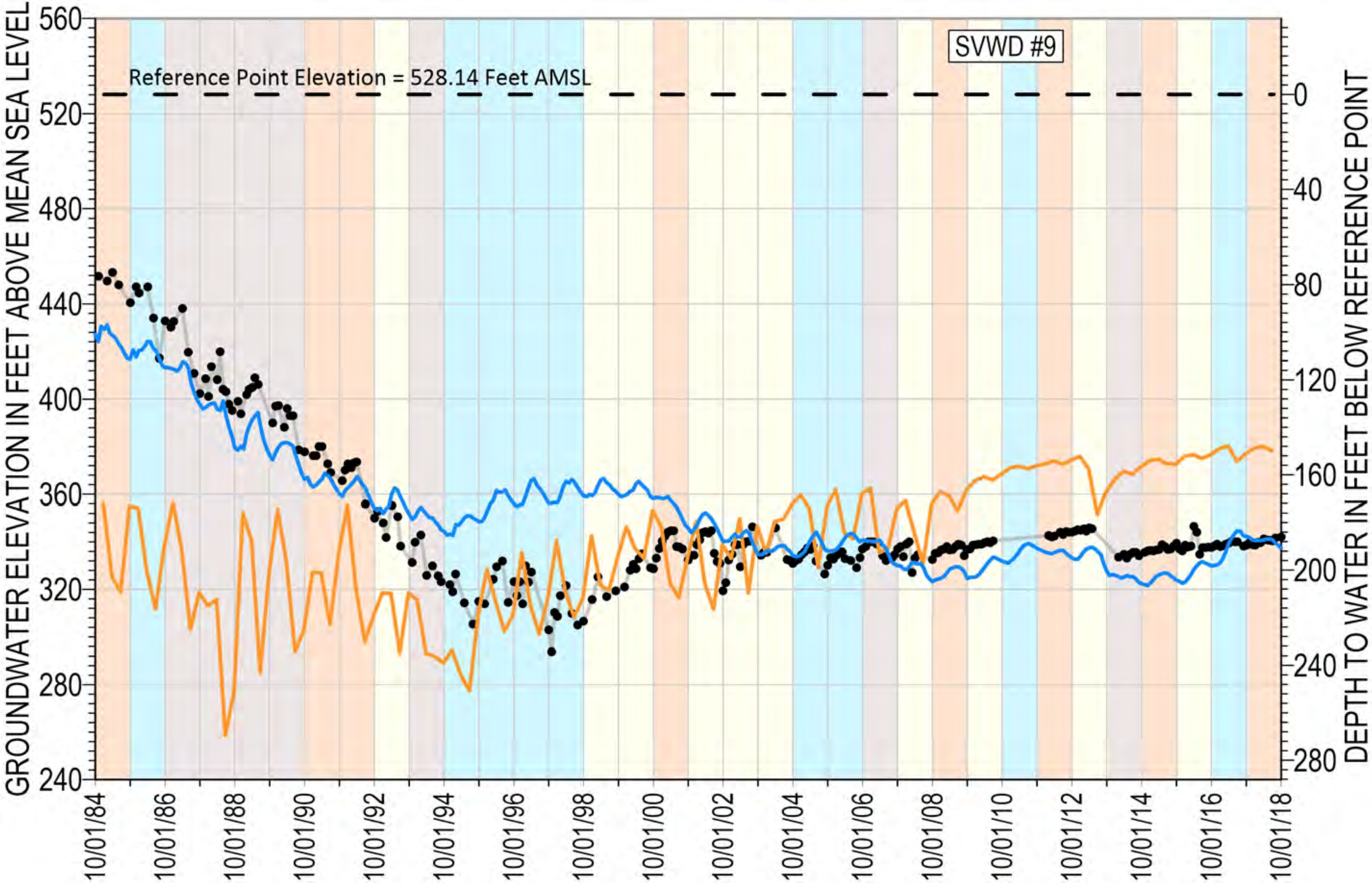
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico,Butano
Reference Point Elevation= 698.25 ft AMSL
Screenings= 700-900, 1000-1150, 1250-1450 ft bg

Water Year Classification

Critically Dry
Dry
Normal
Wet





Reference Point Elevation

Measured

Simulated (KJ Model)

Simulated (M&A Model)

Aquifer: Monterey

Reference Point Elevation= 528.14 ft AMSL

Screenings= Unknown ft bgs

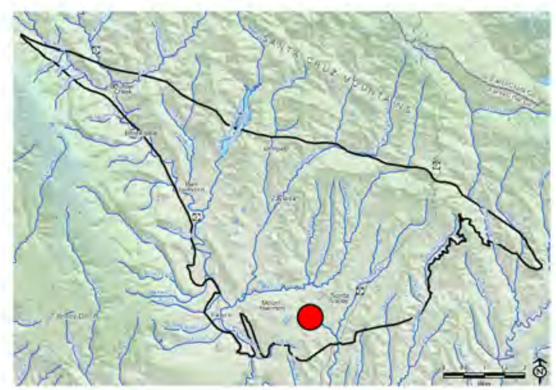
Water Year Classification

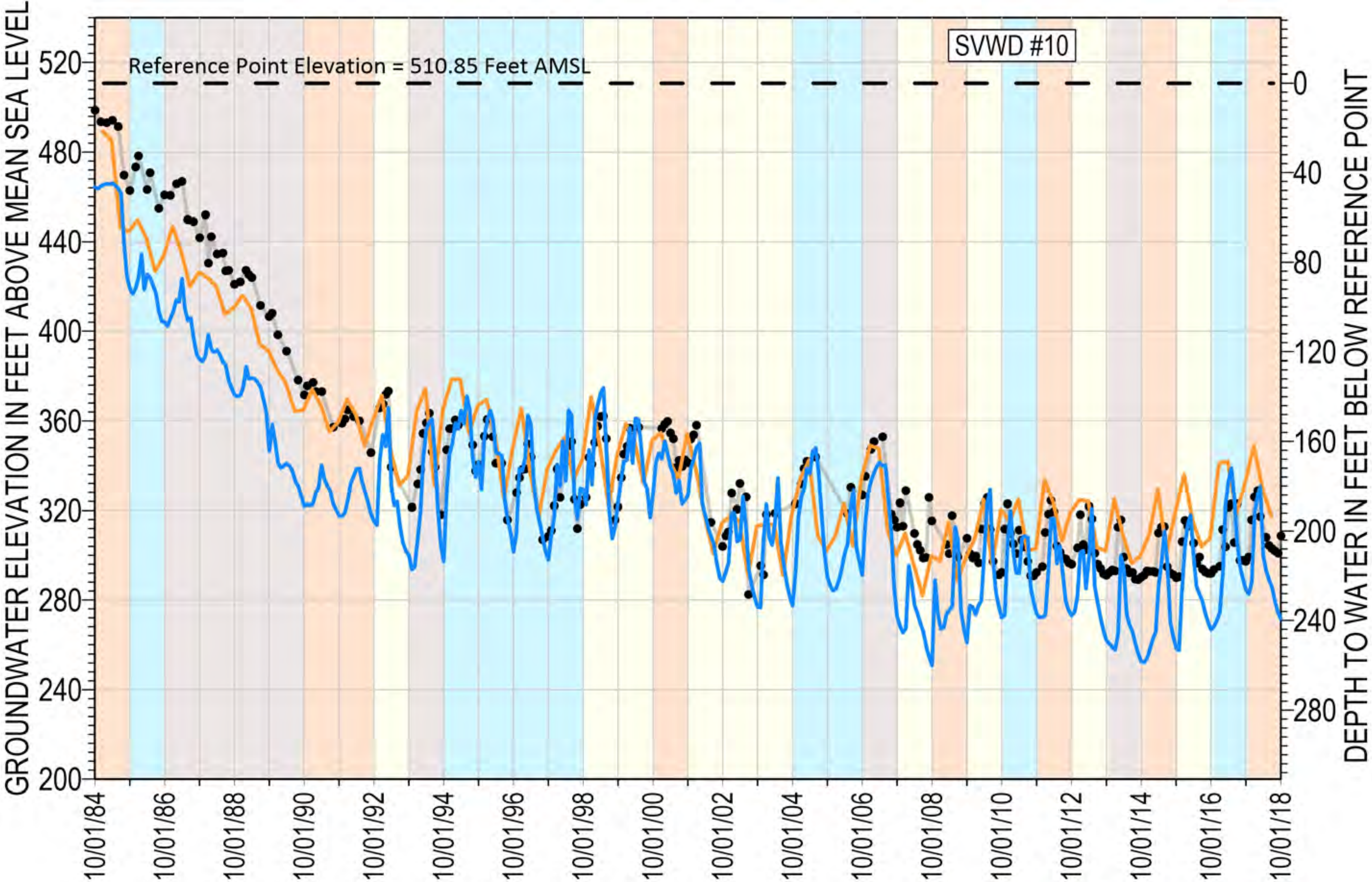
Critically Dry

Normal

Dry

Wet



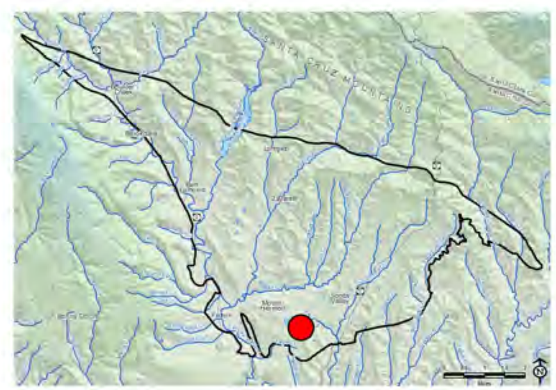


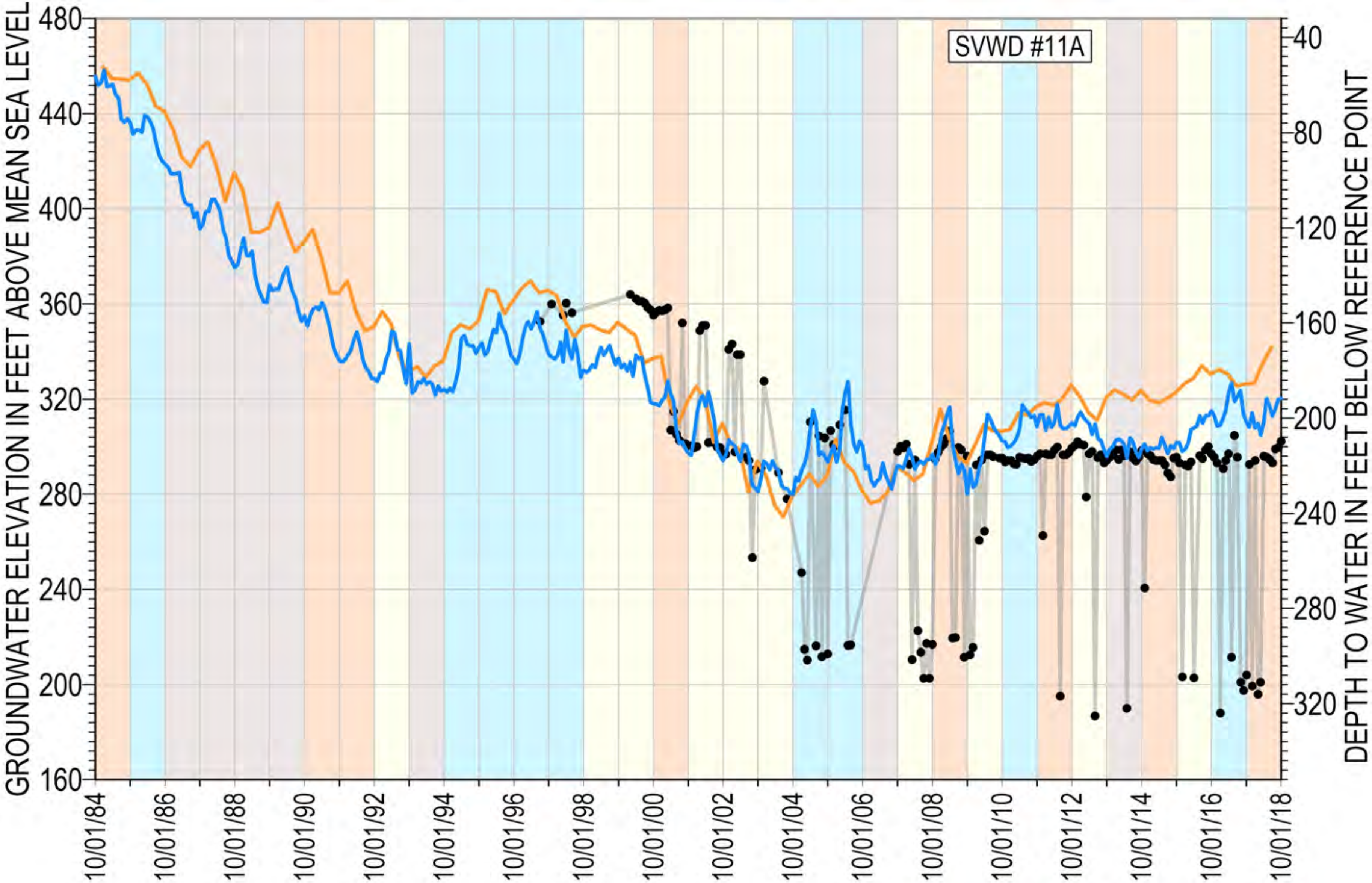
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Santa Margarita,Lompico
Reference Point Elevation= 510.85 ft AMSL
Screenings= 190-220, 240-270, 325-355 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



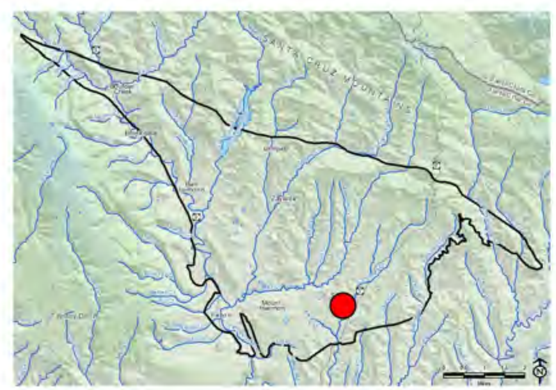


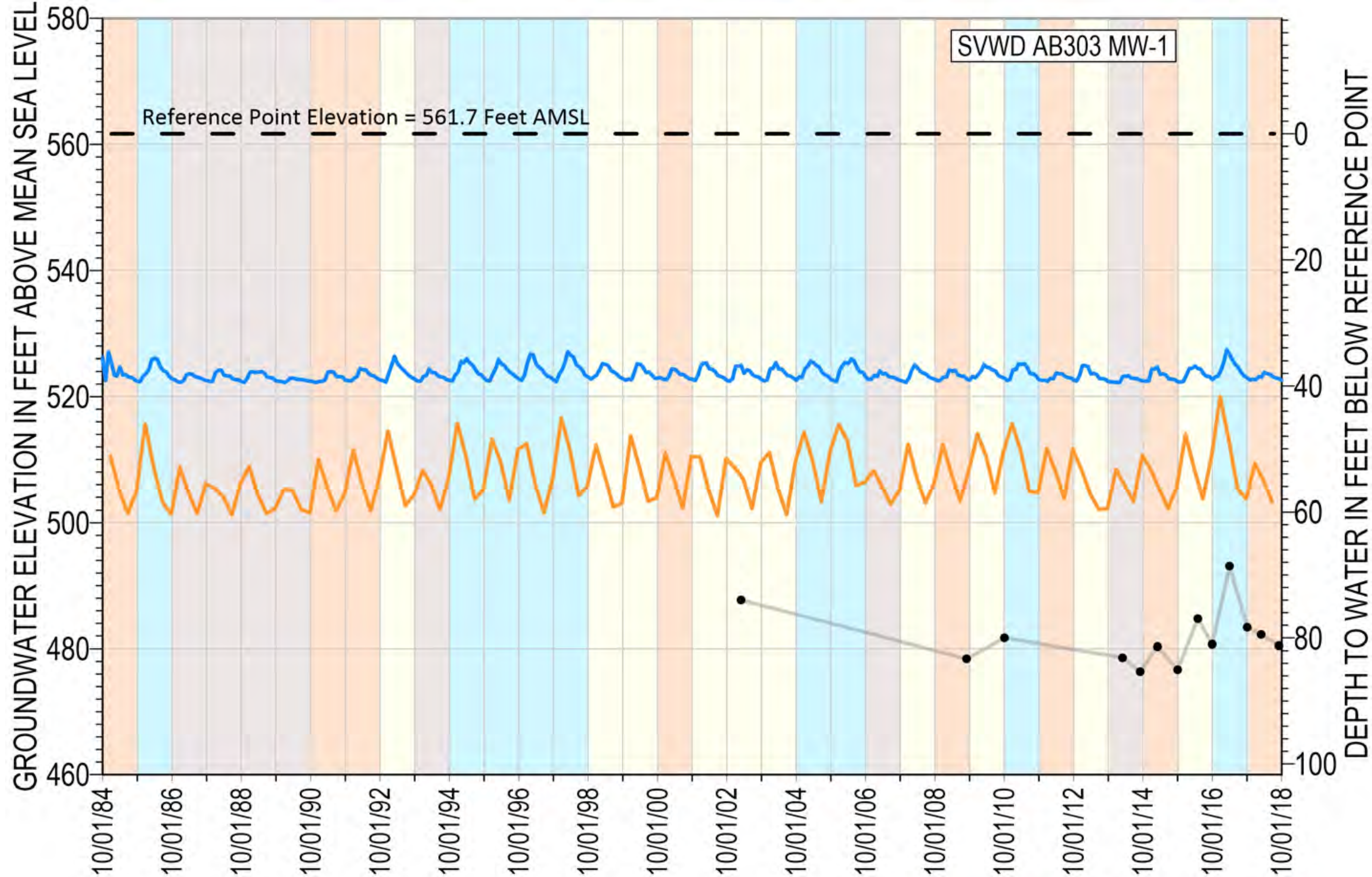
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico
Reference Point Elevation= 512 ft AMSL
Screenings= 282-382, 403-453 ft bgs

Water Year Classification

Critically Dry
Dry
Normal
Wet



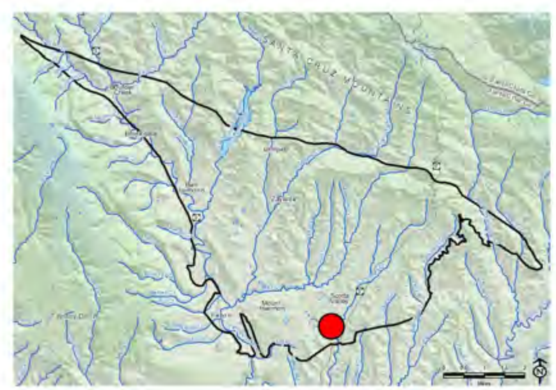


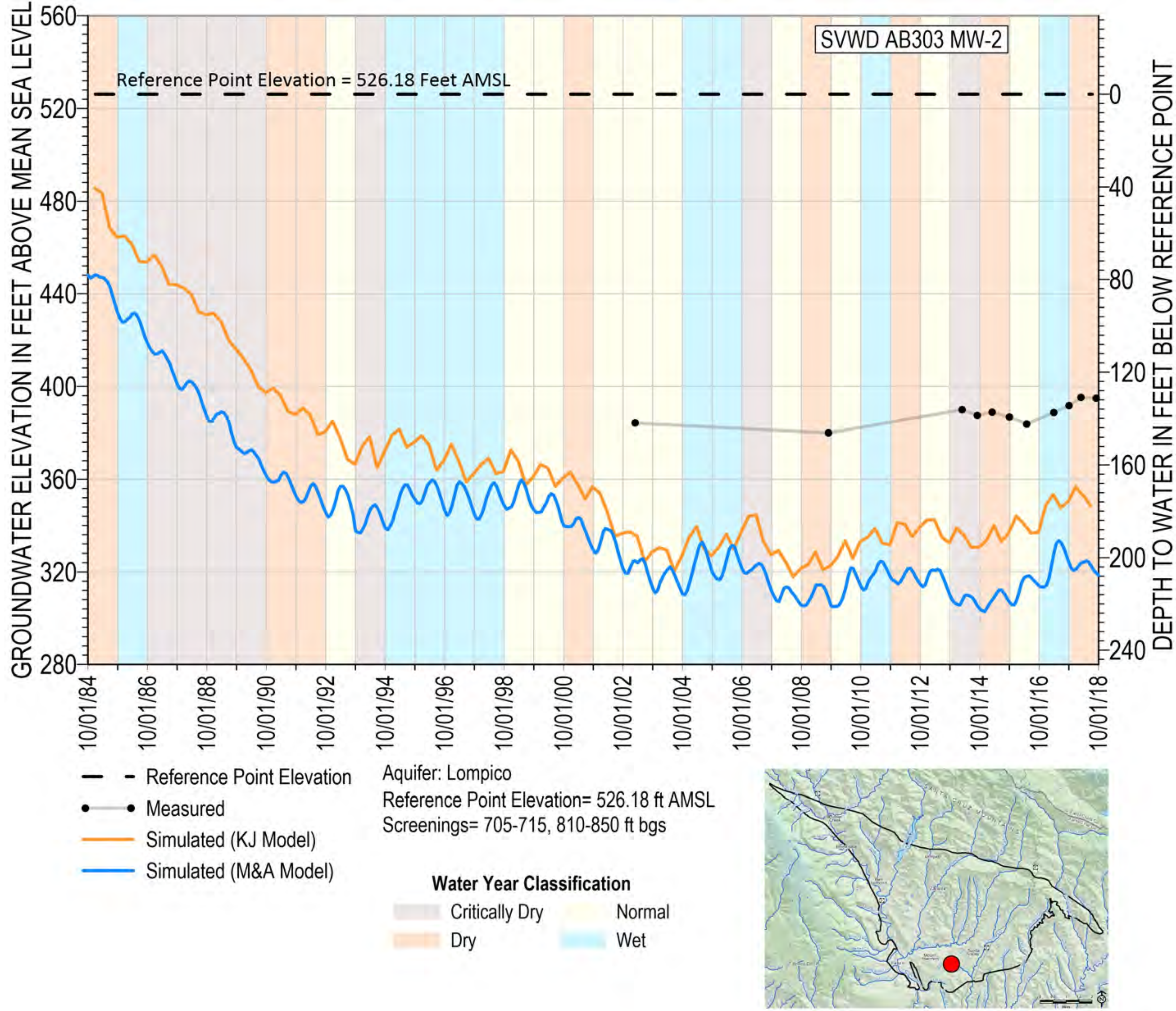
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)

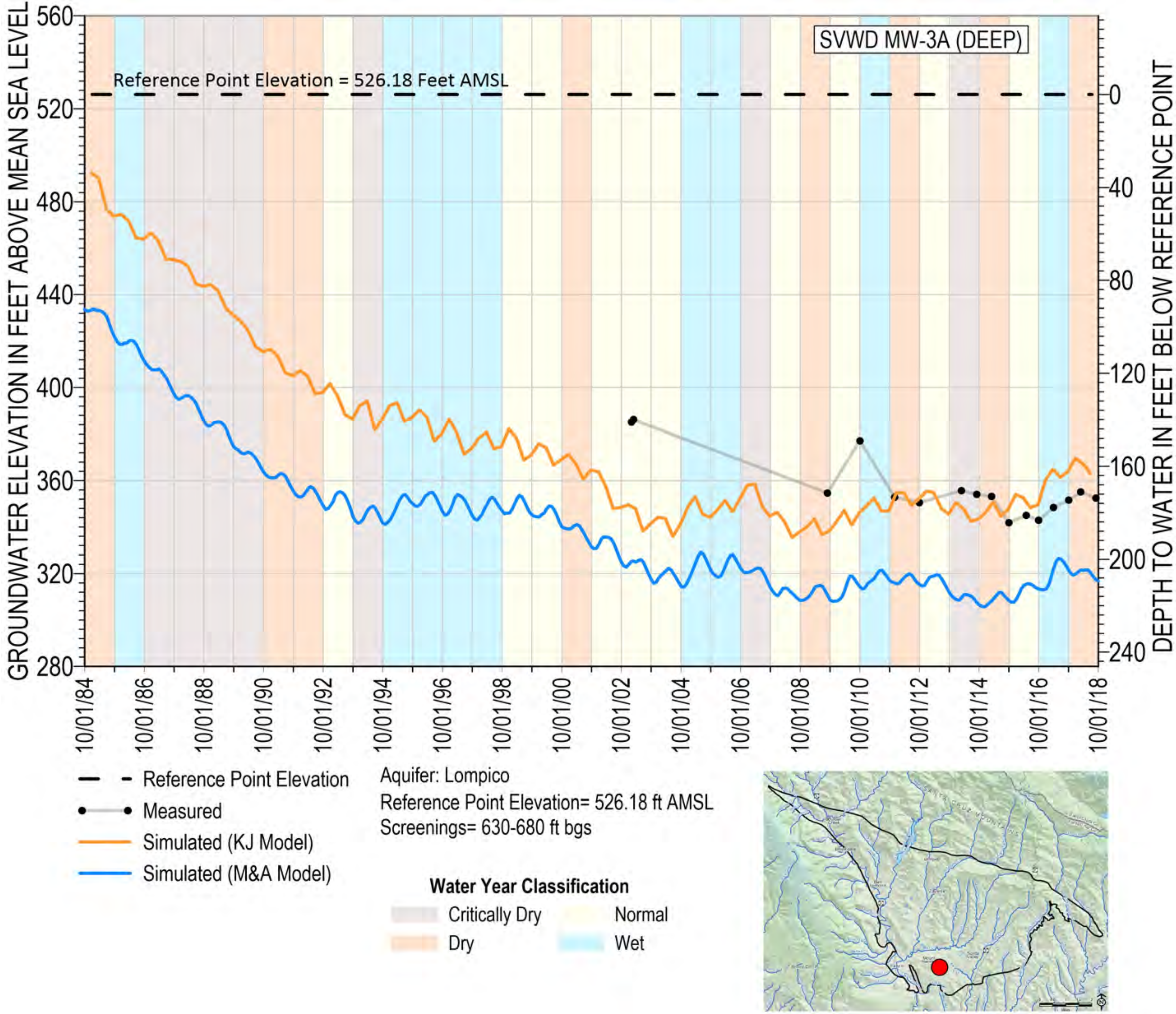
Aquifer: Santa Margarita
Reference Point Elevation= 561.7 ft AMSL
Screenings= 114-124 ft bgs

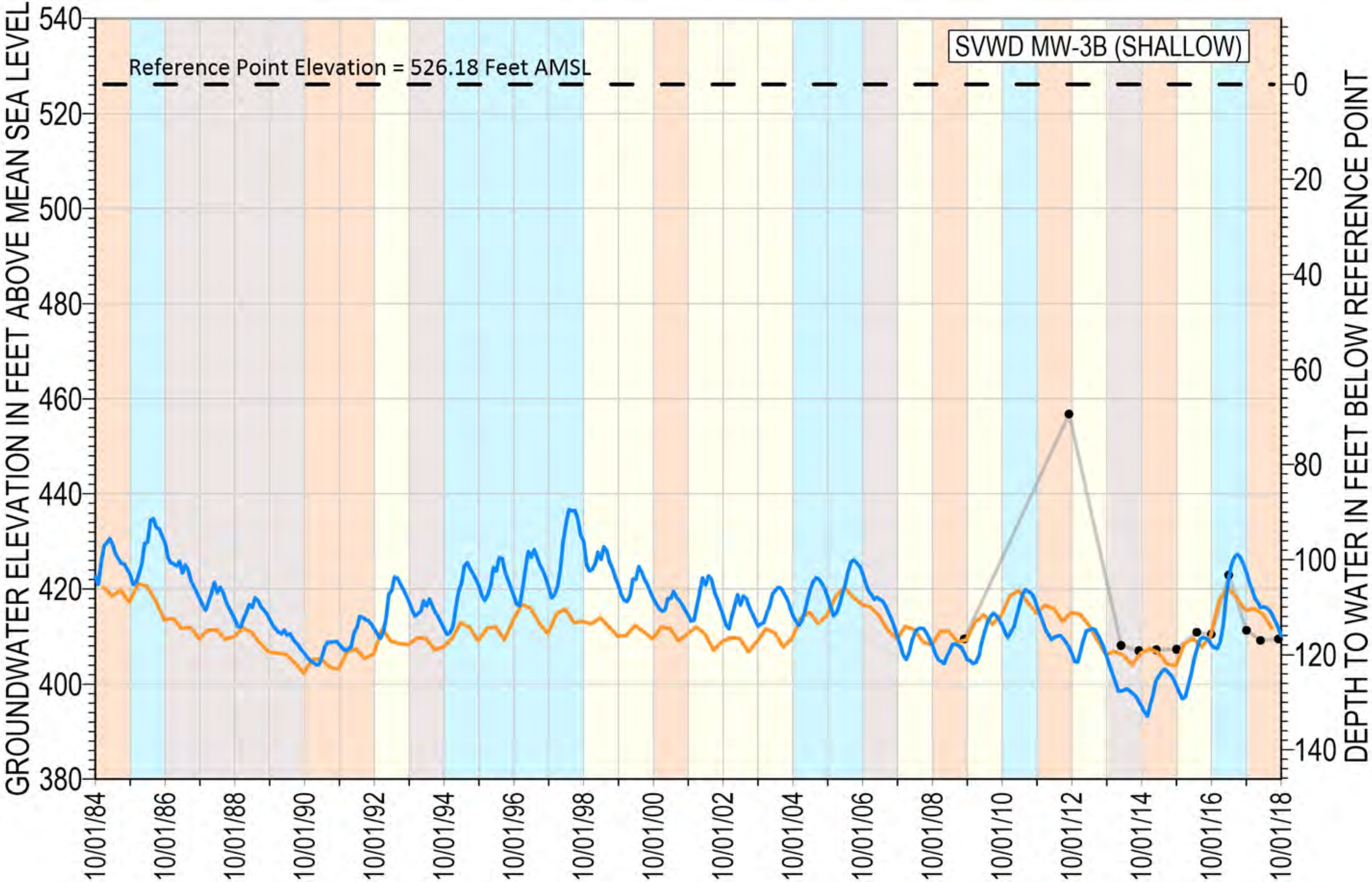
Water Year Classification

Critically Dry
Dry
Normal
Wet




SVWD AB303 MW-2
Reference Point Elevation = 526.18 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
520
480
440
400
360
320
280
0
40
80
120
160
200
240
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 526.18 ft AMSL
Screenings= 705-715, 810-850 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

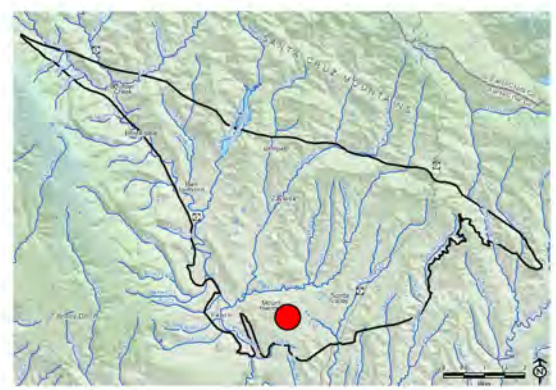

SVWD MW-3A (DEEP)
Reference Point Elevation = 526.18 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
520
480
440
400
360
320
280
0
40
80
120
160
200
240
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Reference Point Elevation
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Lompico
Reference Point Elevation= 526.18 ft AMSL
Screenings= 630-680 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

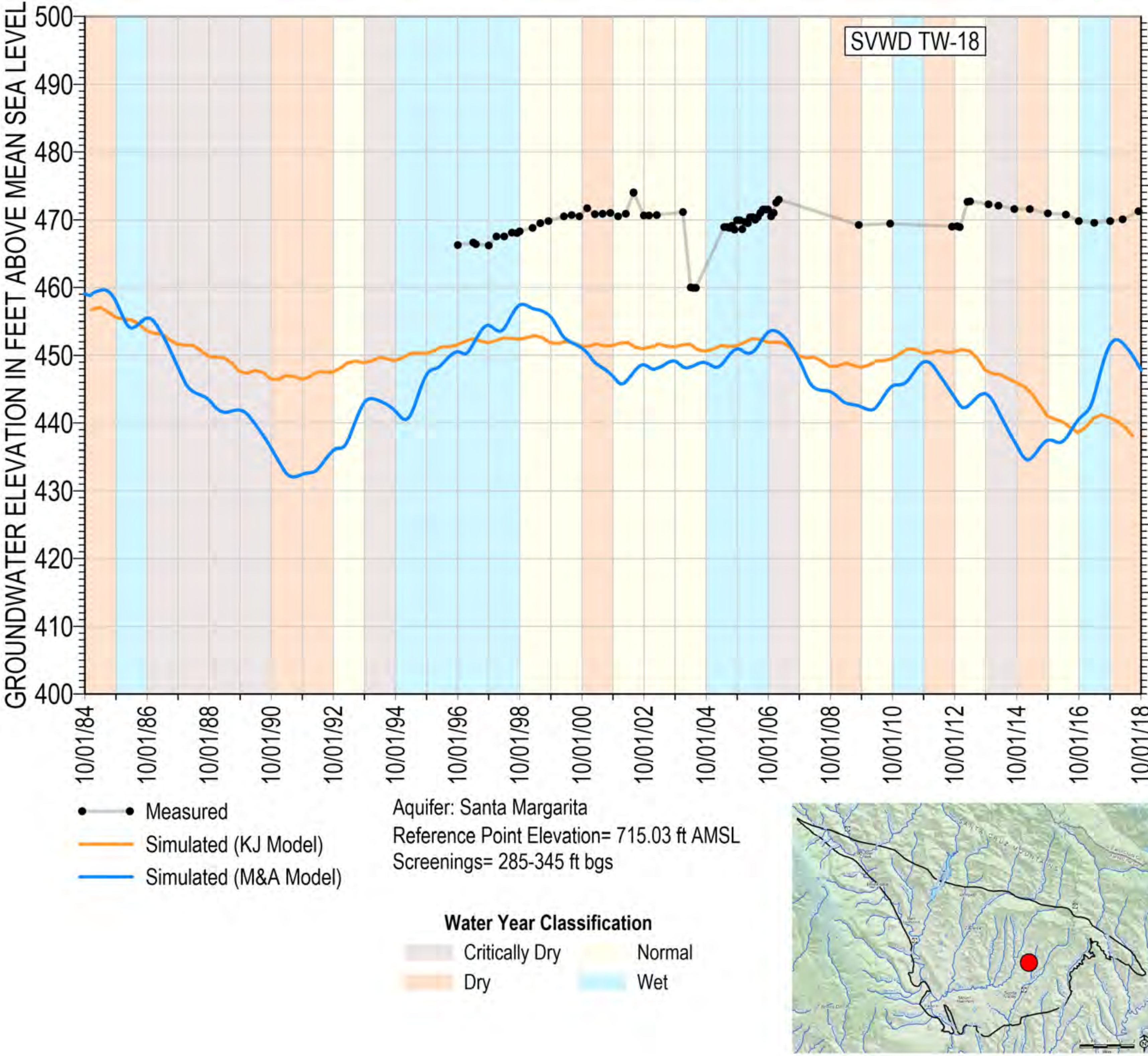


Aquifer: Santa Margarita
Reference Point Elevation= 526.18 ft AMSL
Screenings= 120-125 ft bgs

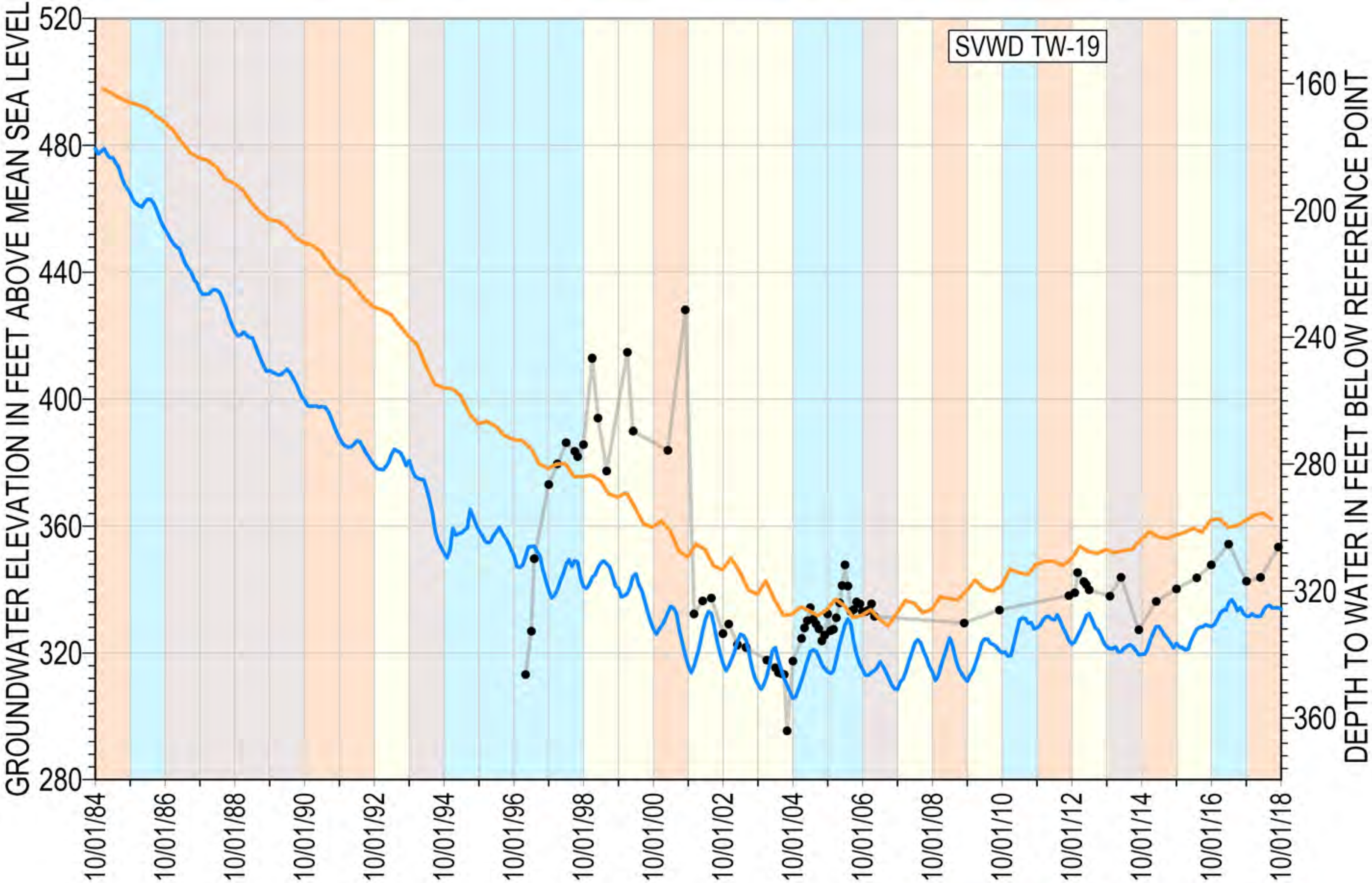
Water Year Classification

Critically Dry
Normal
Dry
Wet





SVWD TW-18
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
500
490
480
470
460
450
440
430
420
410
400
220
230
240
250
260
270
280
290
300
310
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 715.03 ft AMSL
Screenings= 285-345 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

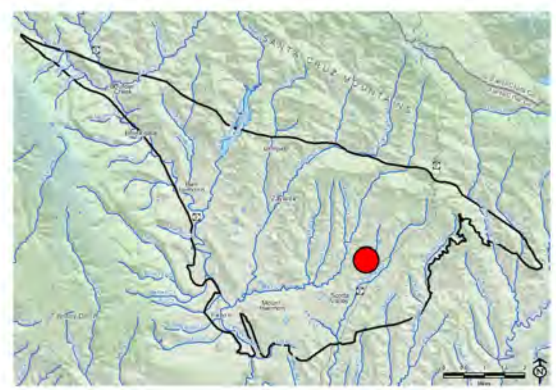


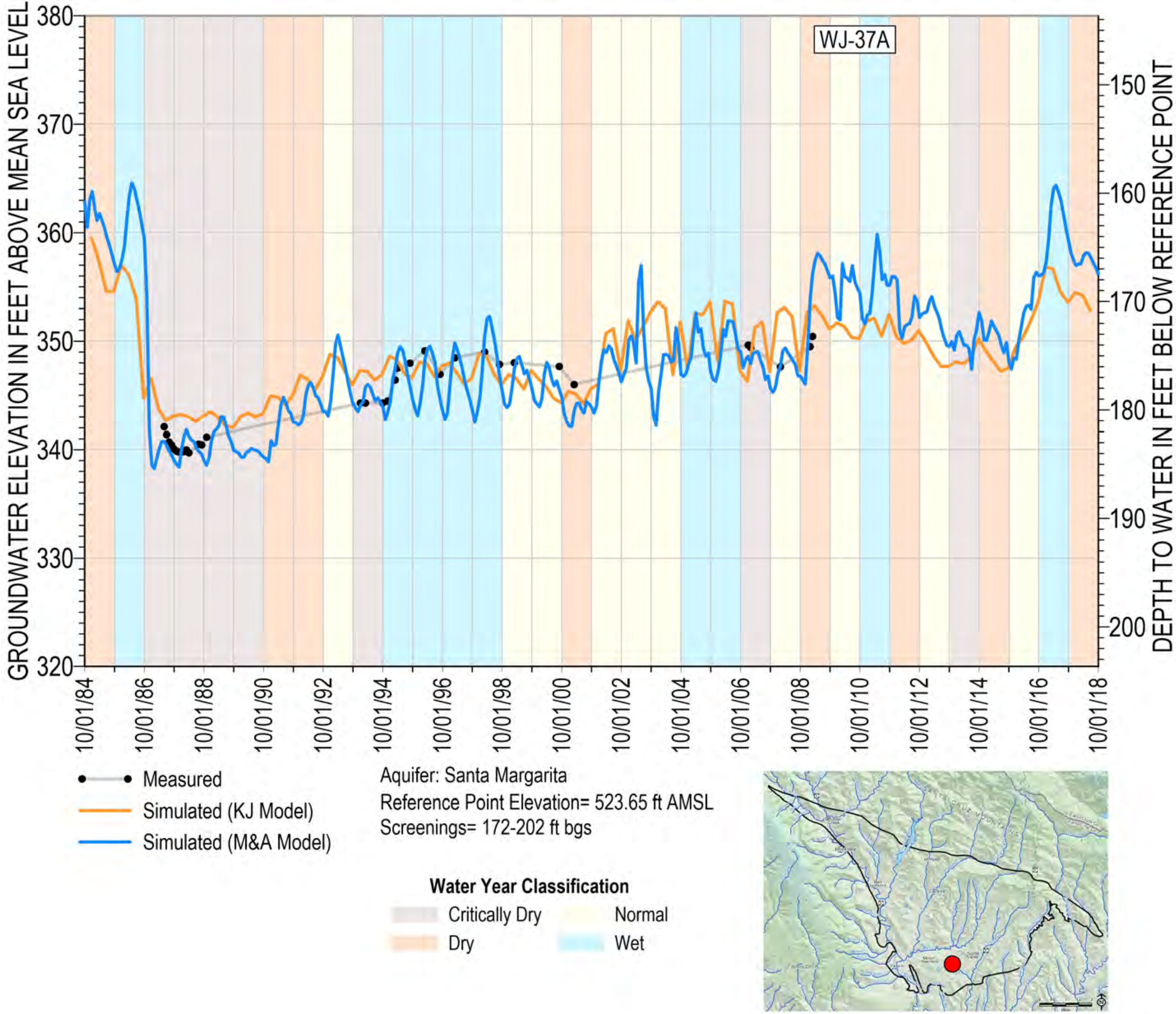
Measured
Simulated (KJ Model)
Simulated (M&A Model)

Aquifer: Lompico
Reference Point Elevation= 659.49 ft AMSL
Screenings= 960-1060 ft bgs

Water Year Classification

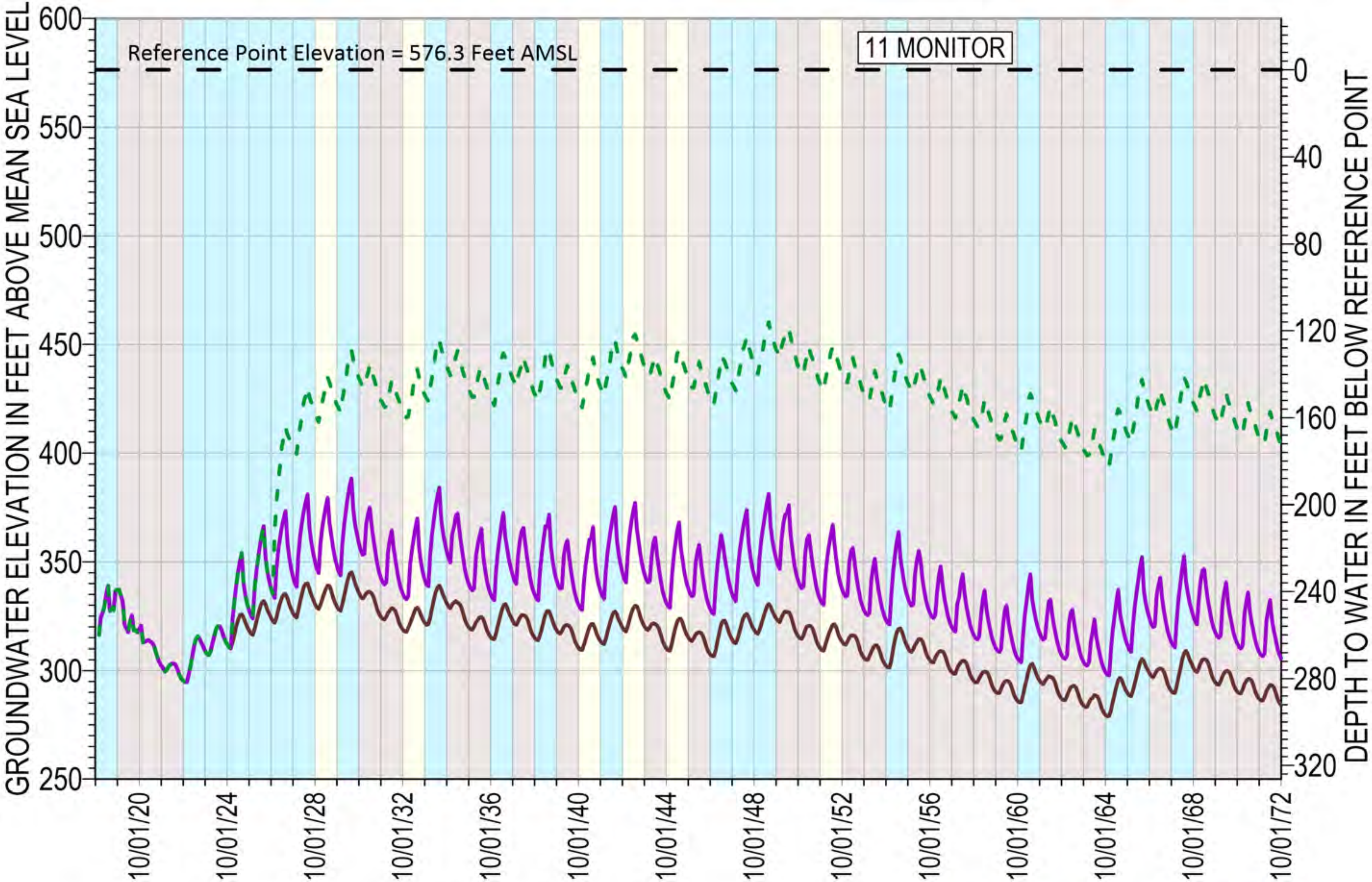
Critically Dry
Normal
Dry
Wet




WJ-37A
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
380
370
360
350
340
330
320
150
160
170
180
190
200
10/01/84
10/01/86
10/01/88
10/01/90
10/01/92
10/01/94
10/01/96
10/01/98
10/01/00
10/01/02
10/01/04
10/01/06
10/01/08
10/01/10
10/01/12
10/01/14
10/01/16
10/01/18
Measured
Simulated (KJ Model)
Simulated (M&A Model)
Aquifer: Santa Margarita
Reference Point Elevation= 523.65 ft AMSL
Screenings= 172-202 ft bgs
Water Year Classification
Critically Dry
Dry
Normal
Wet

Santa Margarita Basin
Groundwater Model
Updates and Simulations for Groundwater Sustainability Planning

Appendix B
Projected Groundwater Level Target Hydrographs for Predictive Scenarios



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico

Reference Point Elevation= 576.3 ft AMSL

Screenings= 160-170, 280-320, 370-470, 520-540

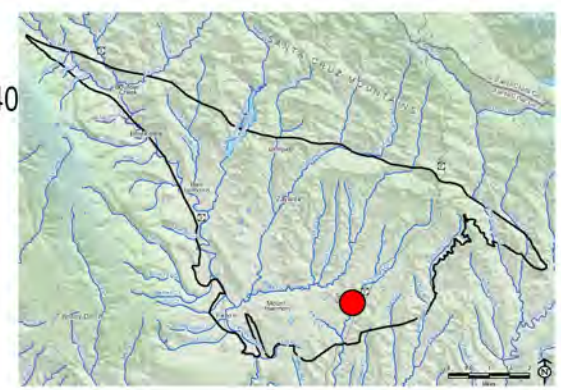
Water Year Classification

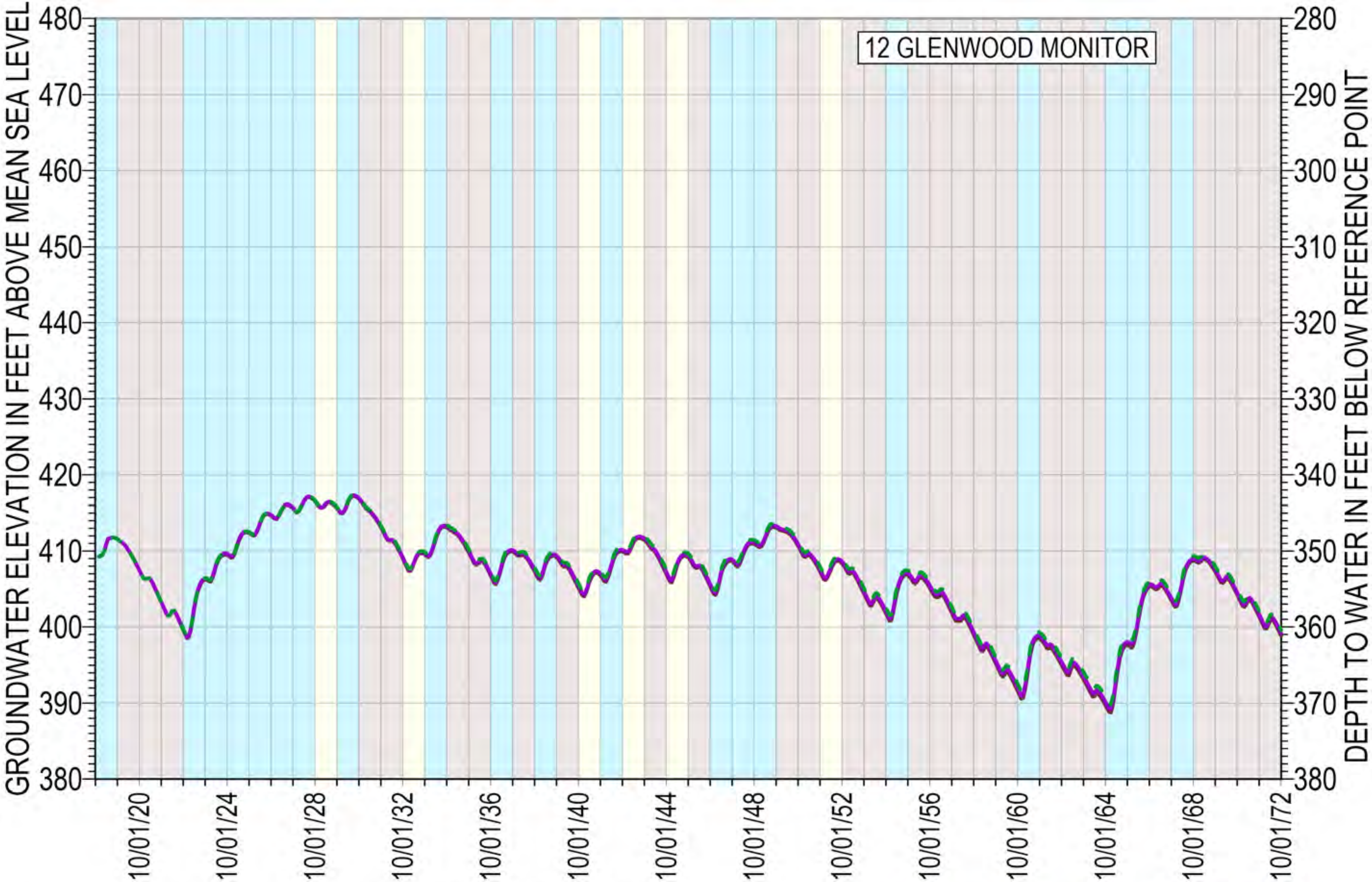
Critically Dry

Normal

Dry

Wet



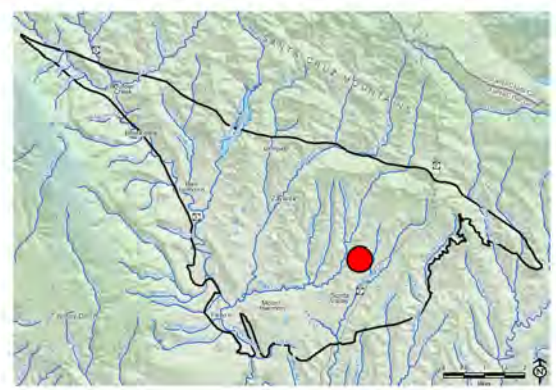


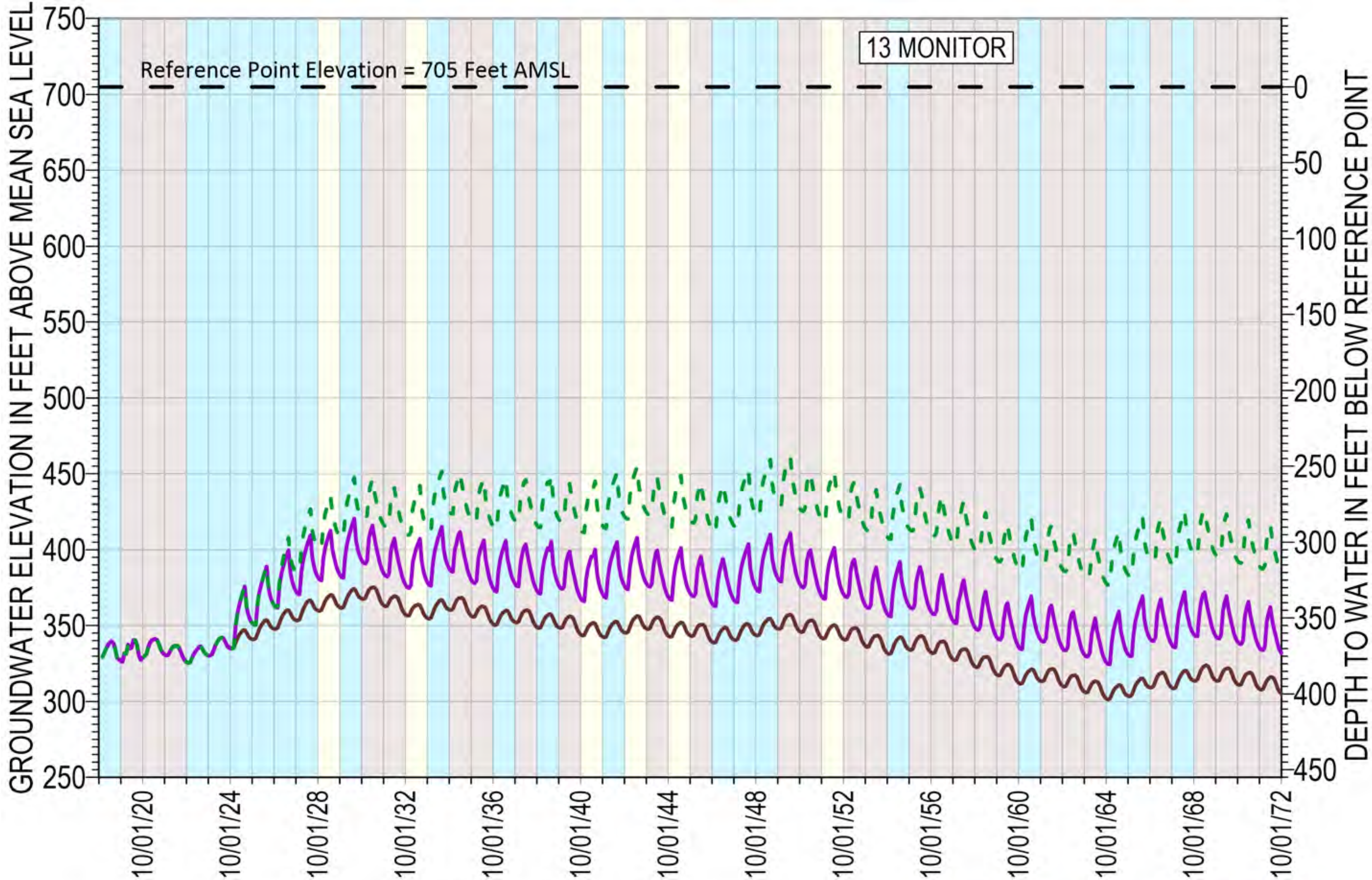
- Measured
- Projected Baseline
- Expanded Conjunctive Use with Loch Lomond (540 AFY)
- Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 760 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



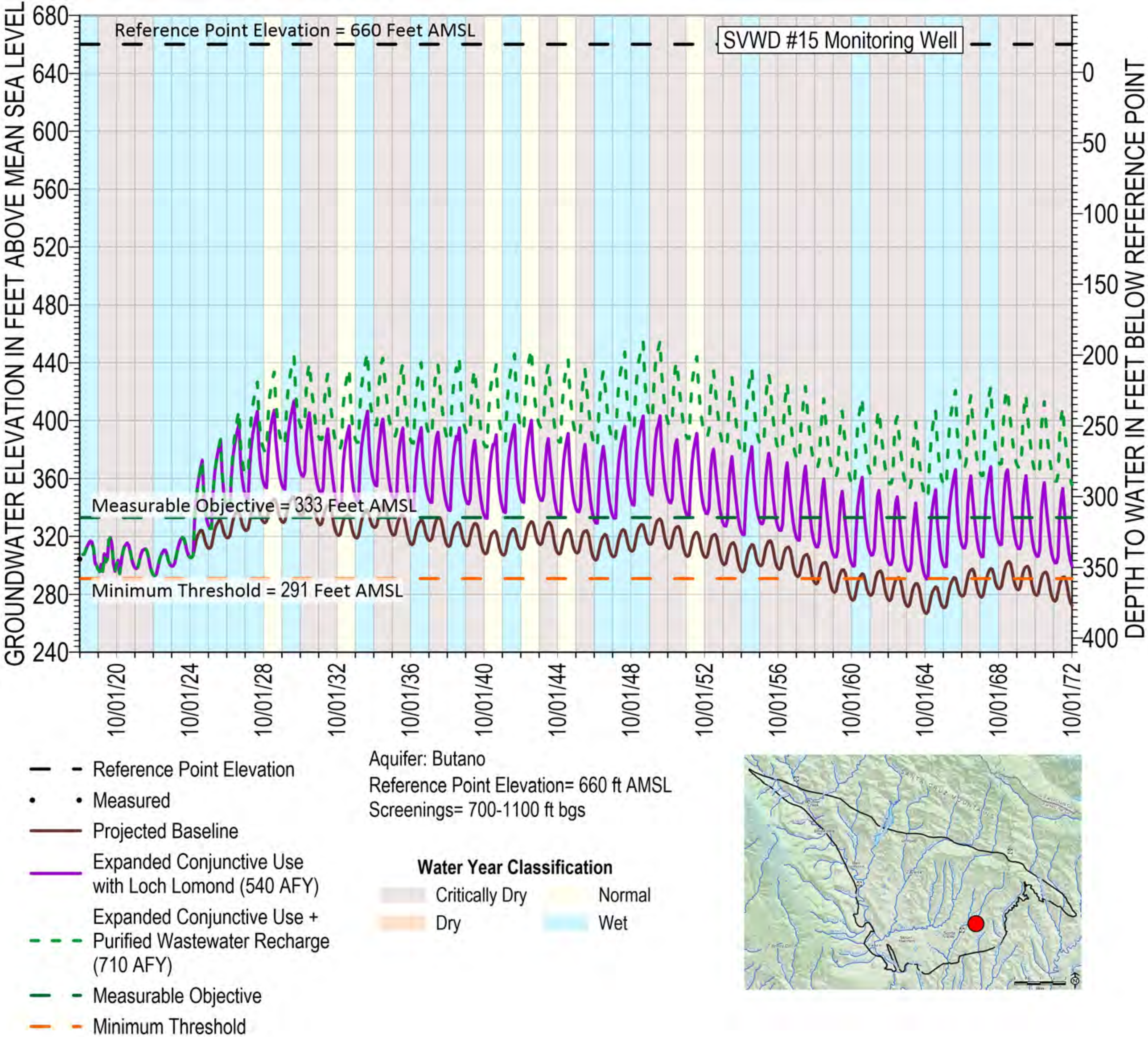


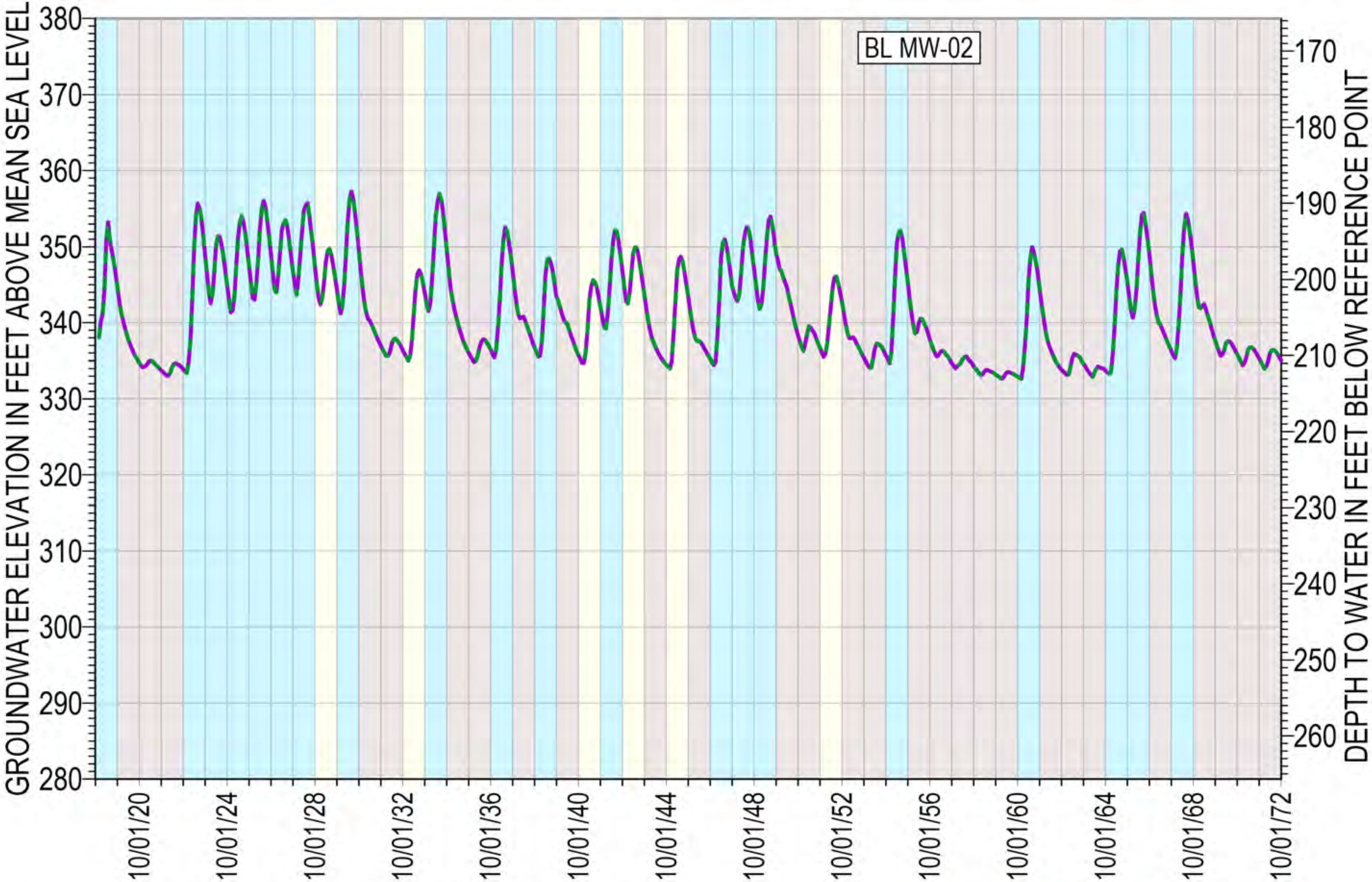
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico
Reference Point Elevation= 705 ft AMSL
Screenings= 470-510, 590-670 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet


SVWD #15 Monitoring Well
Reference Point Elevation = 660 Feet AMSL
Measurable Objective = 333 Feet AMSL
Minimum Threshold = 291 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Butano
Reference Point Elevation= 660 ft AMSL
Screenings= 700-1100 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



• • Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 545.69 ft AMSL

Screenings= 226-256 ft bgs

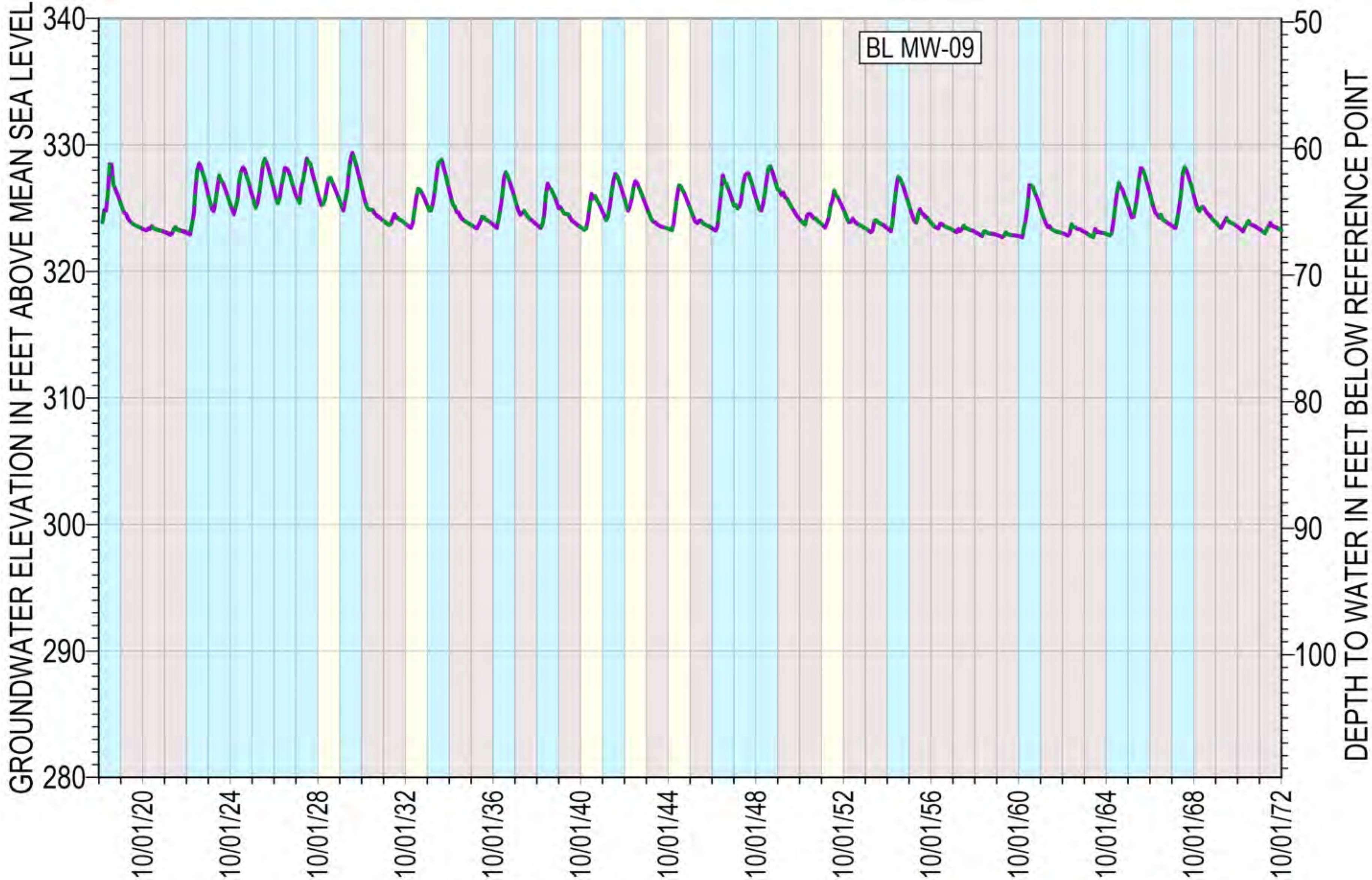
Water Year Classification

Critically Dry

Normal

Dry

Wet

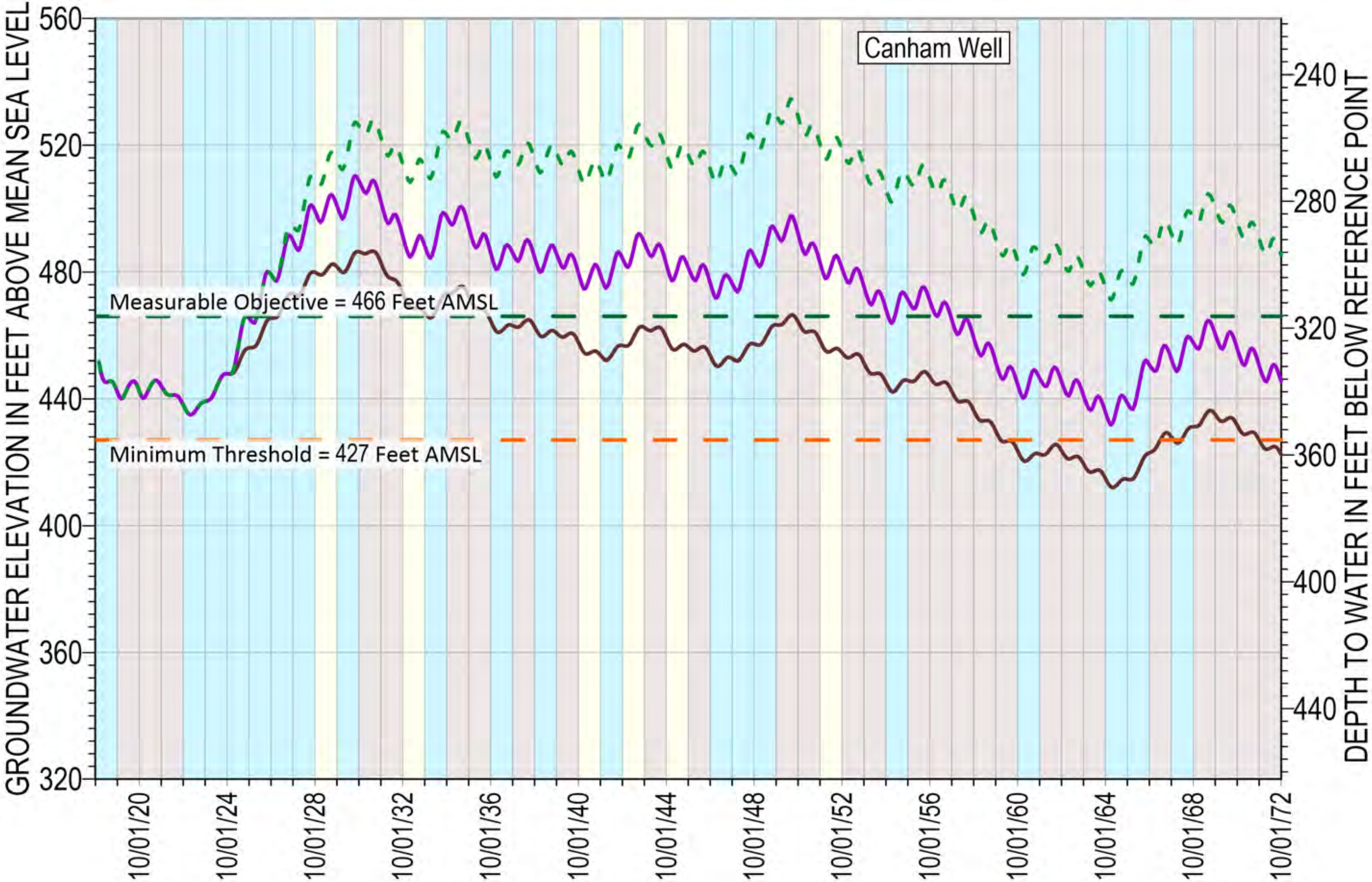


Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 389.71 ft AMSL
Screenings= 70-90 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

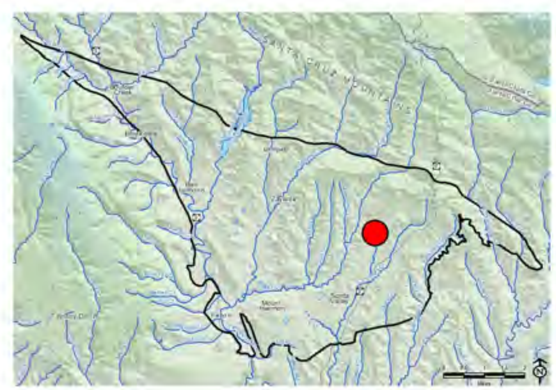


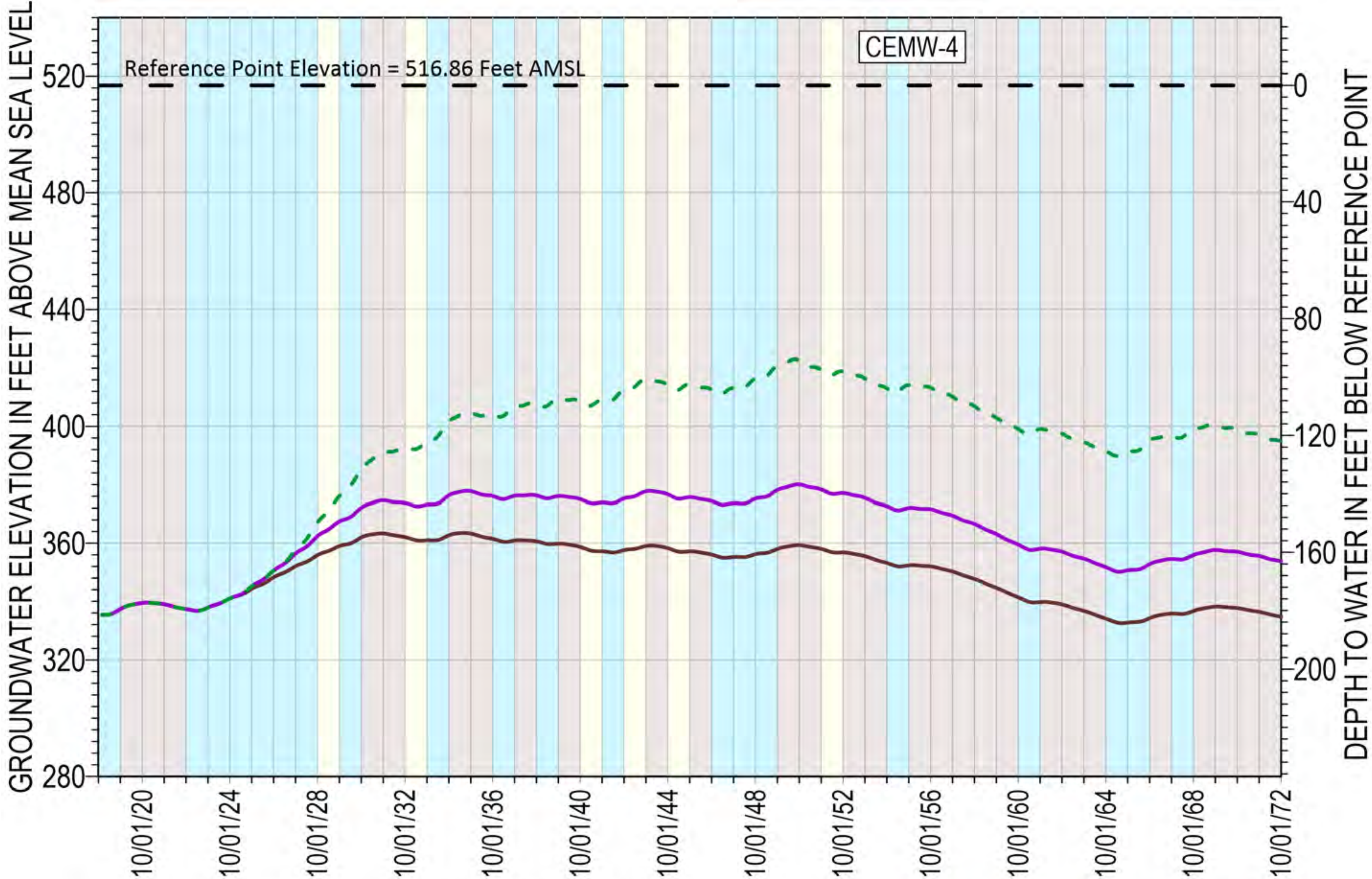
- Measured
- Projected Baseline
- Expanded Conjunctive Use with Loch Lomond (540 AFY)
- Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
- Measurable Objective
- Minimum Threshold

Aquifer: Butano
Reference Point Elevation= 782.27 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry · Normal · Dry · Wet





Reference Point Elevation

Measured

Projected Baseline

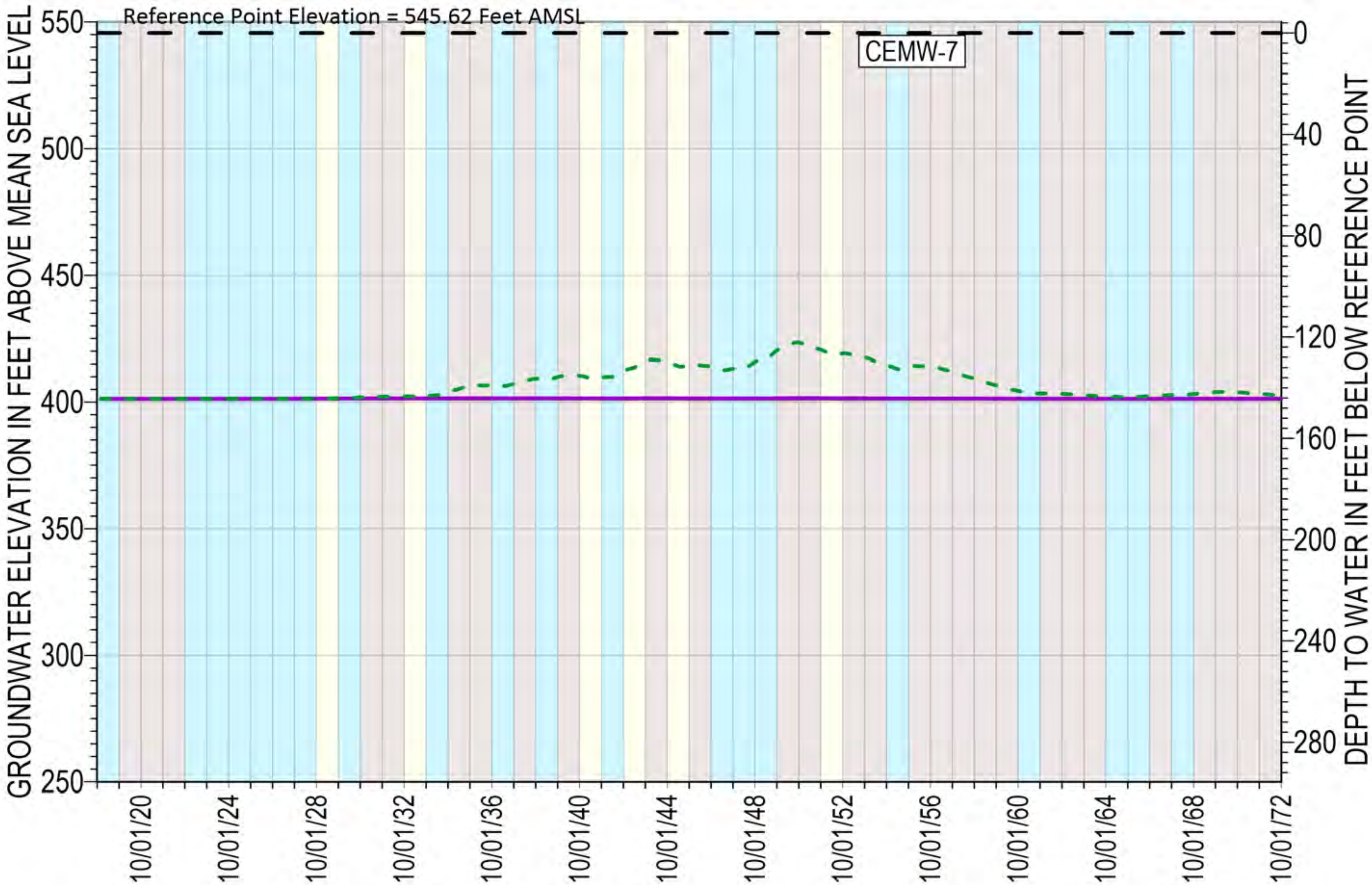
Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 516.86 ft AMSL
Screenings= 281-311 ft bgs

Water Year Classification

Critically Dry | Normal
Dry | Wet

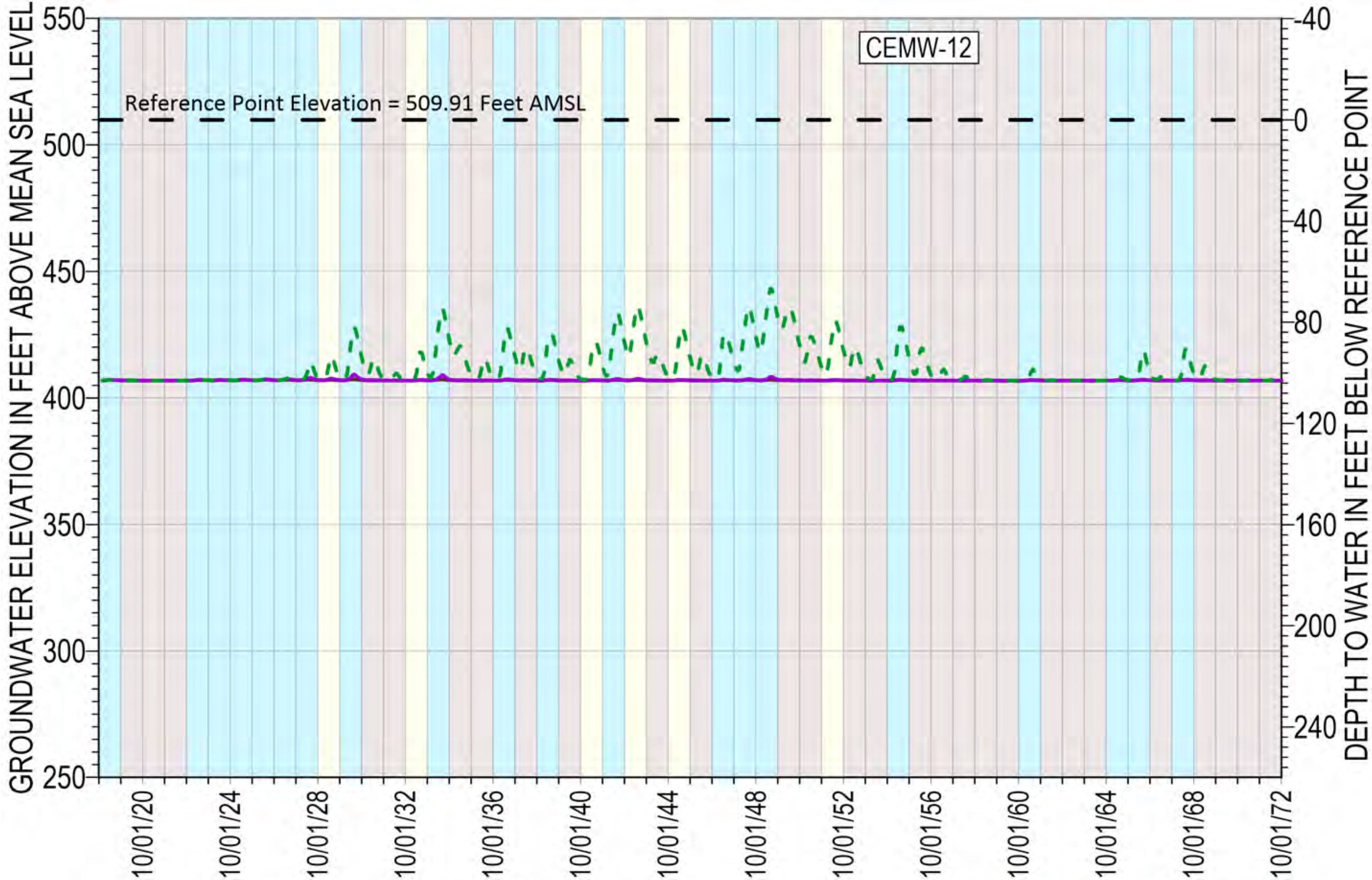


Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico
Reference Point Elevation= 545.62 ft AMSL
Screenings= 220-250 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

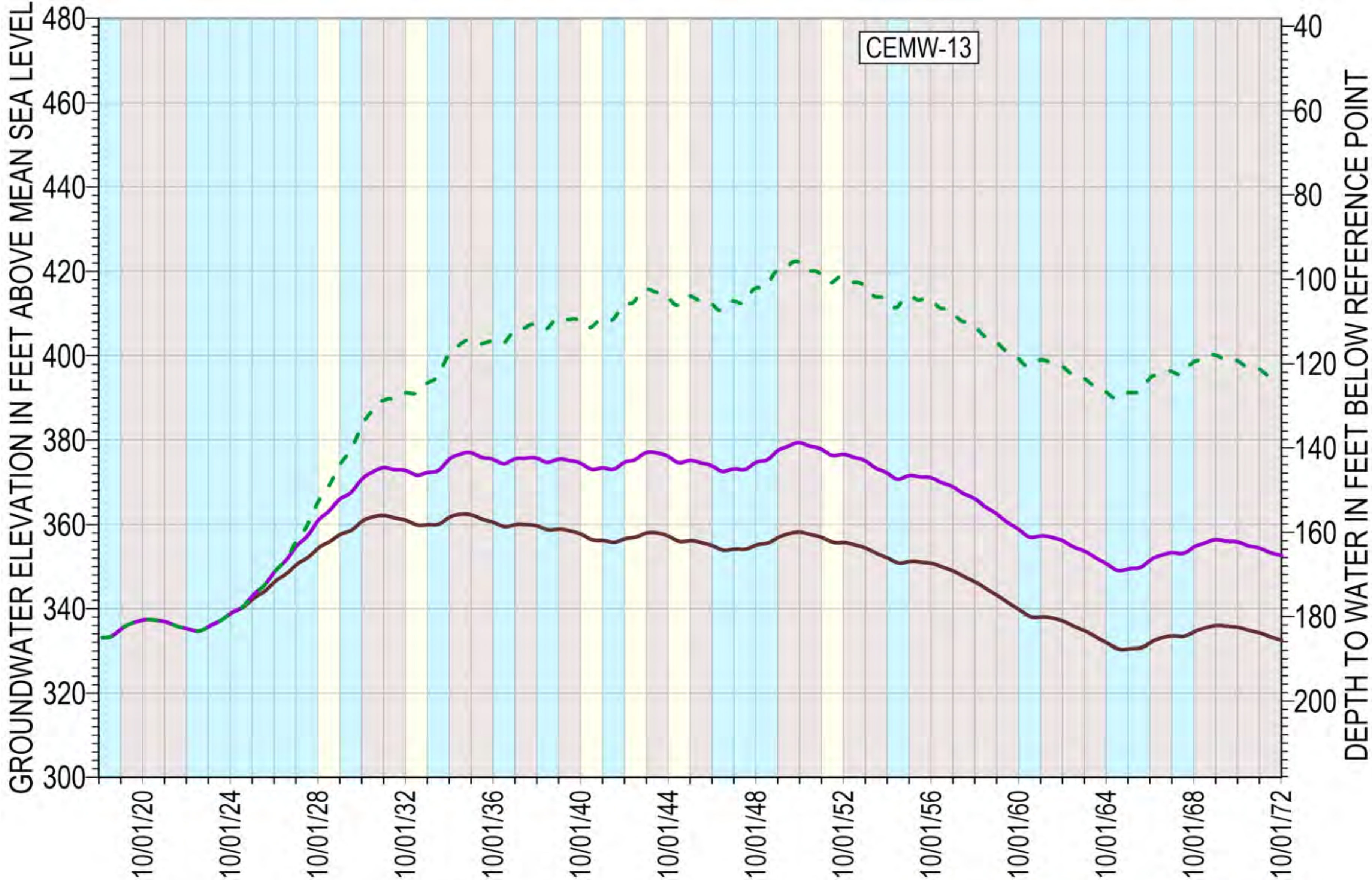


Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 509.91 ft AMSL
Screenings= 115-145 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



• • Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Locatelli

Reference Point Elevation= 518.14 ft AMSL

Screenings= 341-361 ft bgs

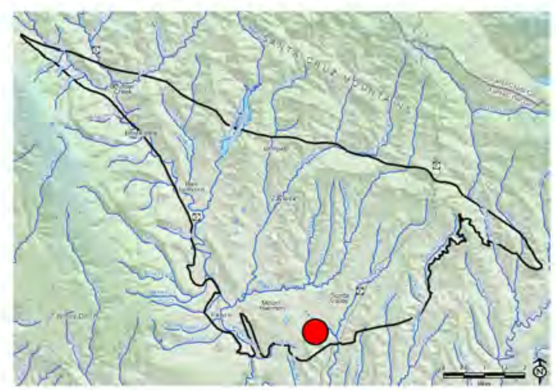
Water Year Classification

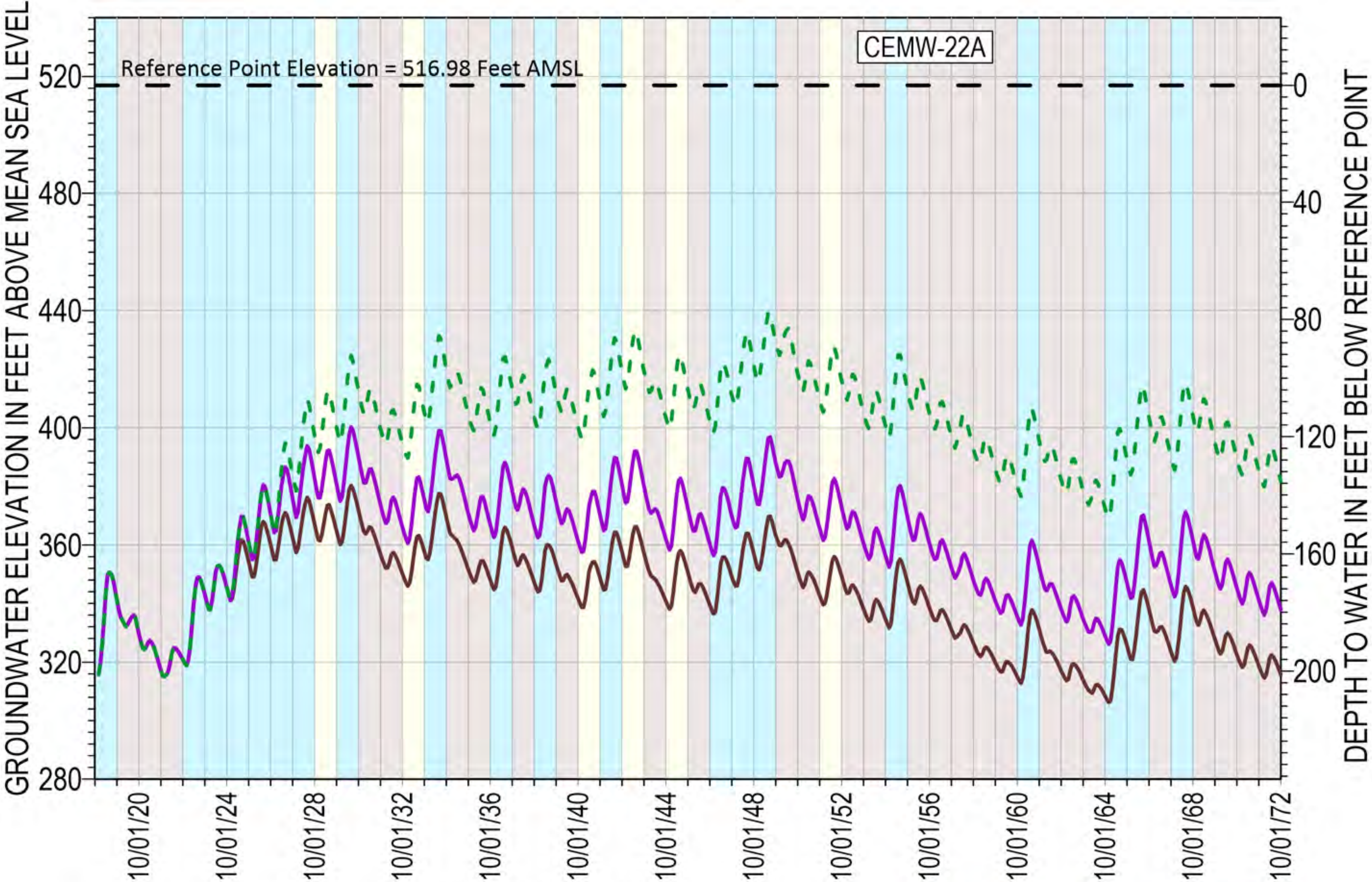
Critically Dry

Normal

Dry

Wet





Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 516.98 ft AMSL

Screenings= Unknown ft bgs

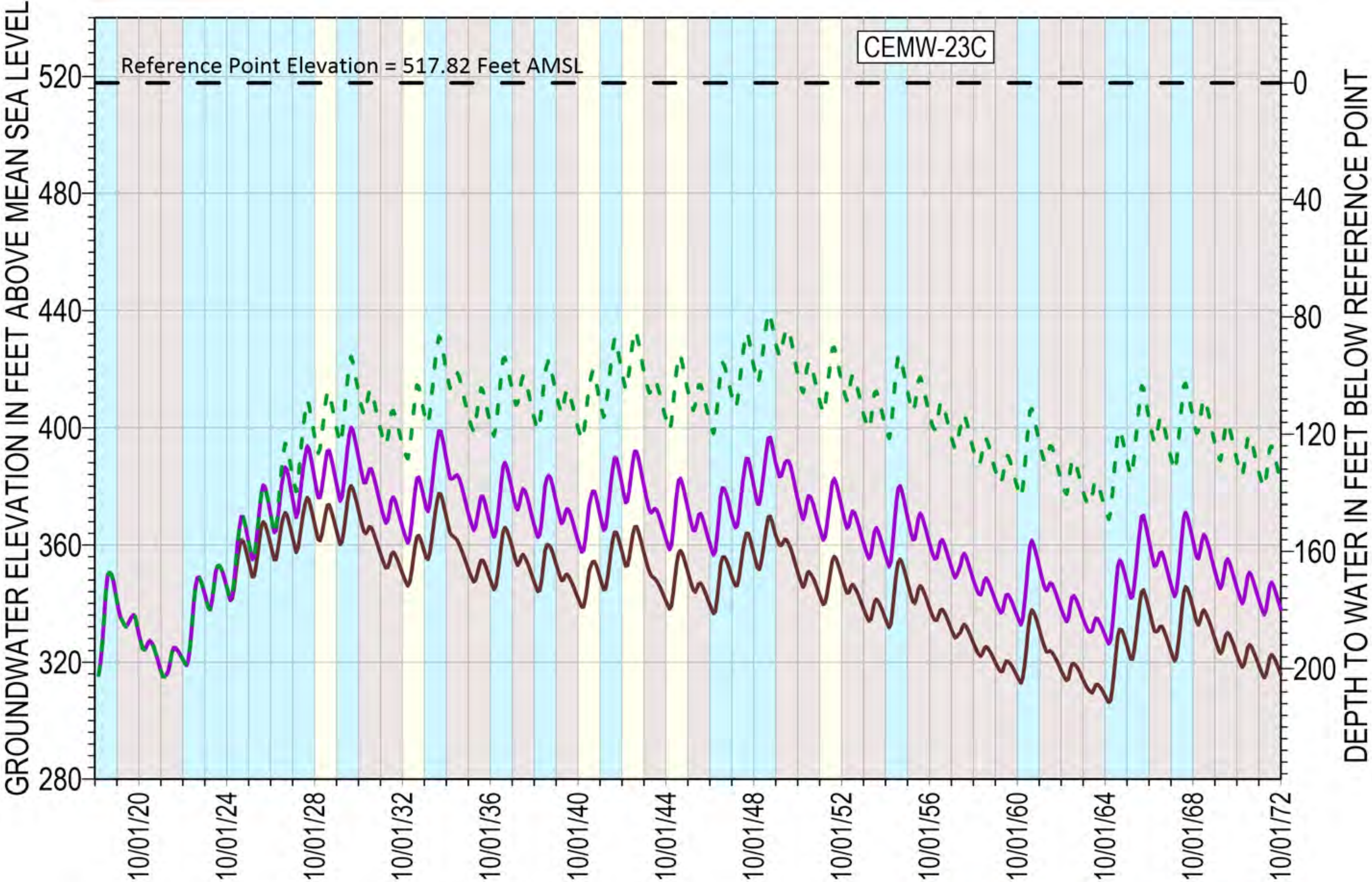
Water Year Classification

Critically Dry

Normal

Dry

Wet

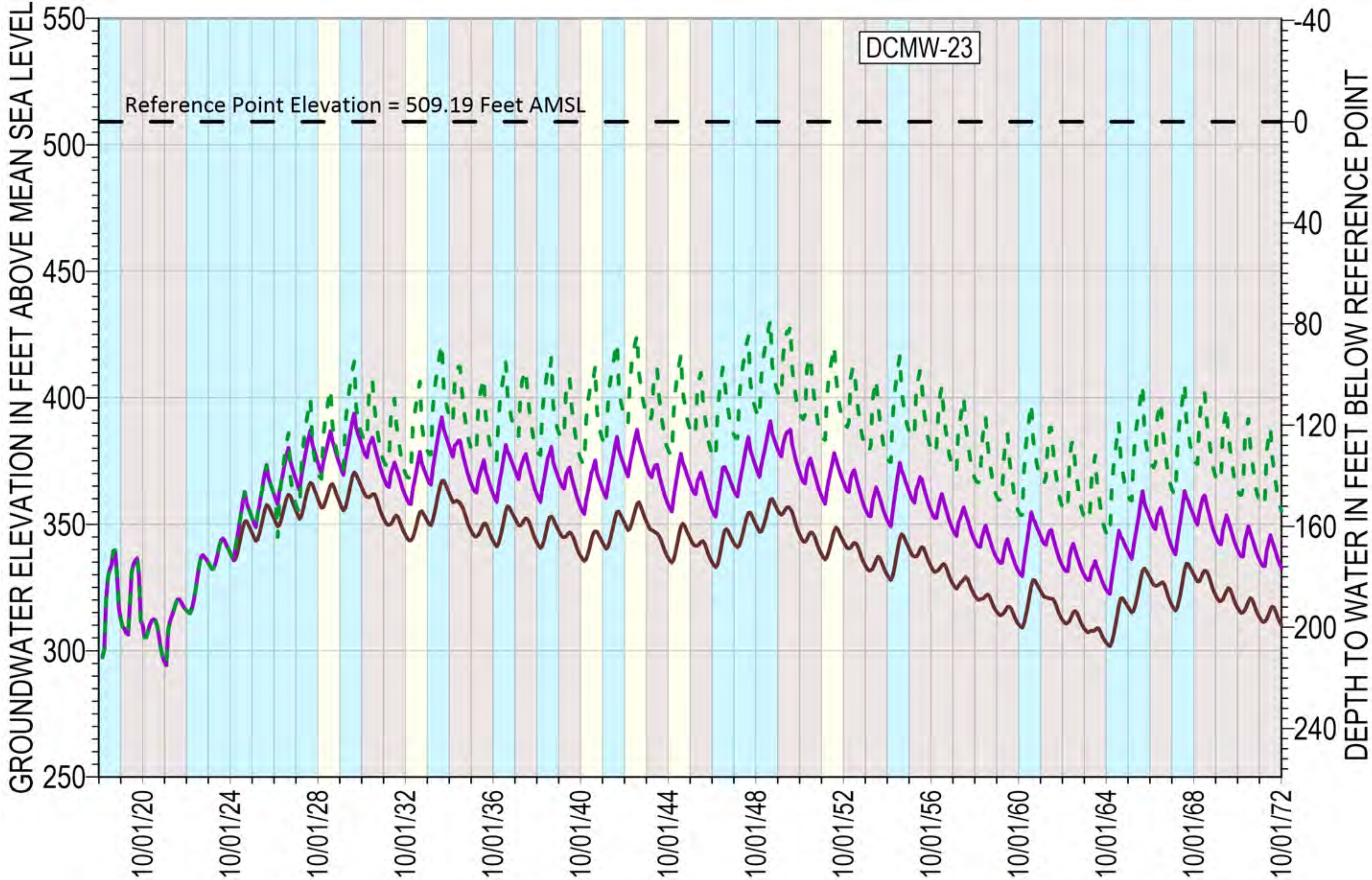


Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Perched
Reference Point Elevation= 517.82 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 509.19 ft AMSL

Screenings= 279-319 ft bgs

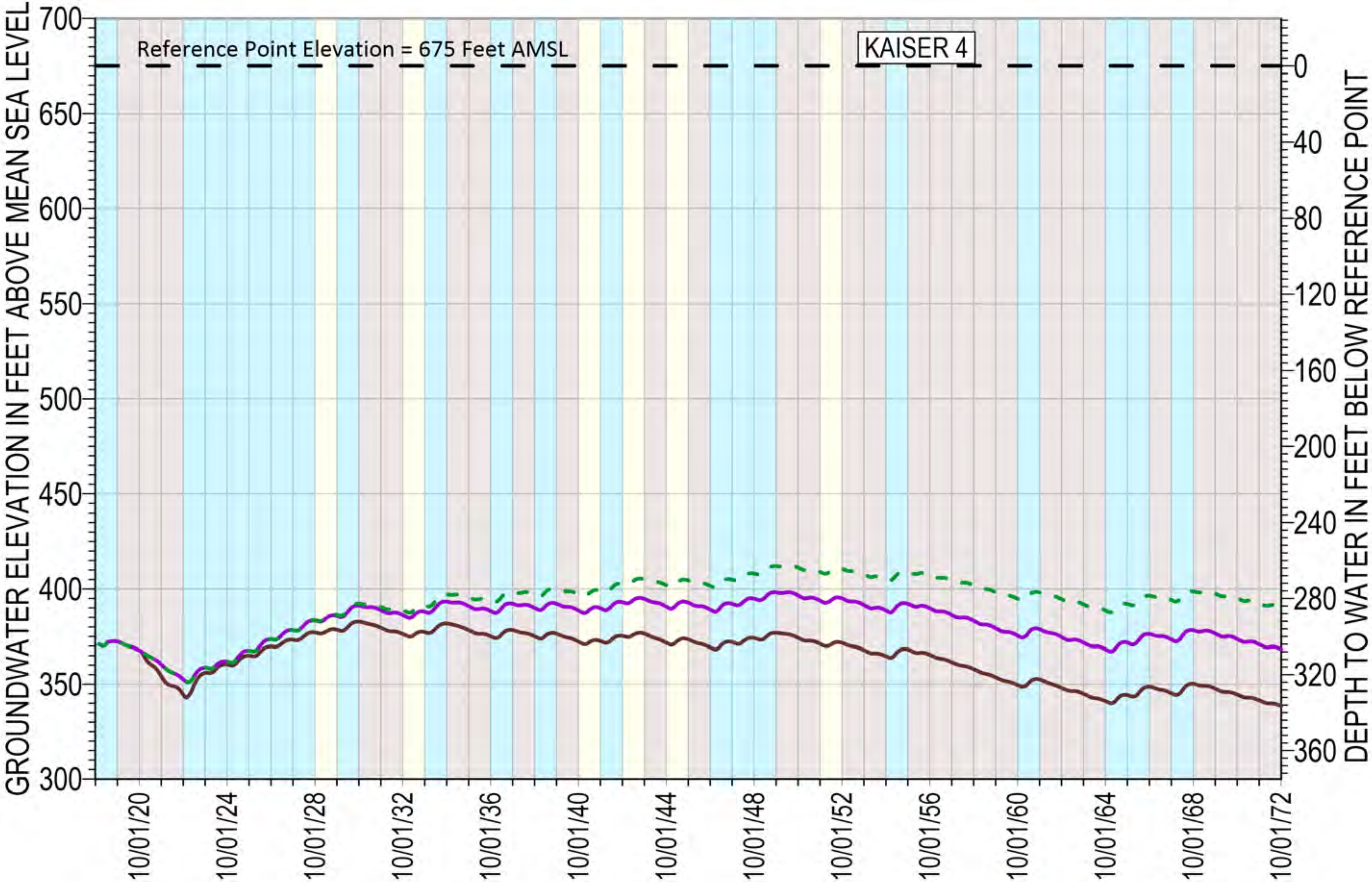
Water Year Classification

Critically Dry

Normal

Dry

Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico

Reference Point Elevation= 675 ft AMSL

Screenings= 197-217, 277-397, 417-477 ft bgs

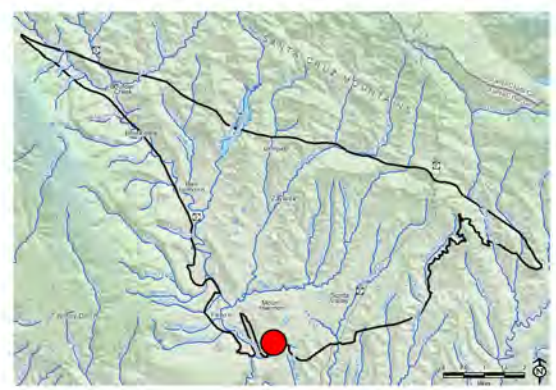
Water Year Classification

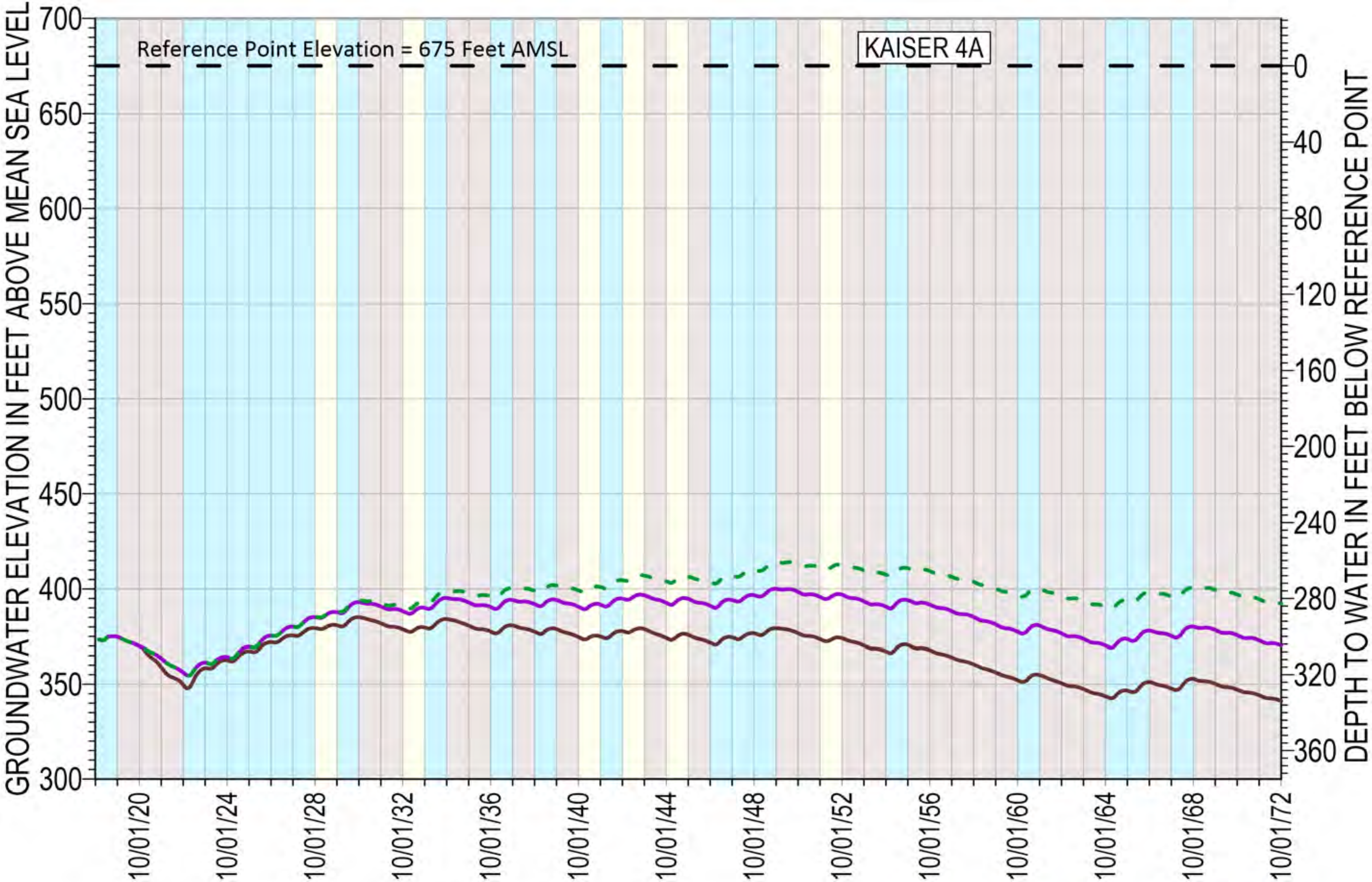
Critically Dry

Normal

Dry

Wet





Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Locatelli

Reference Point Elevation= 675 ft AMSL

Screenings= 249-360, 390-460 ft bgs

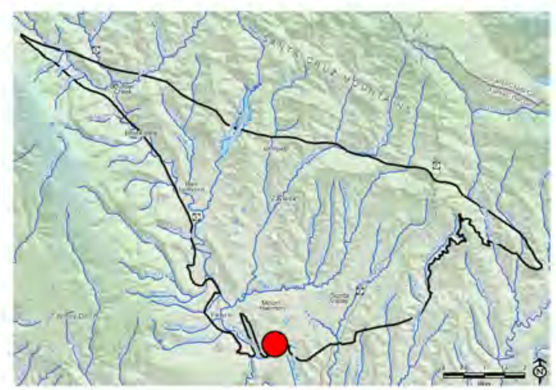
Water Year Classification

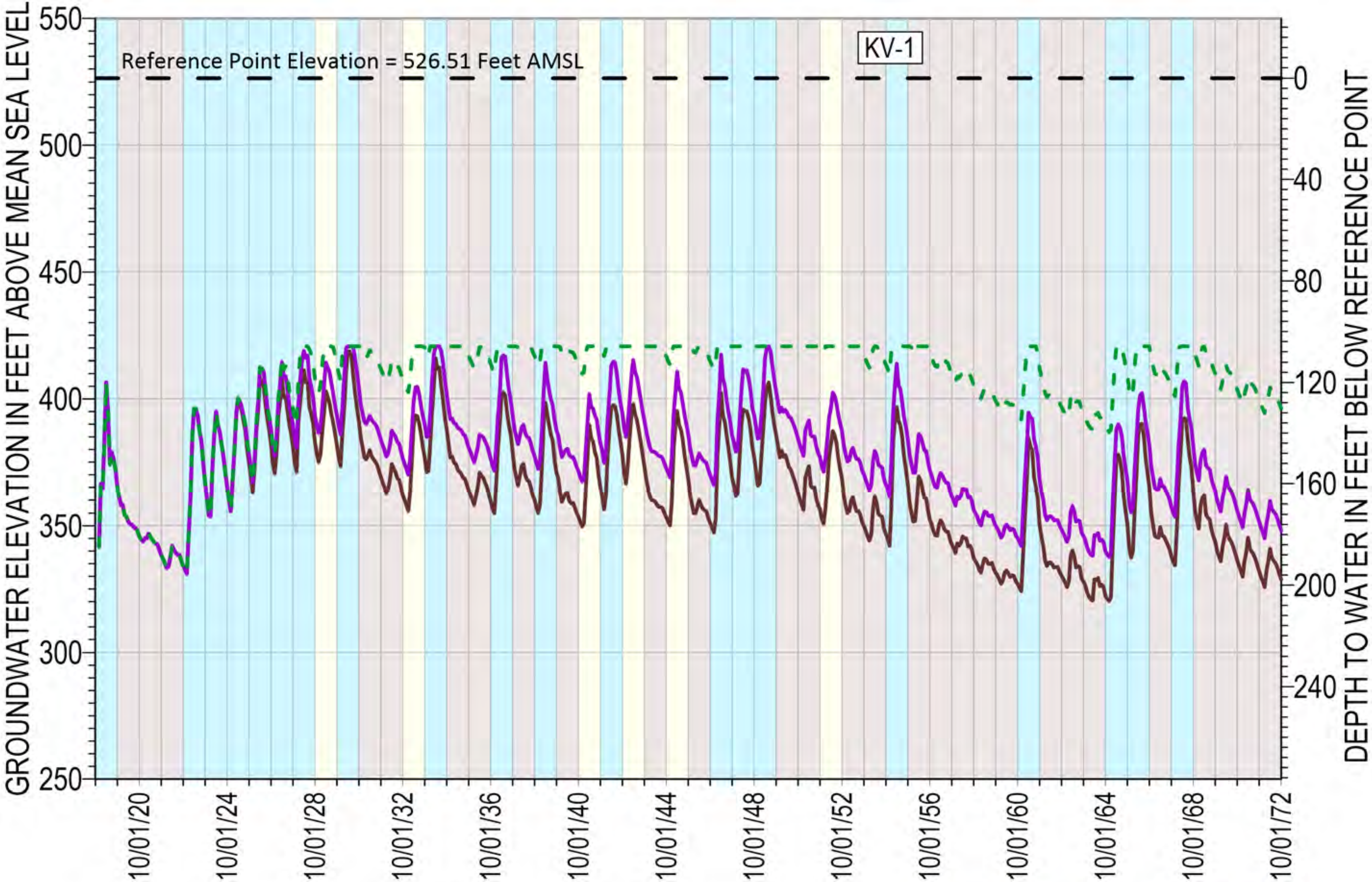
Critically Dry

Normal

Dry

Wet





Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Unknown

Reference Point Elevation= 526.51 ft AMSL

Screenings= Unknown ft bgs

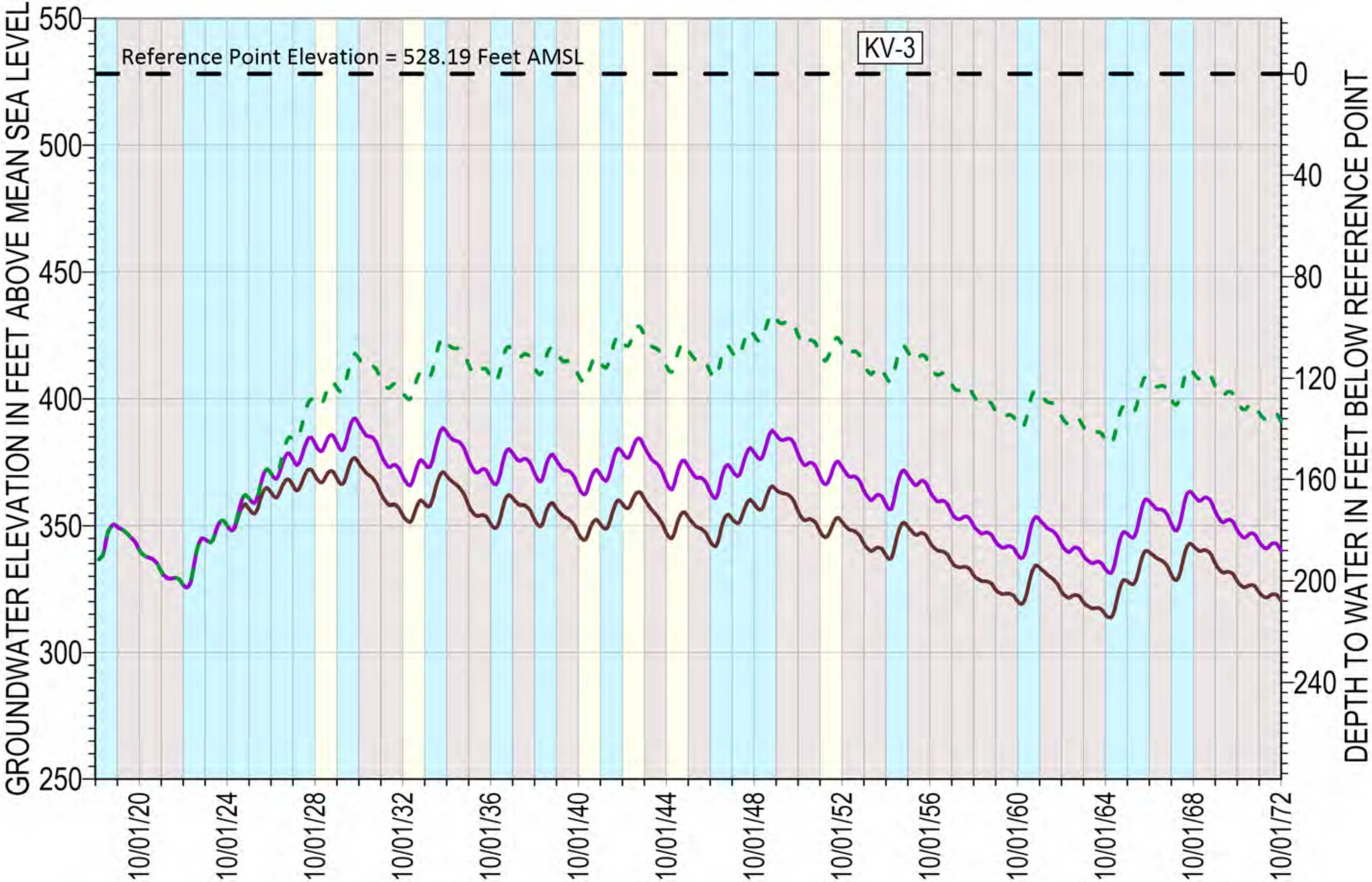
Water Year Classification

Critically Dry

Normal

Dry

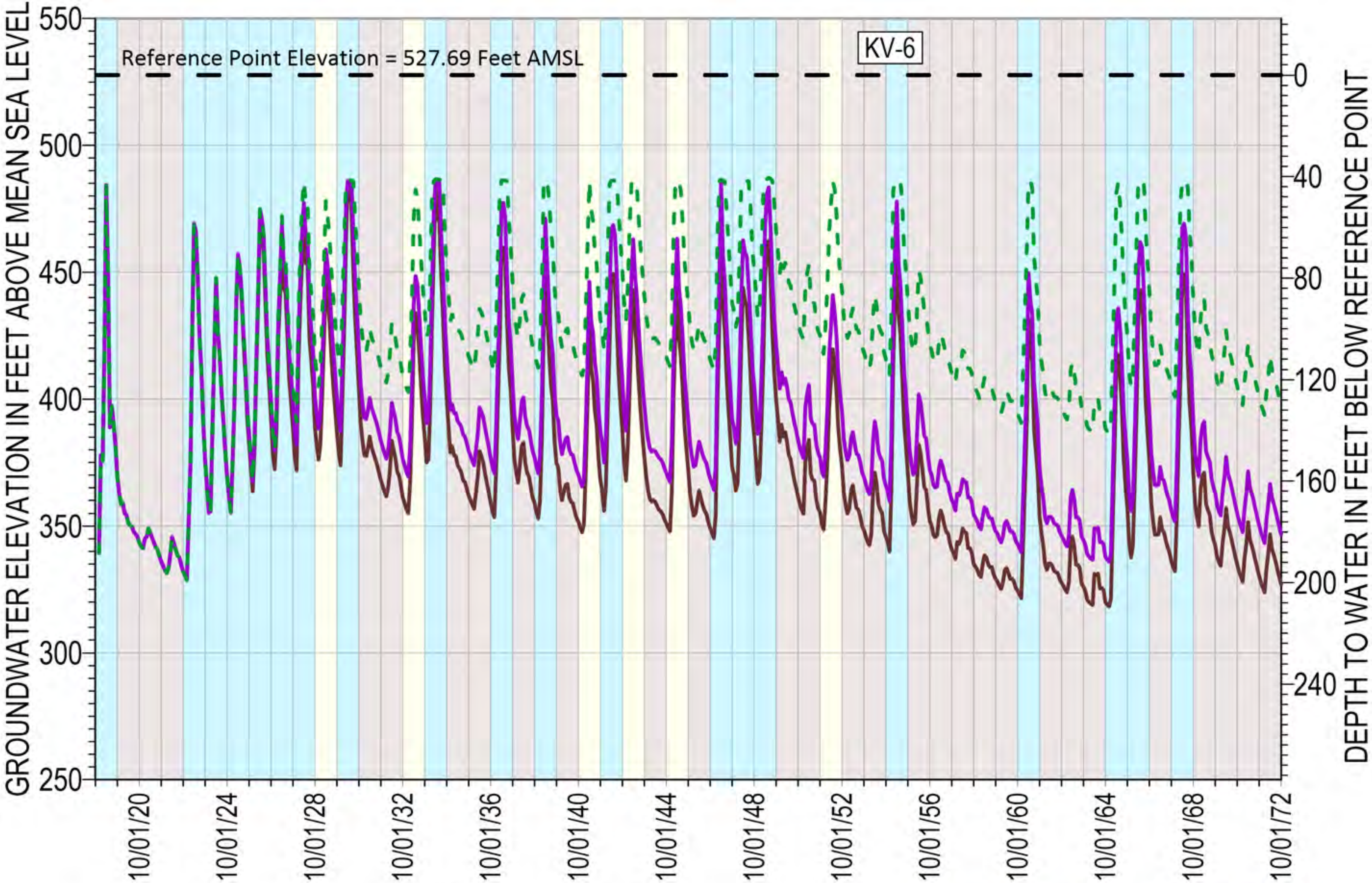
Wet



Aquifer: Unknown
Reference Point Elevation= 528.19 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Unknown

Reference Point Elevation= 527.69 ft AMSL

Screenings= Unknown ft bgs

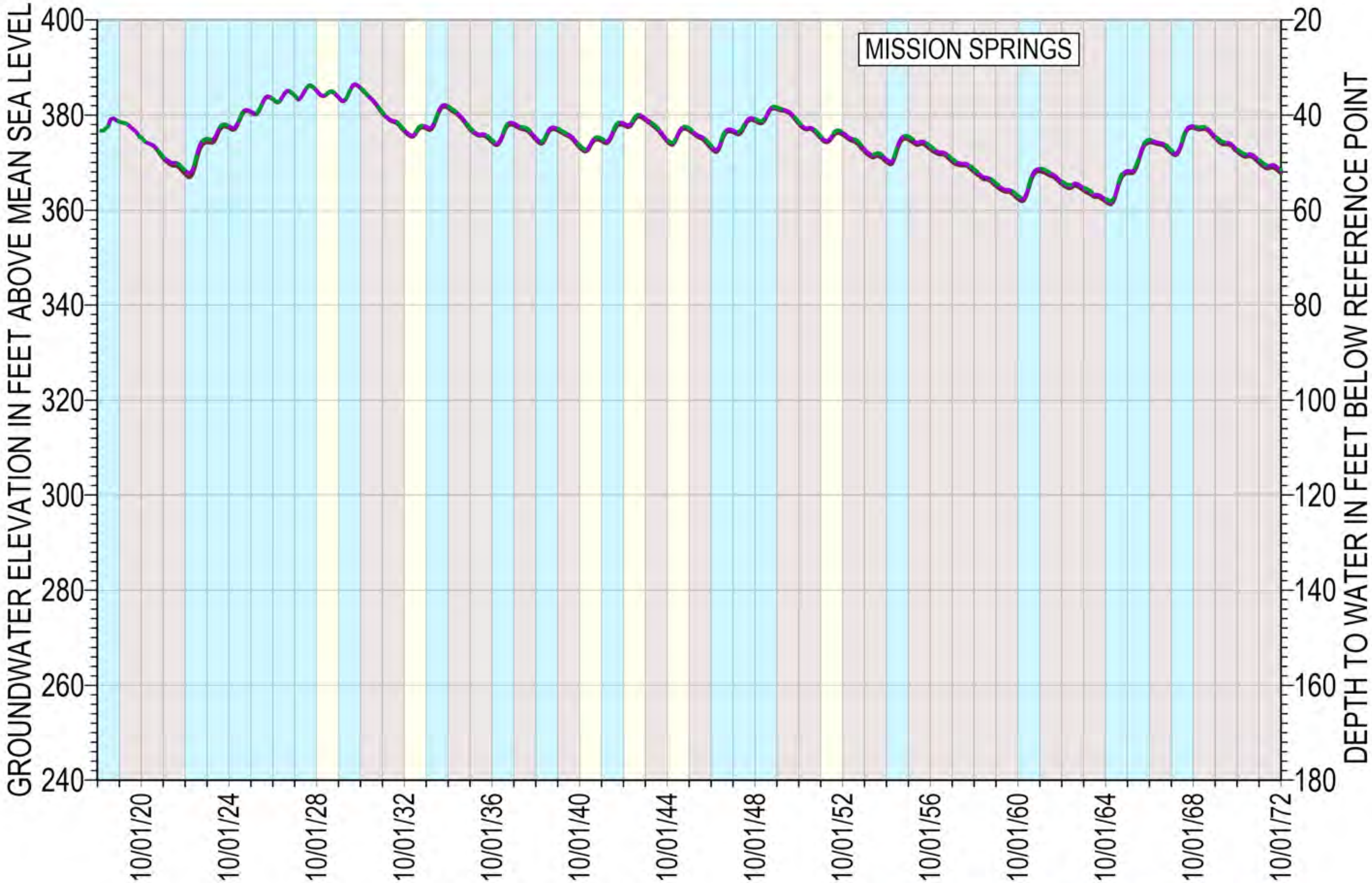
Water Year Classification

Critically Dry

Normal

Dry

Wet

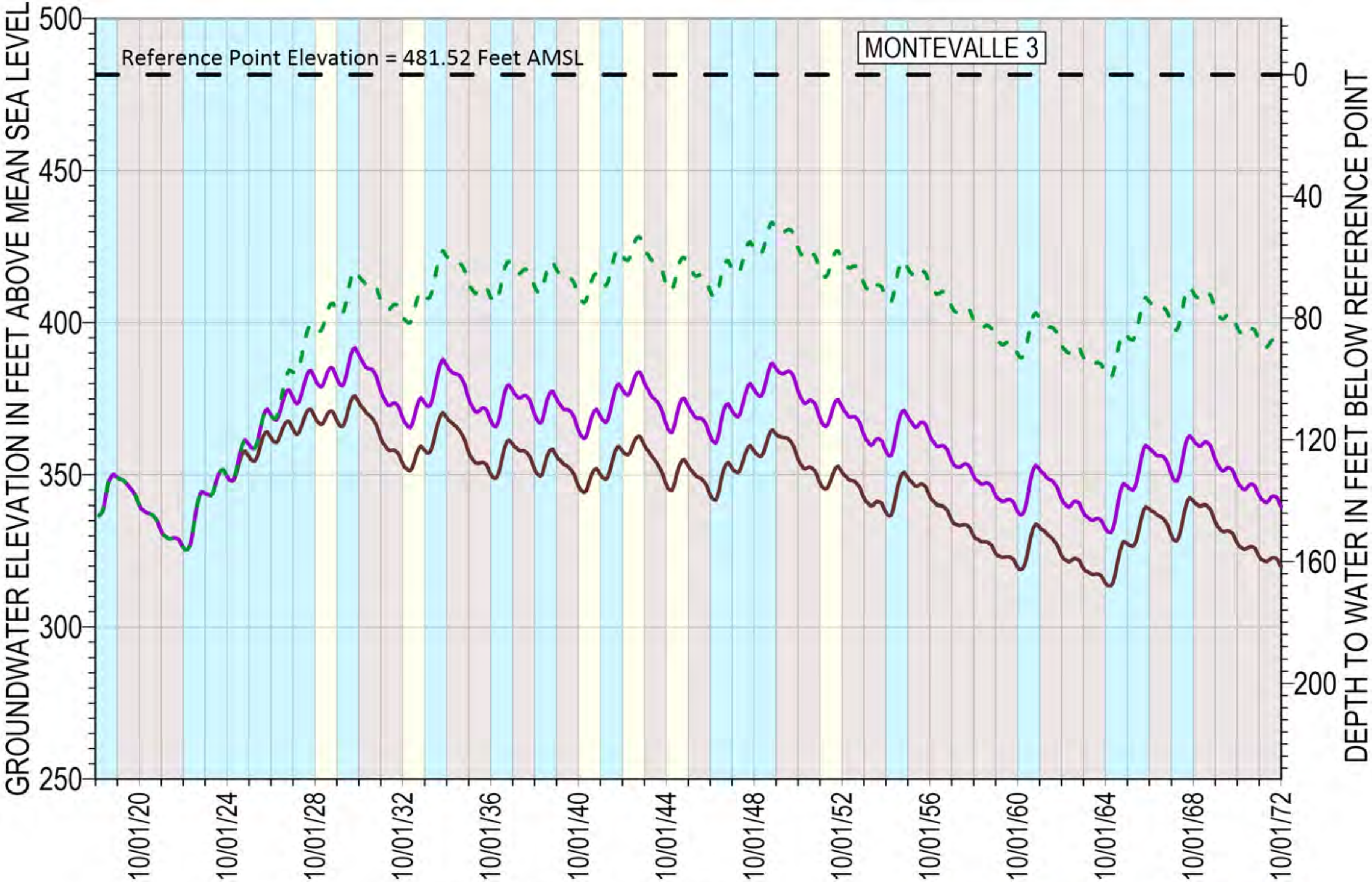


• • Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 420 ft AMSL
Screenings= 159-179, 189-257 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Projected Baseline

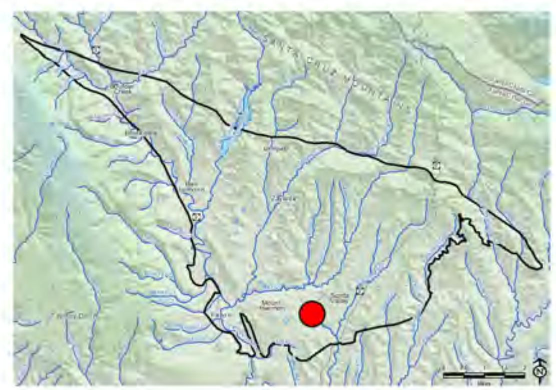
Expanded Conjunctive Use with Loch Lomond (540 AFY)

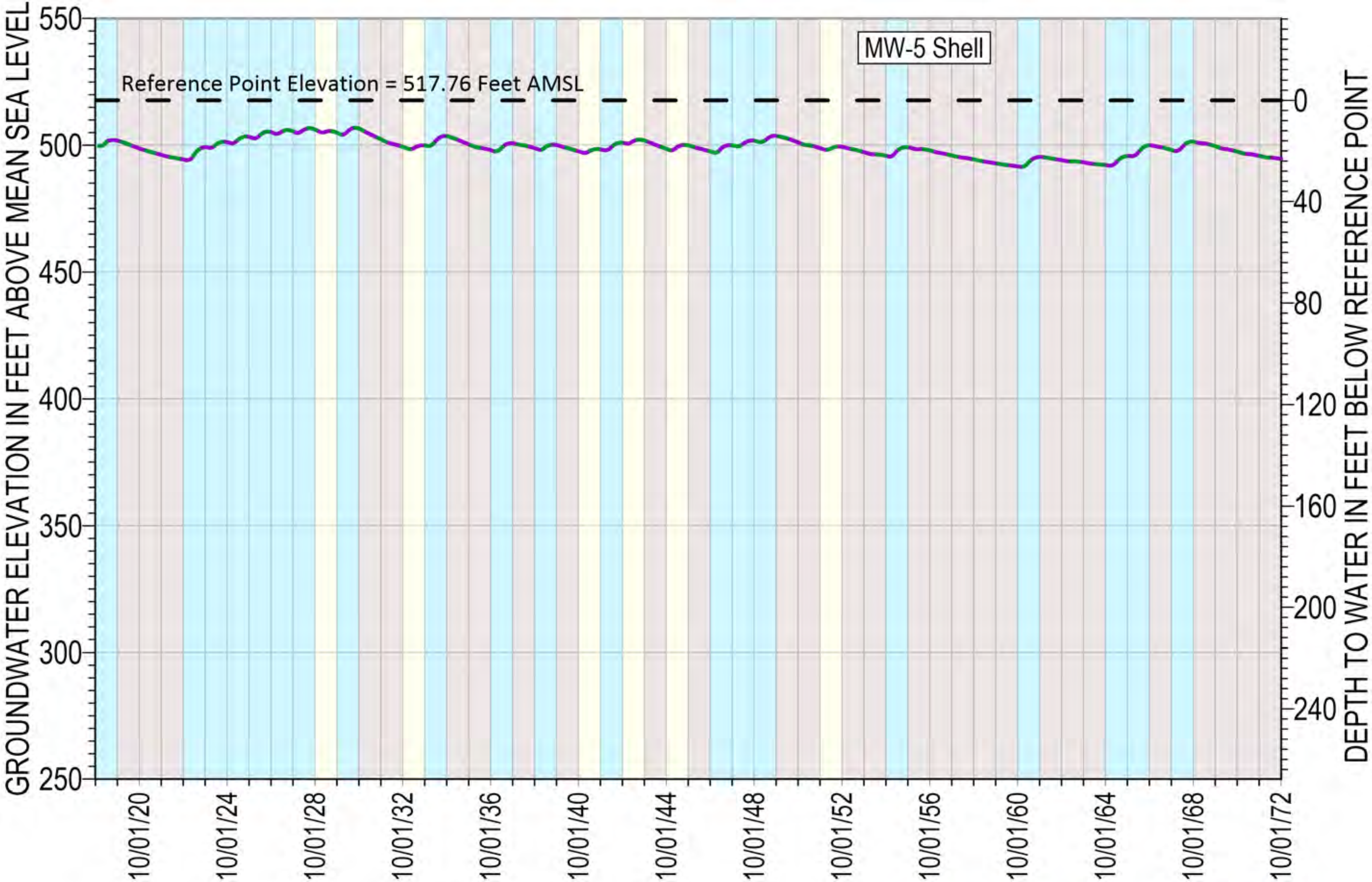
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita,Monterey
Reference Point Elevation= 481.52 ft AMSL
Screenings= 105-145, 210-225, 340-375 ft bgs

Water Year Classification

Critically Dry | Normal
Dry | Wet





Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Perched

Reference Point Elevation= 517.76 ft AMSL

Screenings= Unknown ft bgs

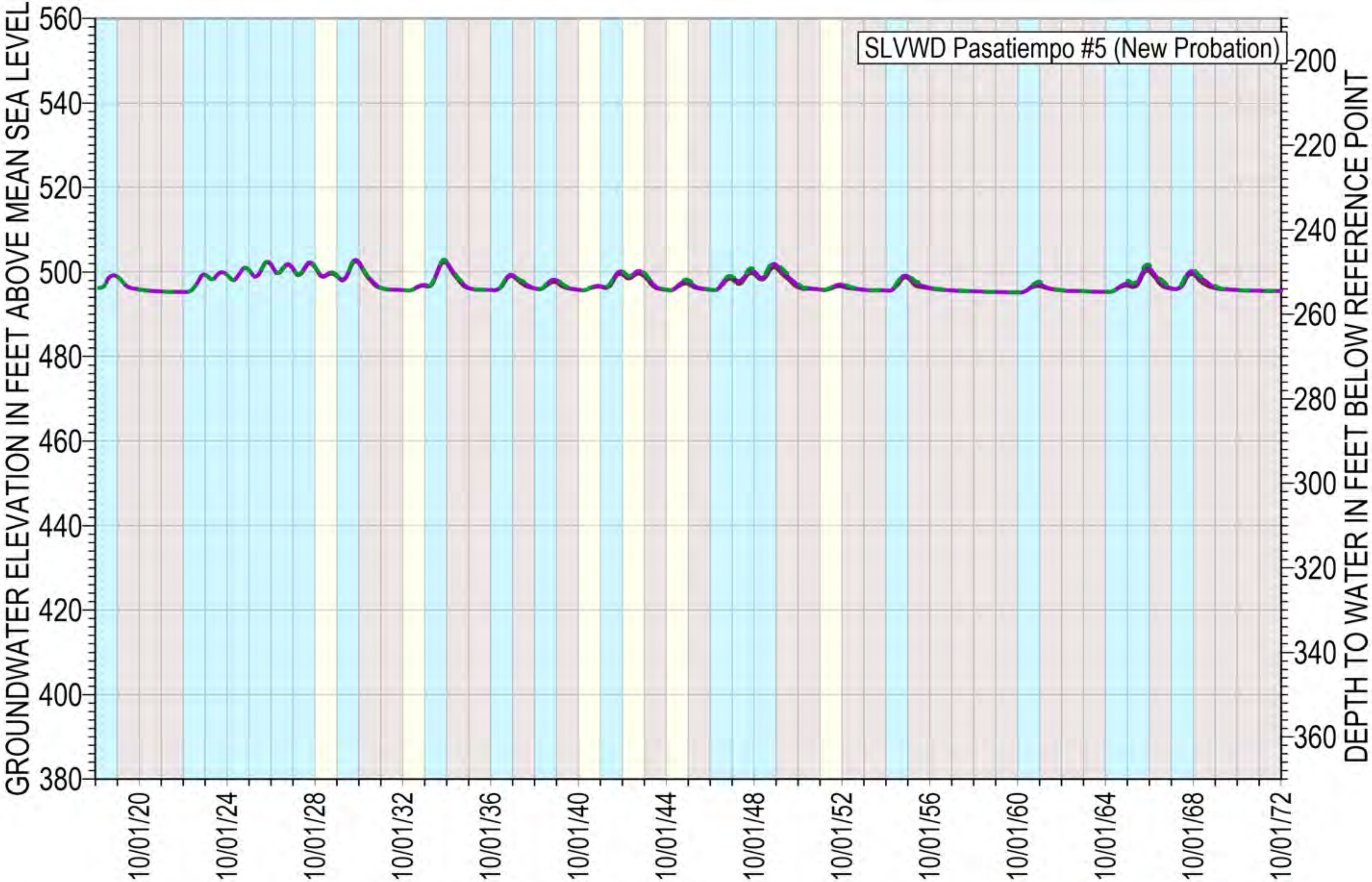
Water Year Classification

Critically Dry

Normal

Dry

Wet



Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita,Monterey

Reference Point Elevation= 750 ft AMSL

Screenings= 265-290, 343-363, 380-394 ft bgs

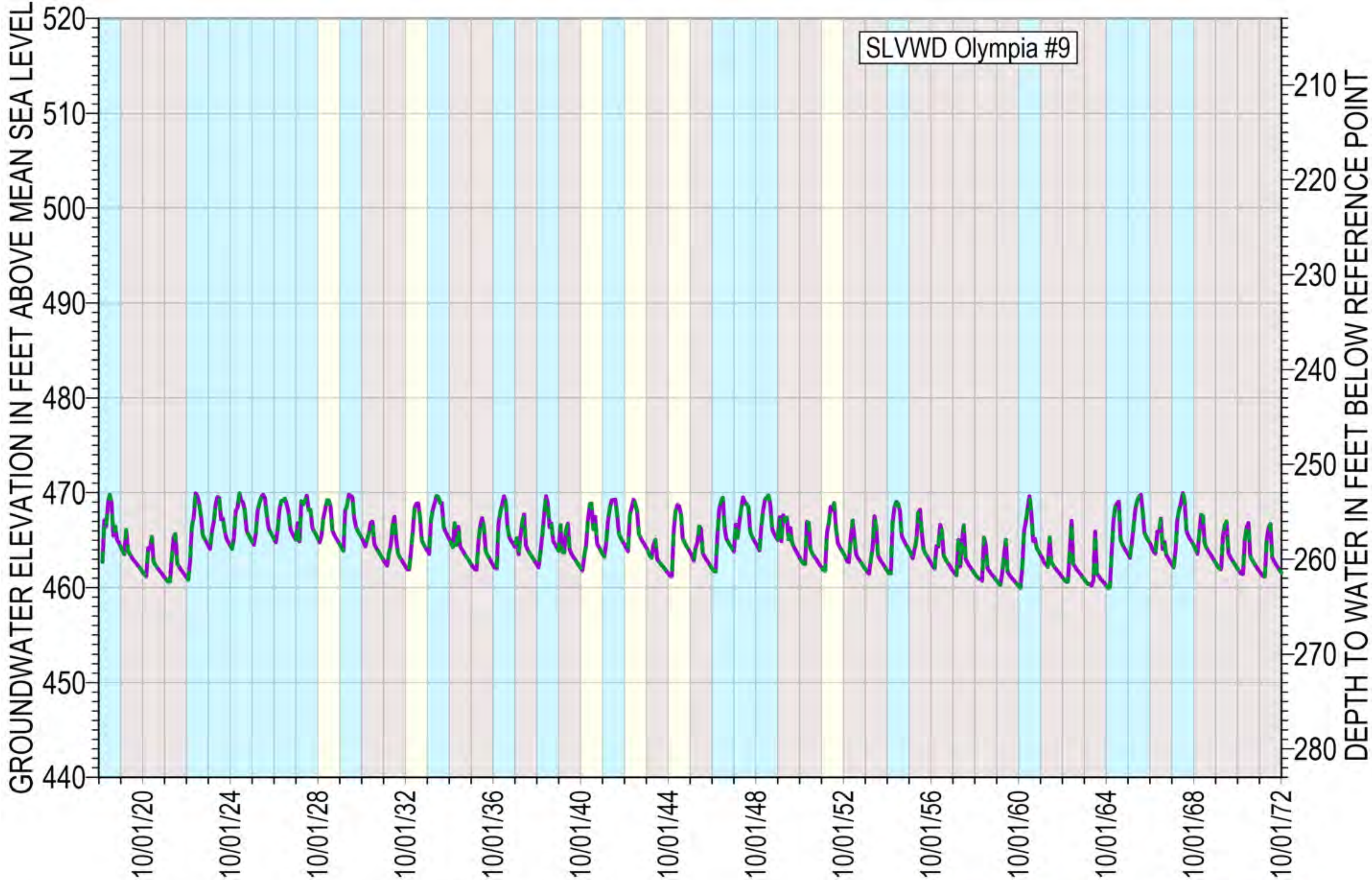
Water Year Classification

Critically Dry

Normal

Dry

Wet



• • Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico,Butano

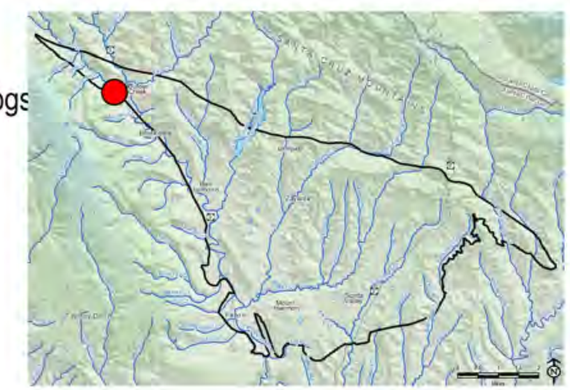
Reference Point Elevation= 723 ft AMSL

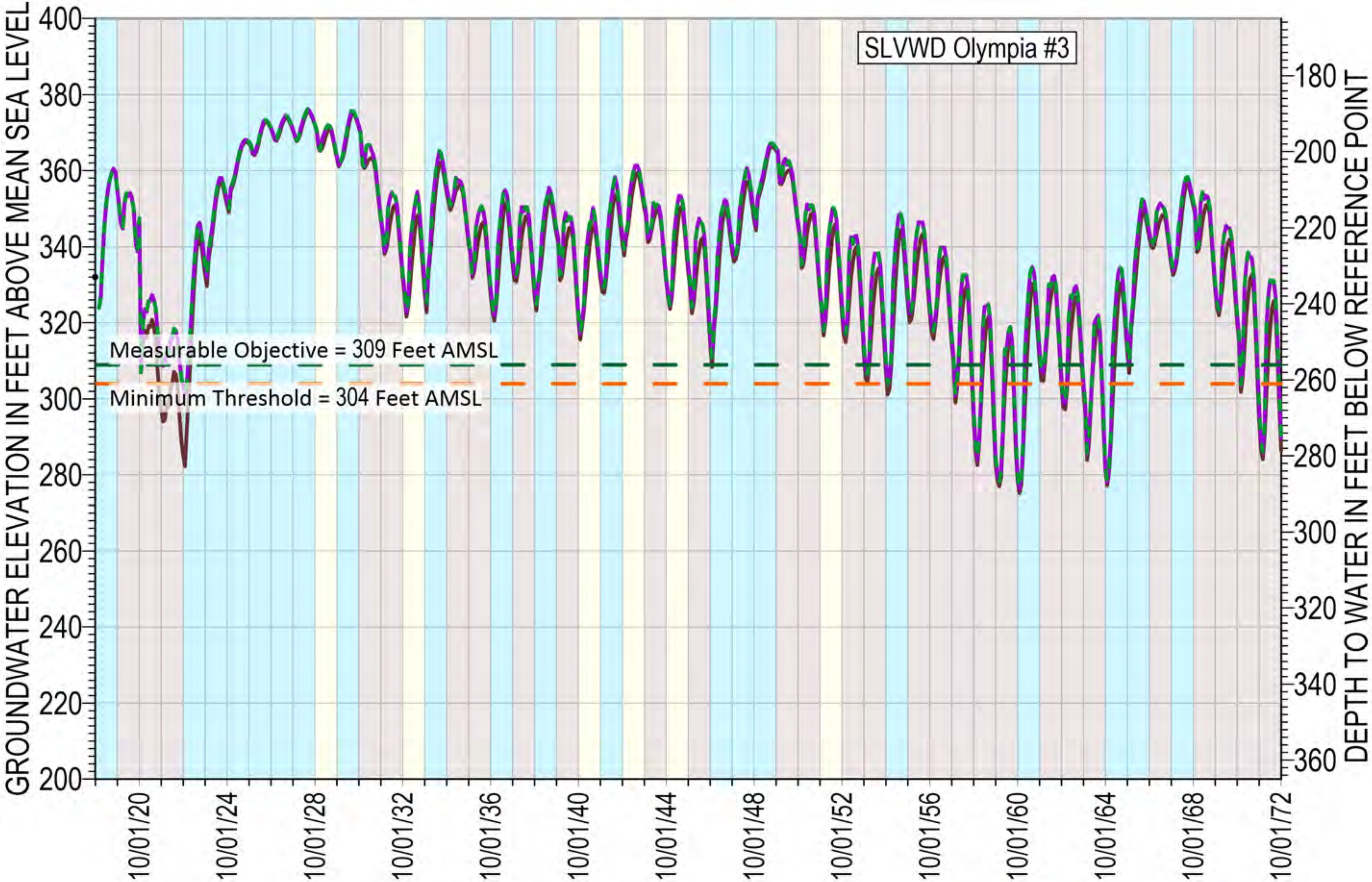
Screenings= 705-784, 805-1063, 1084-1455 ft bgs

Water Year Classification

Critically Dry | Normal

Dry | Wet



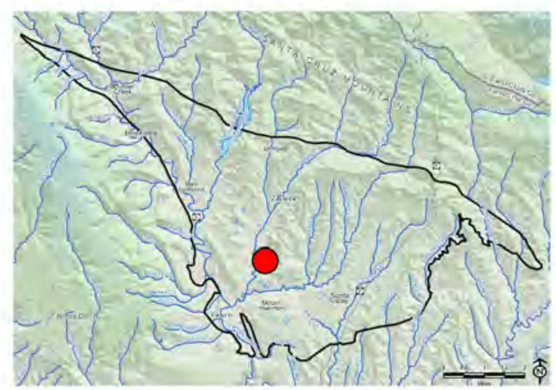


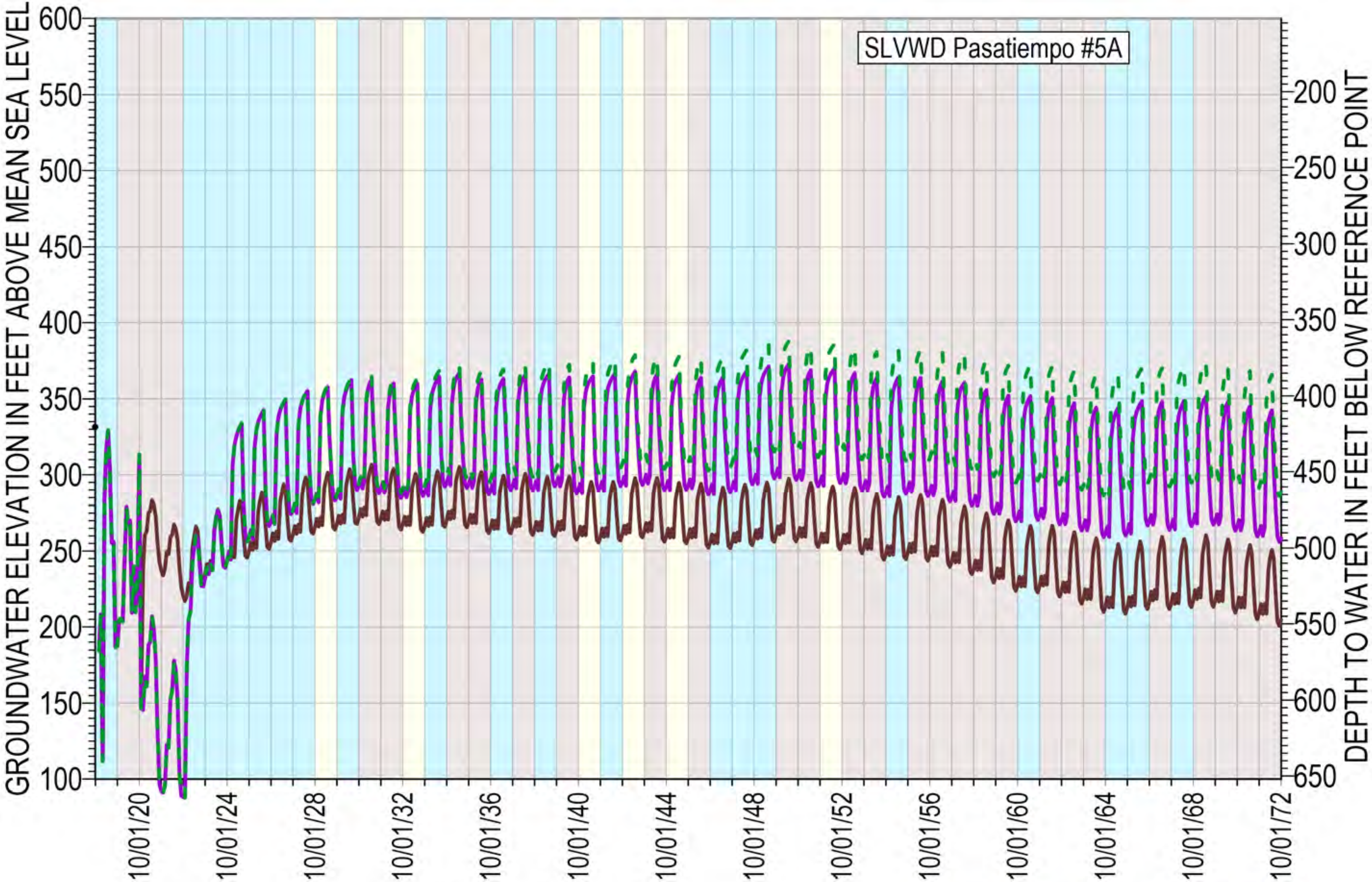
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Santa Margarita
Reference Point Elevation= 565 ft AMSL
Screenings= 230-308 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet





• • Measured

Projected Baseline

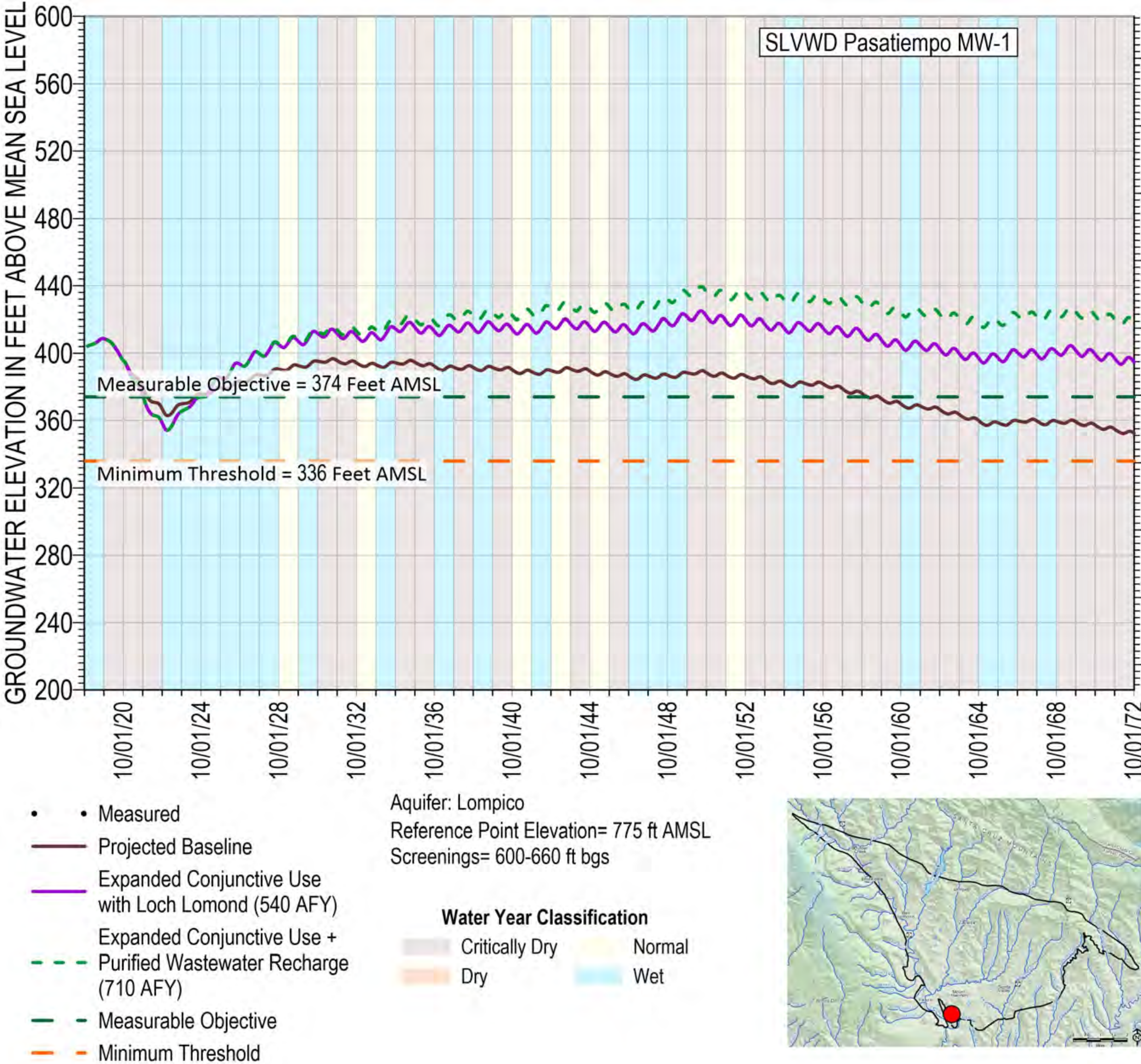
Expanded Conjunctive Use with Loch Lomond (540 AFY)

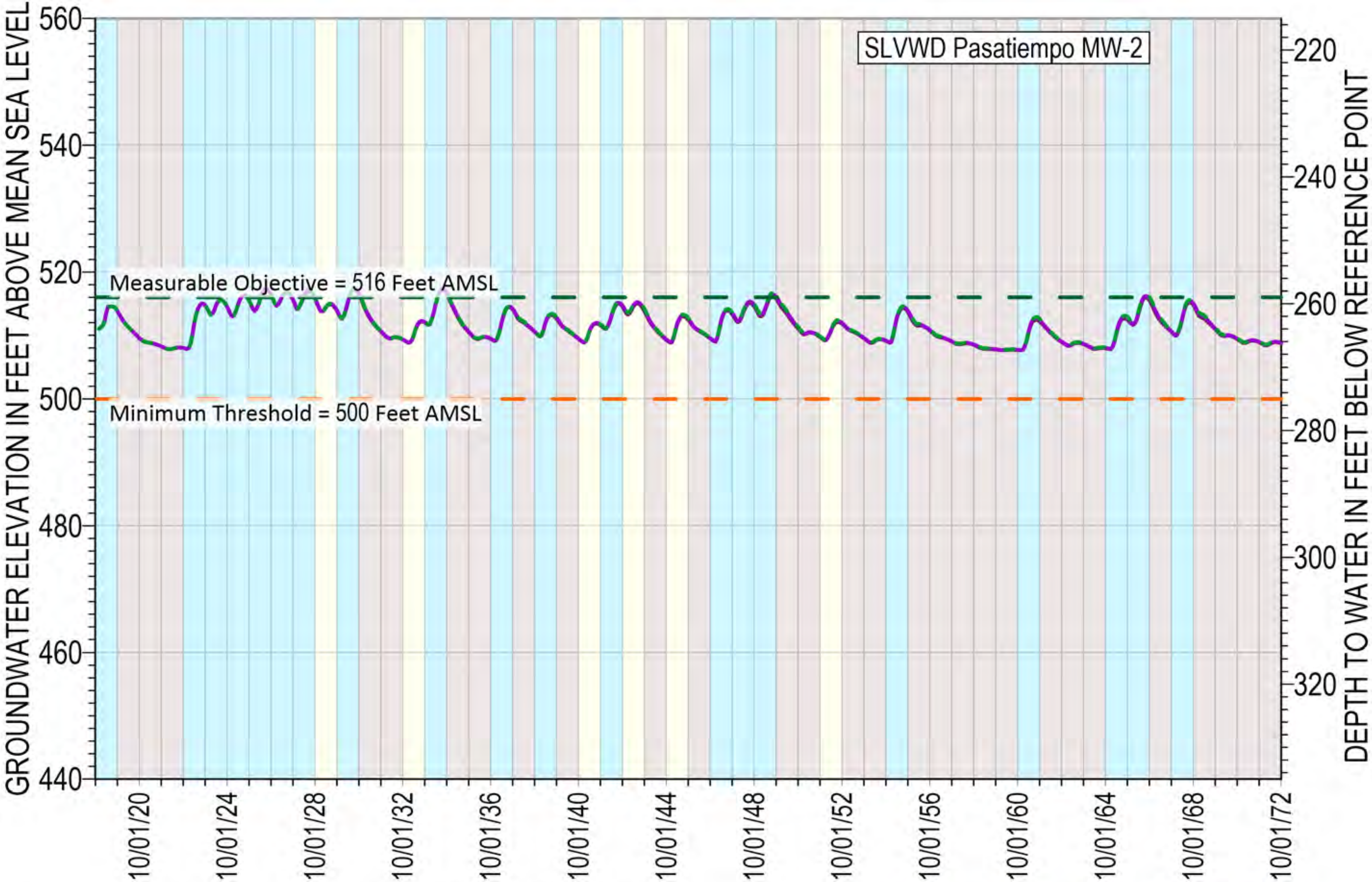
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico
Reference Point Elevation= 752 ft AMSL
Screenings= 400-700 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet


SLVWD Pasatiempo MW-1
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
560
520
480
440
400
360
320
280
240
200
200
240
280
320
360
400
440
480
520
560
Measurable Objective = 374 Feet AMSL
Minimum Threshold = 336 Feet AMSL
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Lompico
Reference Point Elevation= 775 ft AMSL
Screenings= 600-660 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

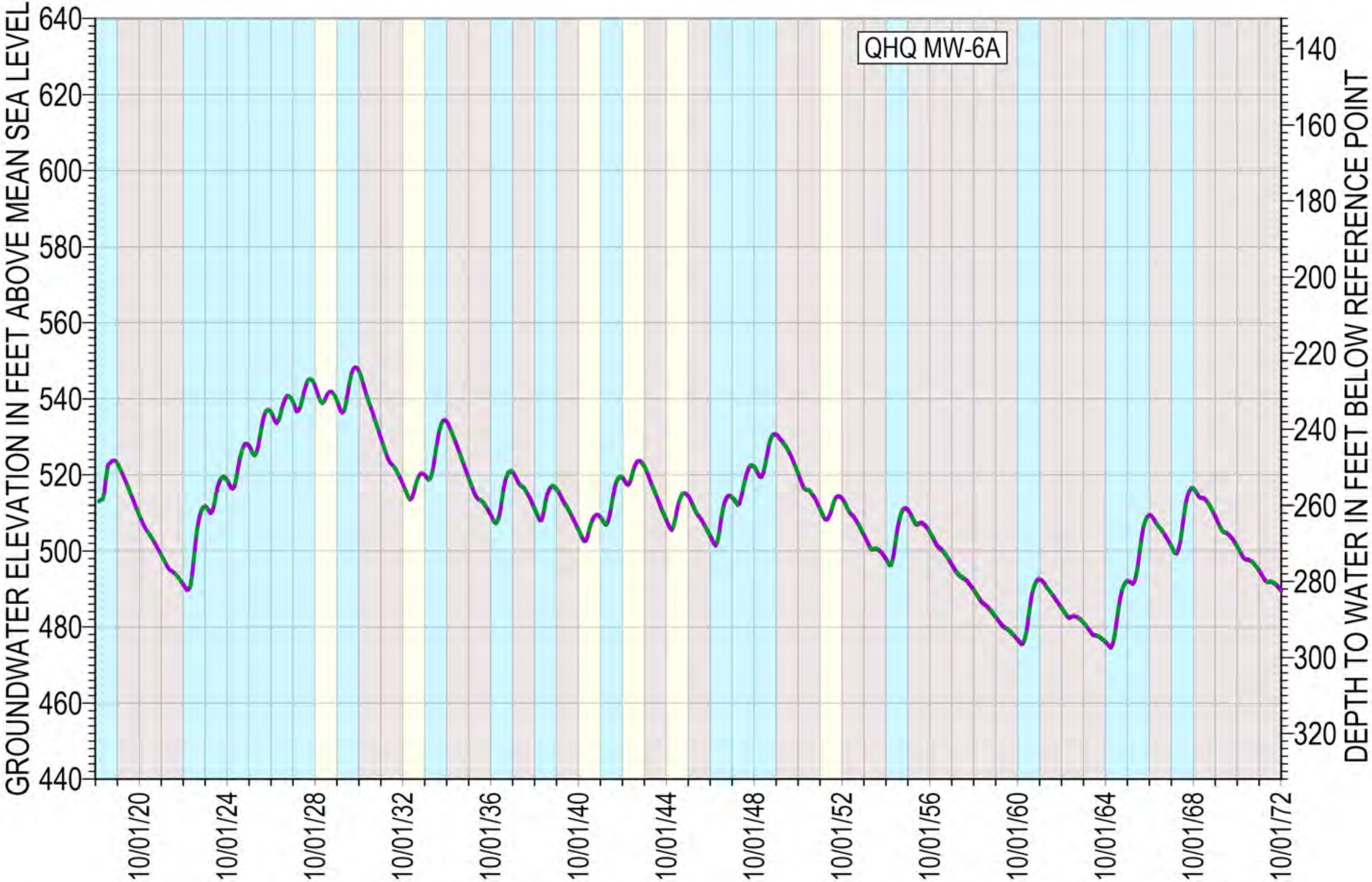


Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Santa Margarita
Reference Point Elevation= 775 ft AMSL
Screenings= 280-340 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet



Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 772 ft AMSL

Screenings= 229-234 ft bgs

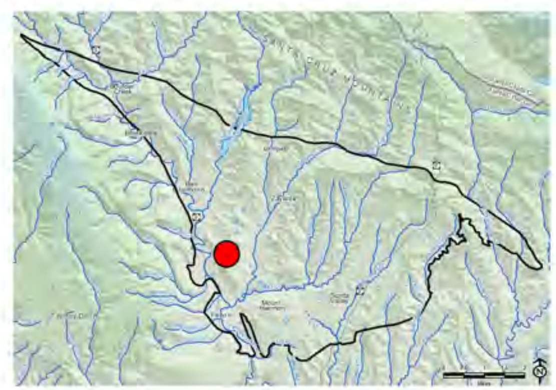
Water Year Classification

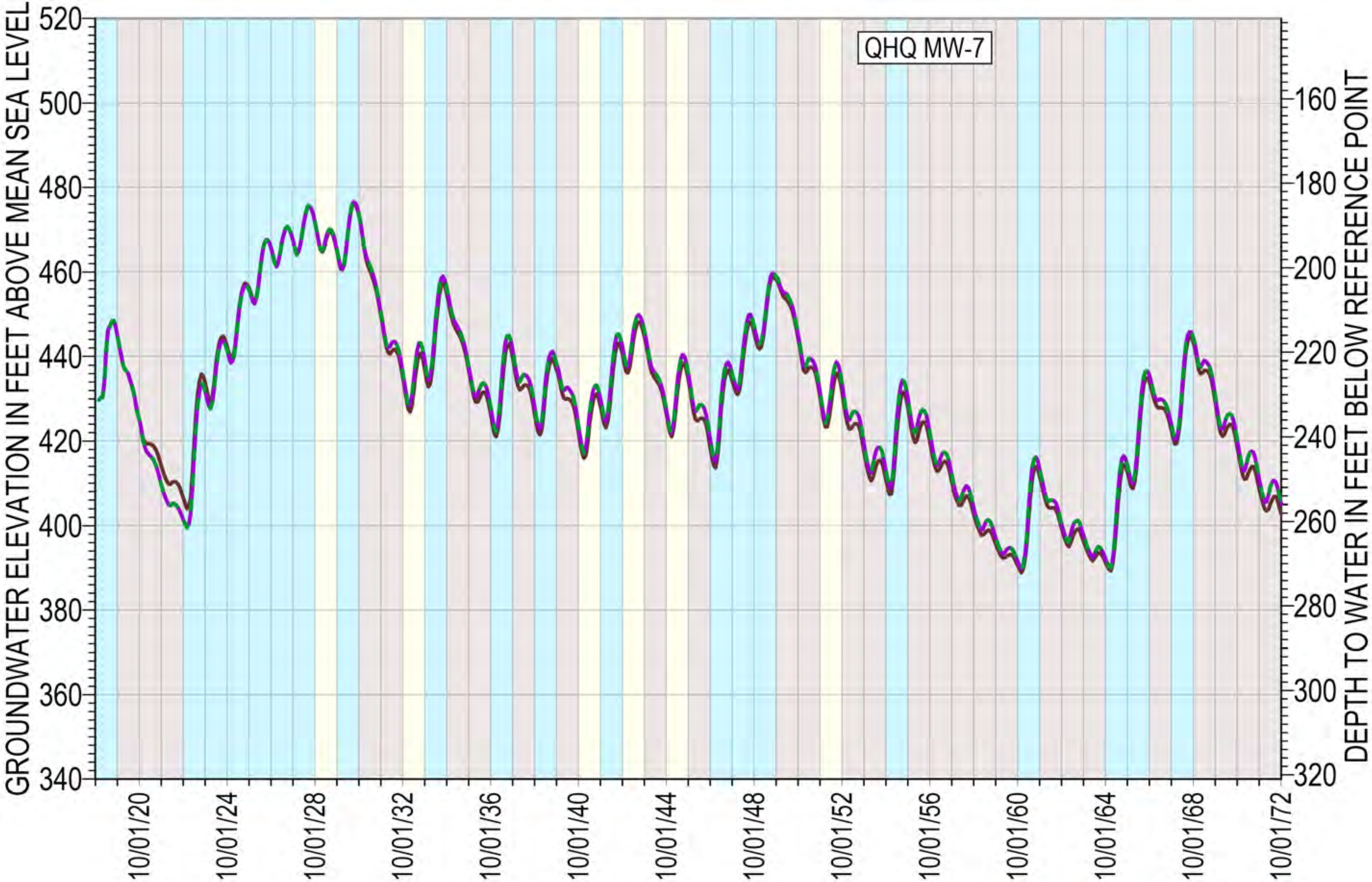
Critically Dry

Normal

Dry

Wet





Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 661 ft AMSL

Screenings= 153-203 ft bgs

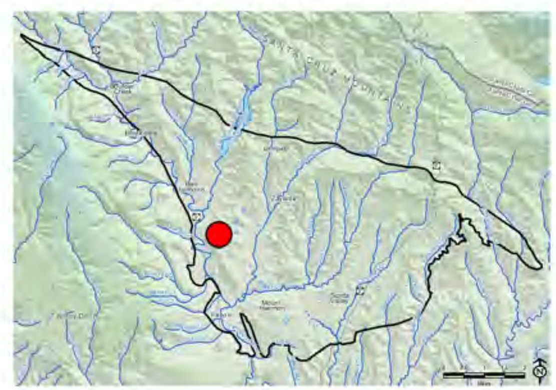
Water Year Classification

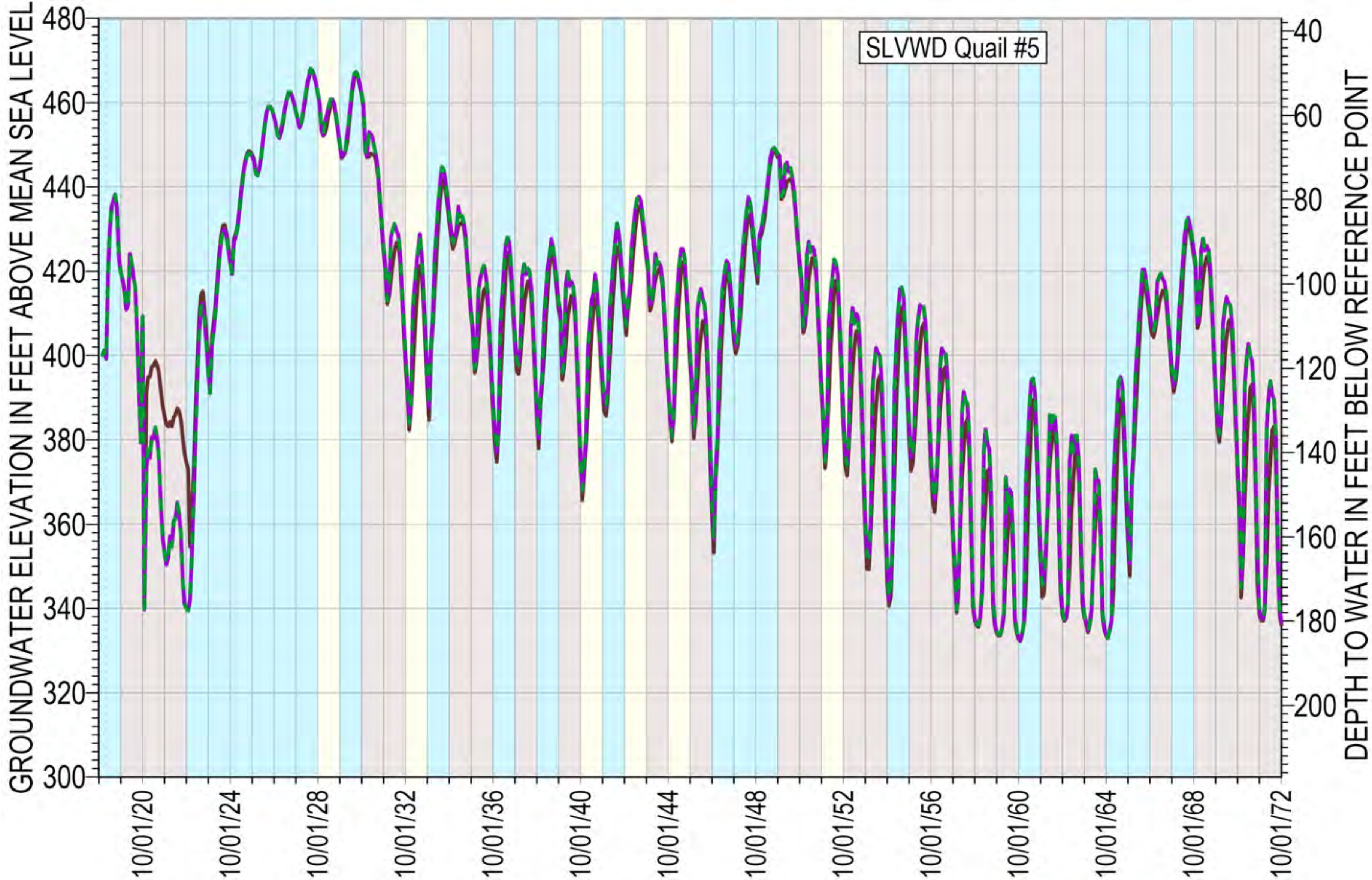
Critically Dry

Normal

Dry

Wet





Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 517 ft AMSL

Screenings= 130-170 ft bgs

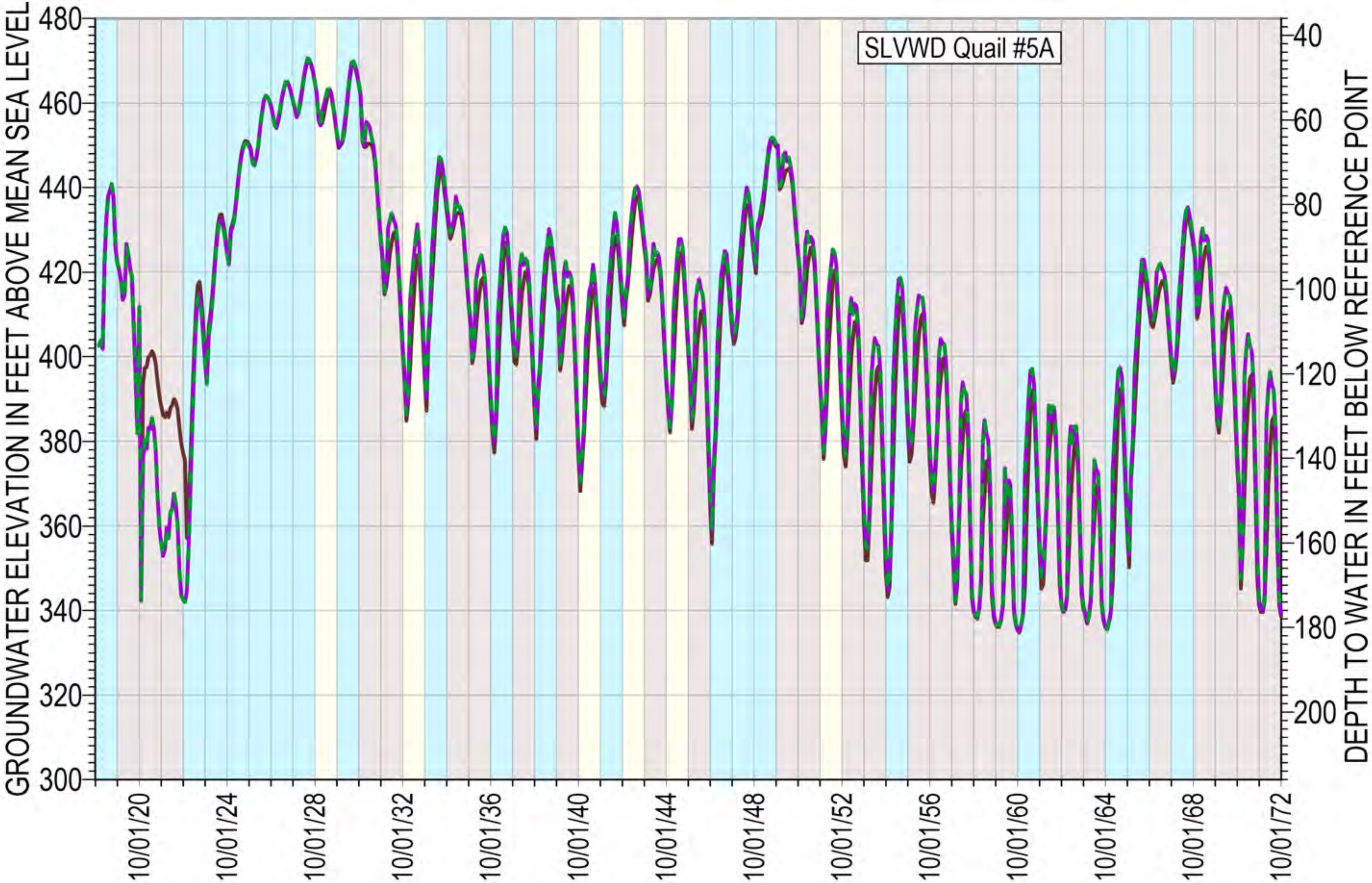
Water Year Classification

Critically Dry

Normal

Dry

Wet



Measured

Projected Baseline

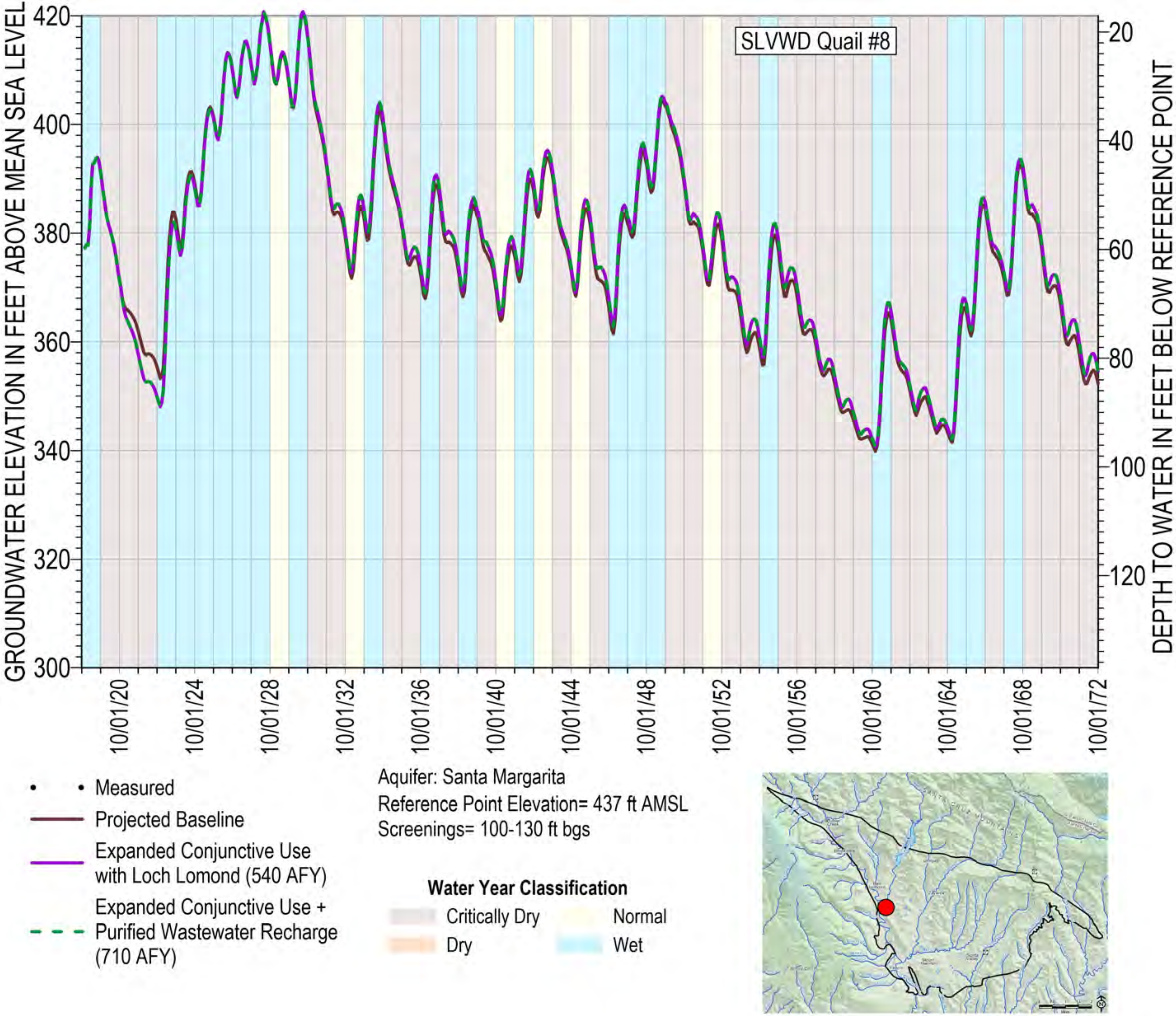
Expanded Conjunctive Use with Loch Lomond (540 AFY)

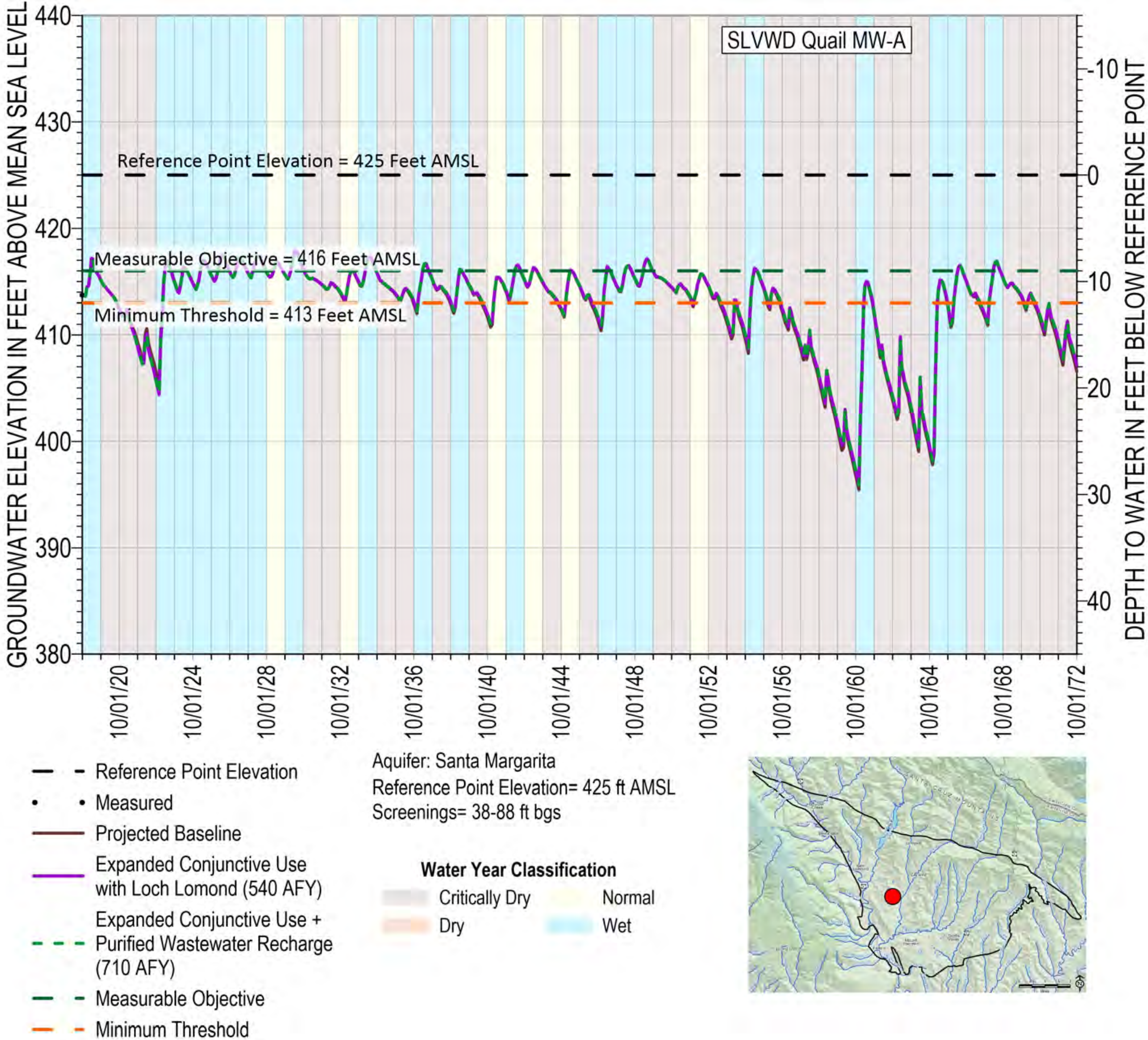
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 516 ft AMSL
Screenings= 124-164 ft bgs

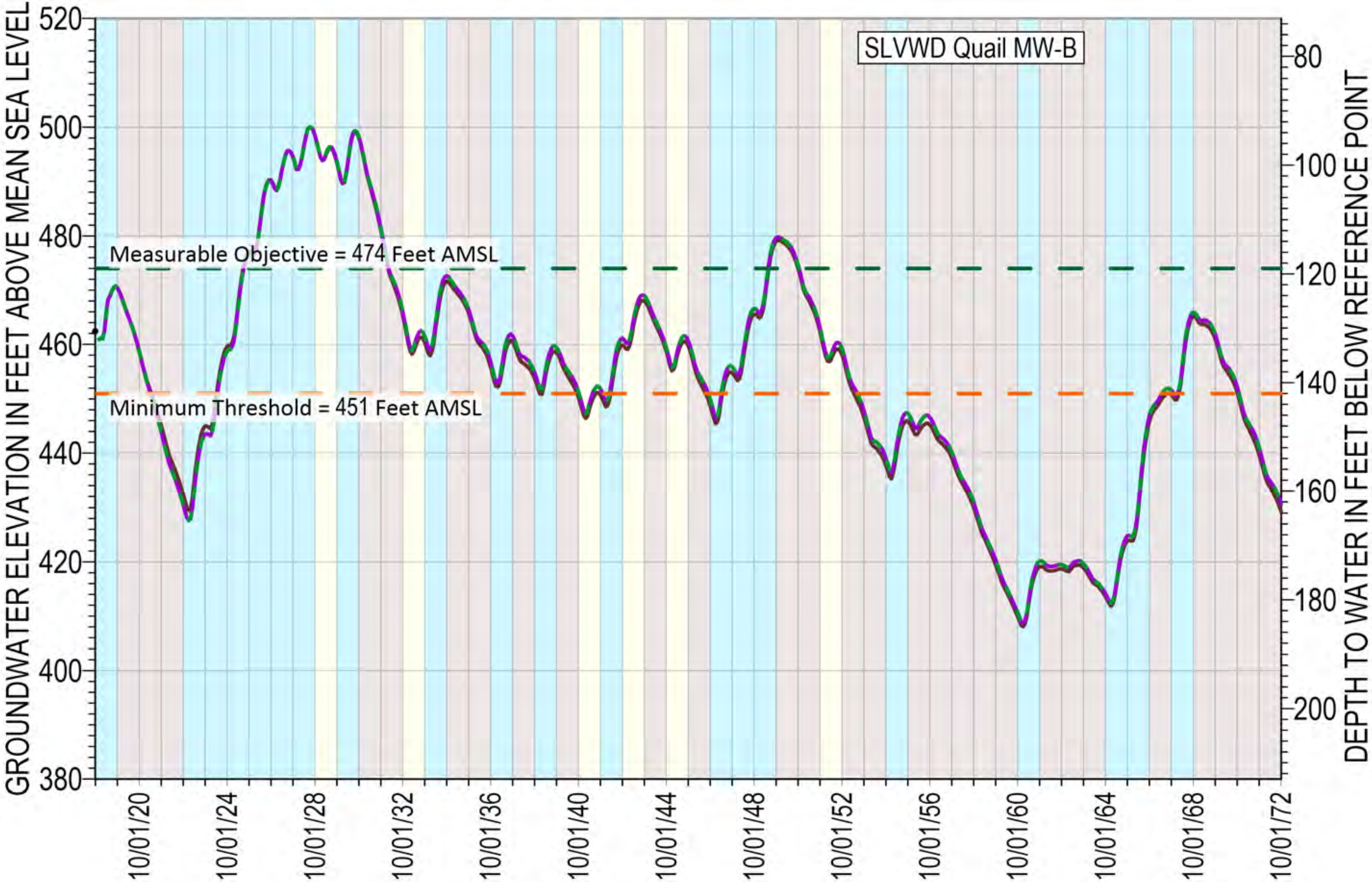
Water Year Classification

Critically Dry | Normal
Dry | Wet


SLVWD Quail #8
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
420
400
380
360
340
320
300
20
40
60
80
100
120
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Santa Margarita
Reference Point Elevation= 437 ft AMSL
Screenings= 100-130 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



SLVWD Quail MW-A
Reference Point Elevation = 425 Feet AMSL
Measurable Objective = 416 Feet AMSL
Minimum Threshold = 413 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
440
430
420
410
400
390
380
-10
0
10
20
30
40
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Santa Margarita
Reference Point Elevation= 425 ft AMSL
Screenings= 38-88 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

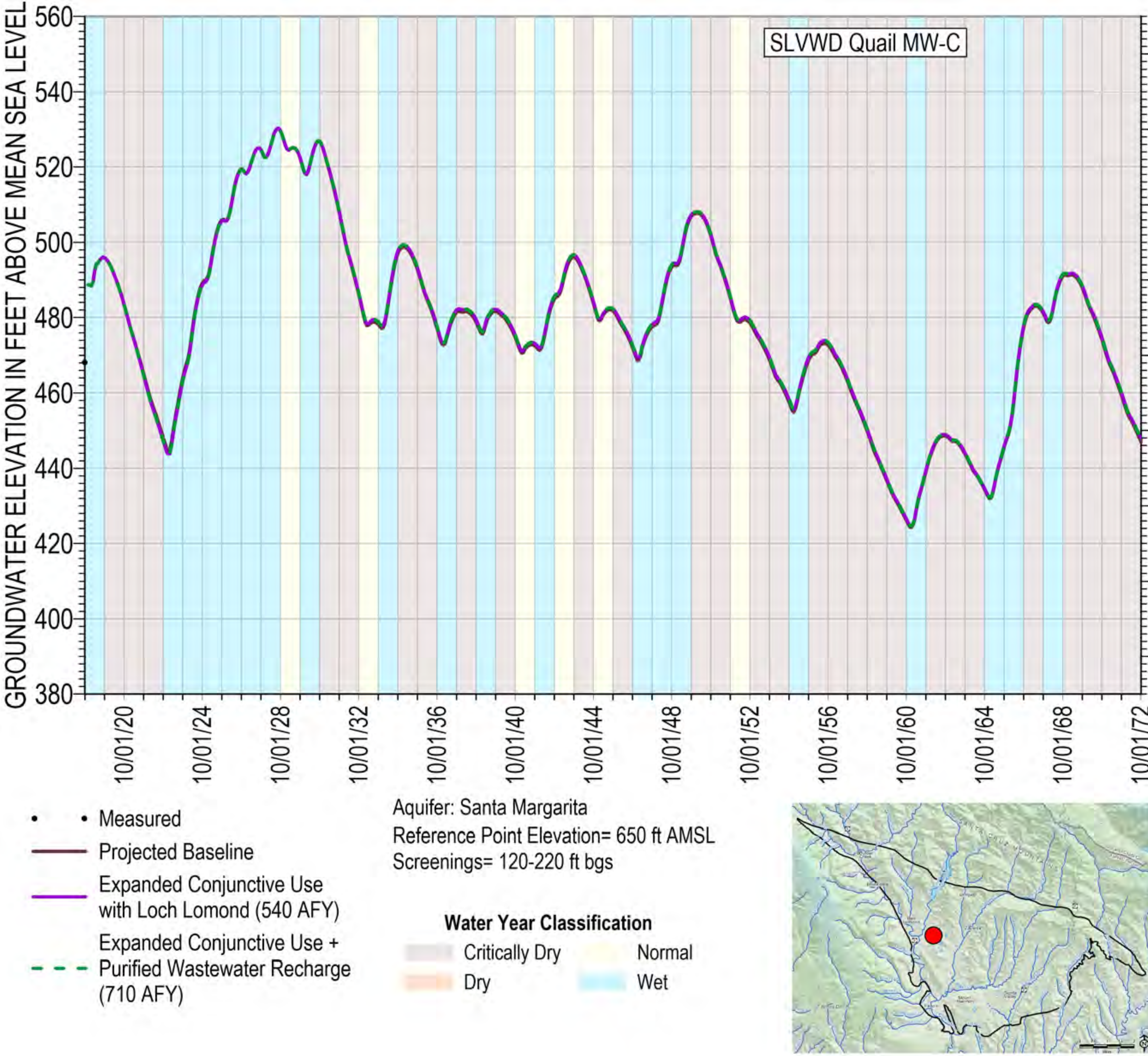


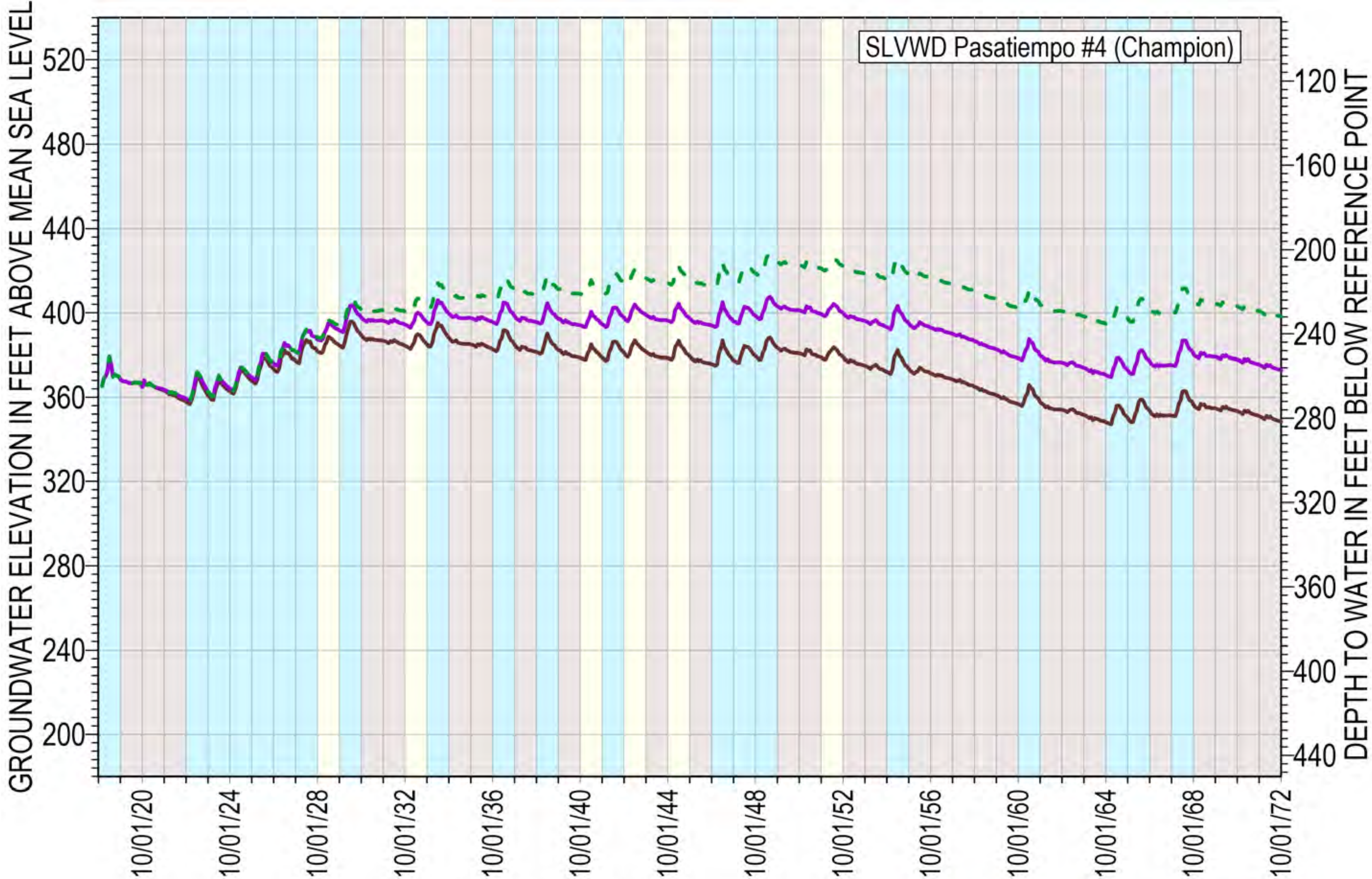
- Measured
- Projected Baseline
- Expanded Conjunctive Use with Loch Lomond (540 AFY)
- Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
- Measurable Objective
- Minimum Threshold

Aquifer: Santa Margarita
Reference Point Elevation= 593 ft AMSL
Screenings= 95-195 ft bgs

Water Year Classification

- Critically Dry
- Normal
- Dry
- Wet


SLVWD Quail MW-C
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
560
540
520
500
480
460
440
420
400
380
100
120
140
160
180
200
220
240
260
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Santa Margarita
Reference Point Elevation= 650 ft AMSL
Screenings= 120-220 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 630 ft AMSL

Screenings= 100-105, 120-140 ft bgs

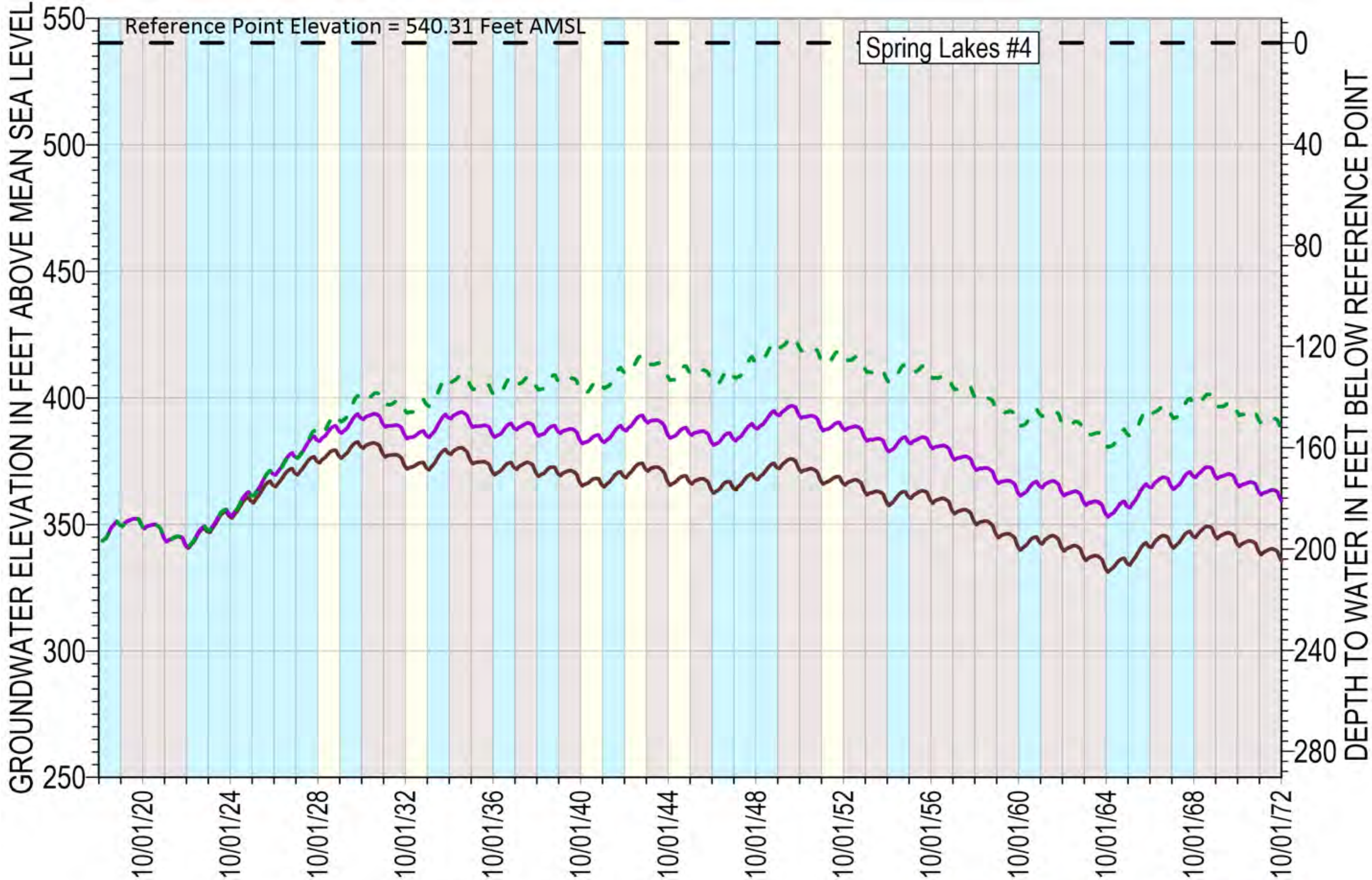
Water Year Classification

Critically Dry

Normal

Dry

Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

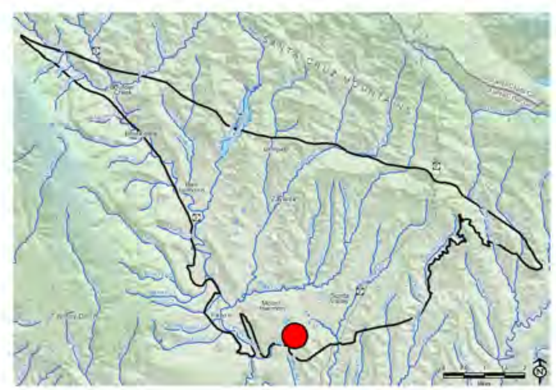
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

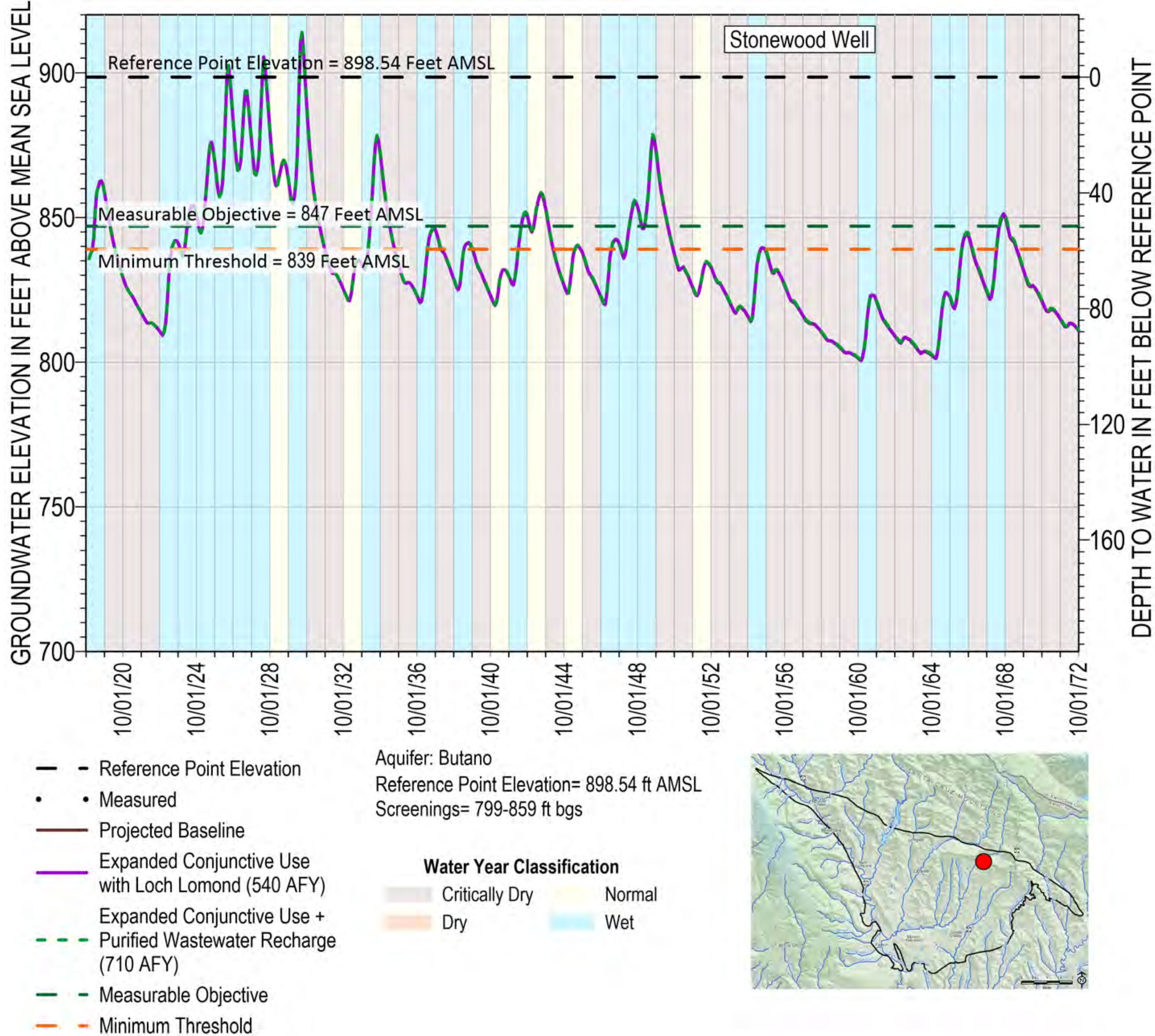
Aquifer: Lompico
Reference Point Elevation= 540.31 ft AMSL
Screenings= 180-250, 264-310 ft bgs

Water Year Classification

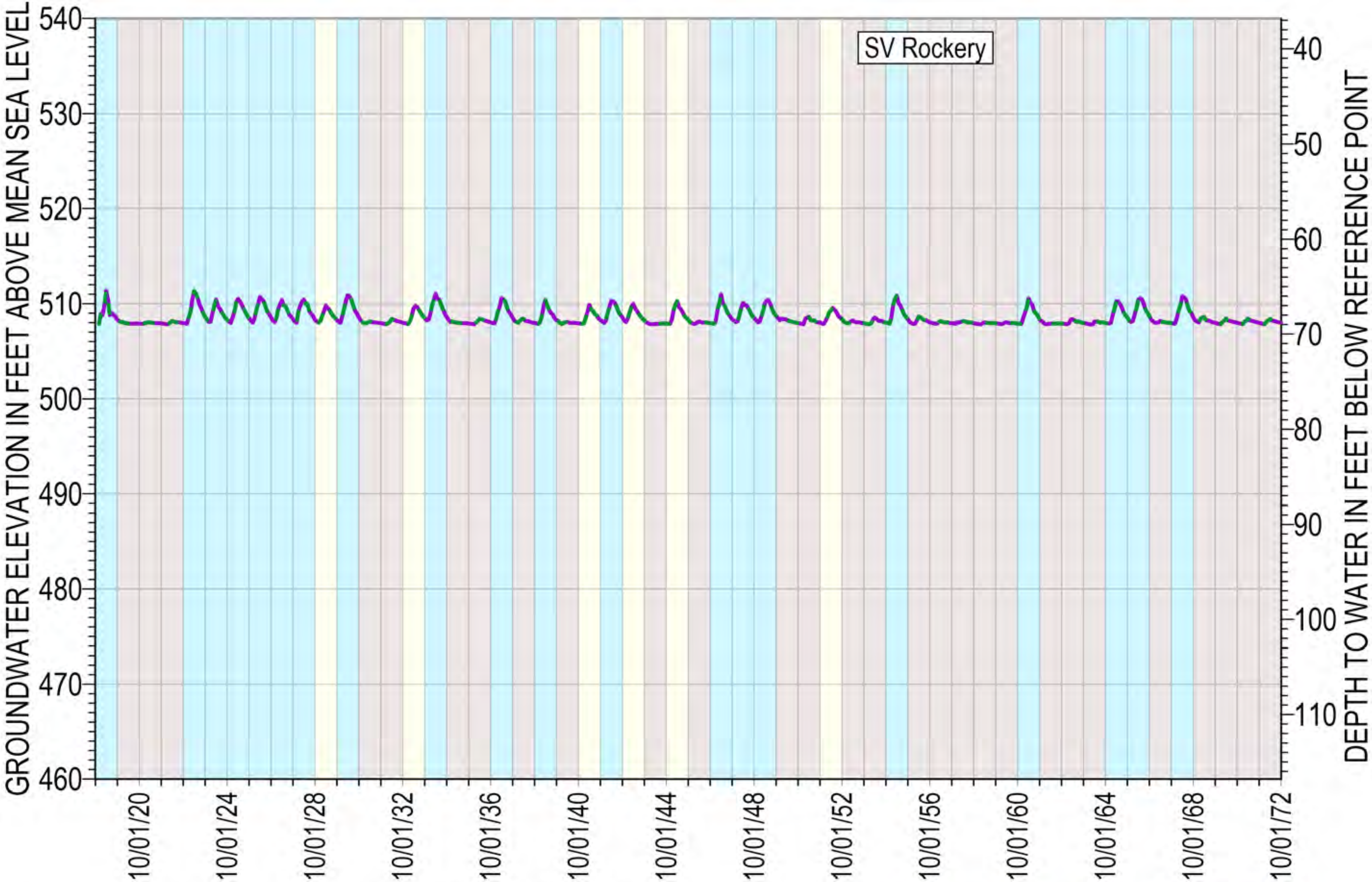
Critically Dry | Normal

Dry | Wet





Stonewood Well
Reference Point Elevation = 898.54 Feet AMSL
Measurable Objective = 847 Feet AMSL
Minimum Threshold = 839 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
900
850
800
750
700
0
40
80
120
160
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Butano
Reference Point Elevation= 898.54 ft AMSL
Screenings= 799-859 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



• • Measured

Projected Baseline

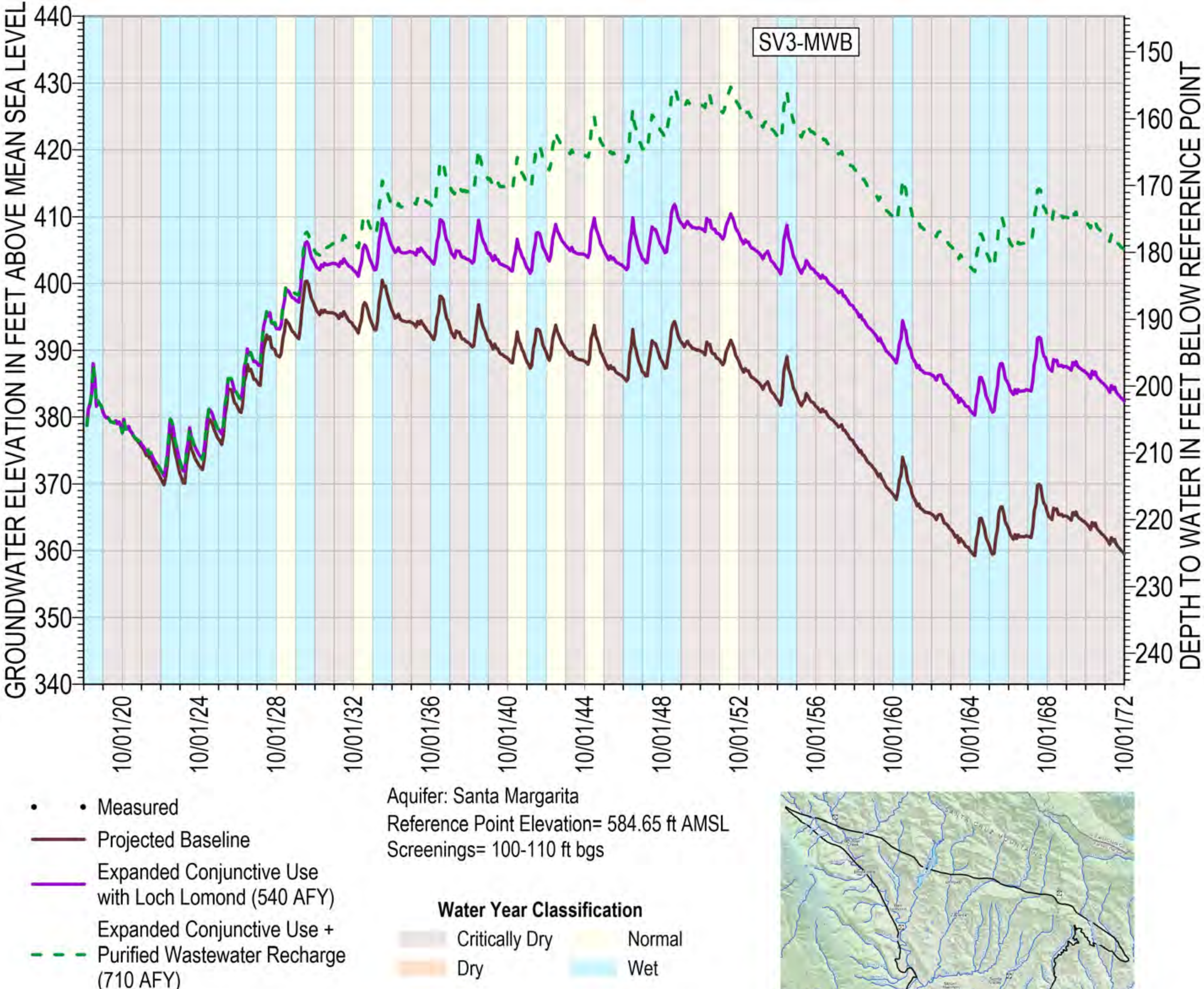
Expanded Conjunctive Use with Loch Lomond (540 AFY)

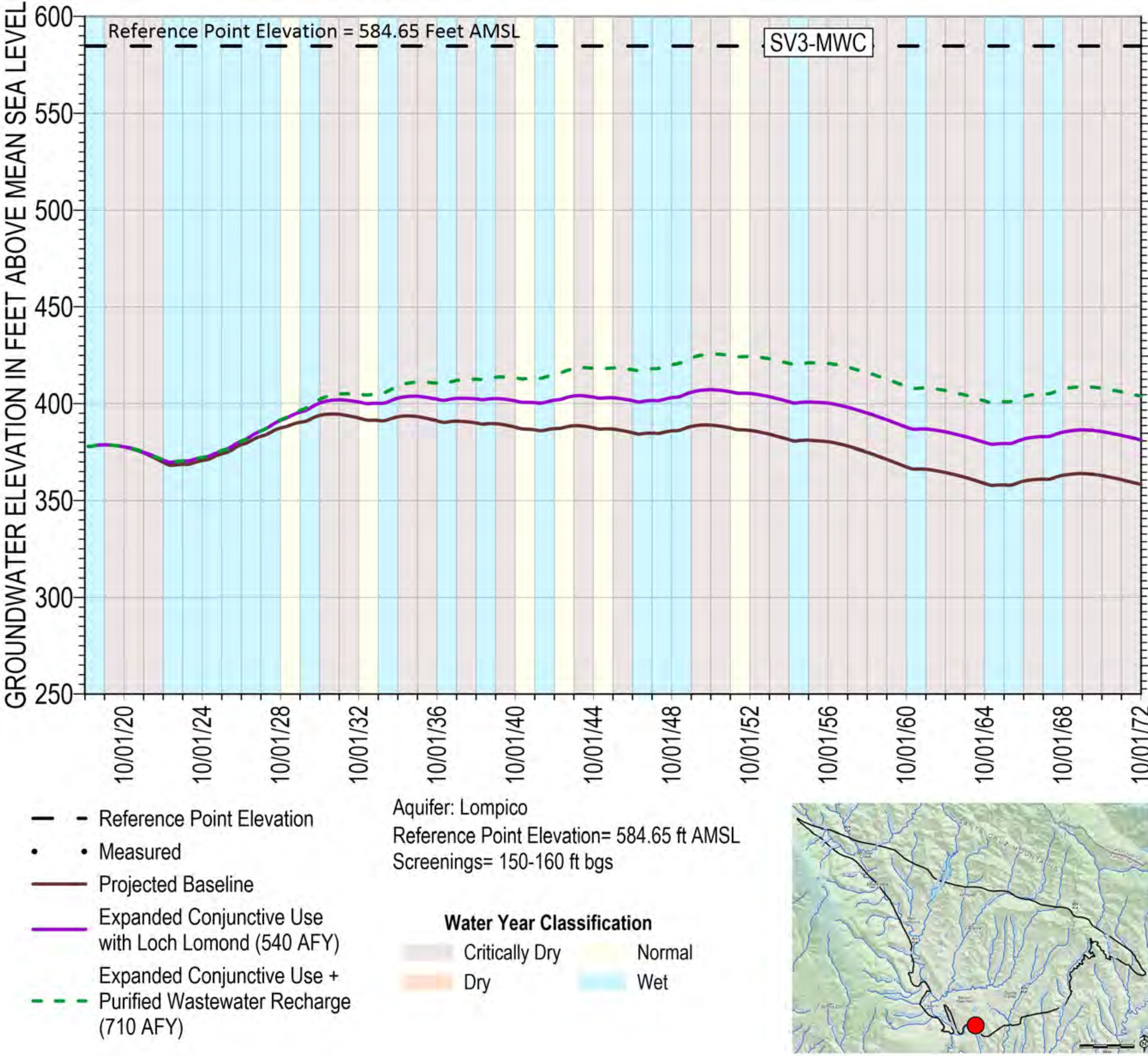
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 576.8 ft AMSL
Screenings= 70-76, 115-121 ft bgs

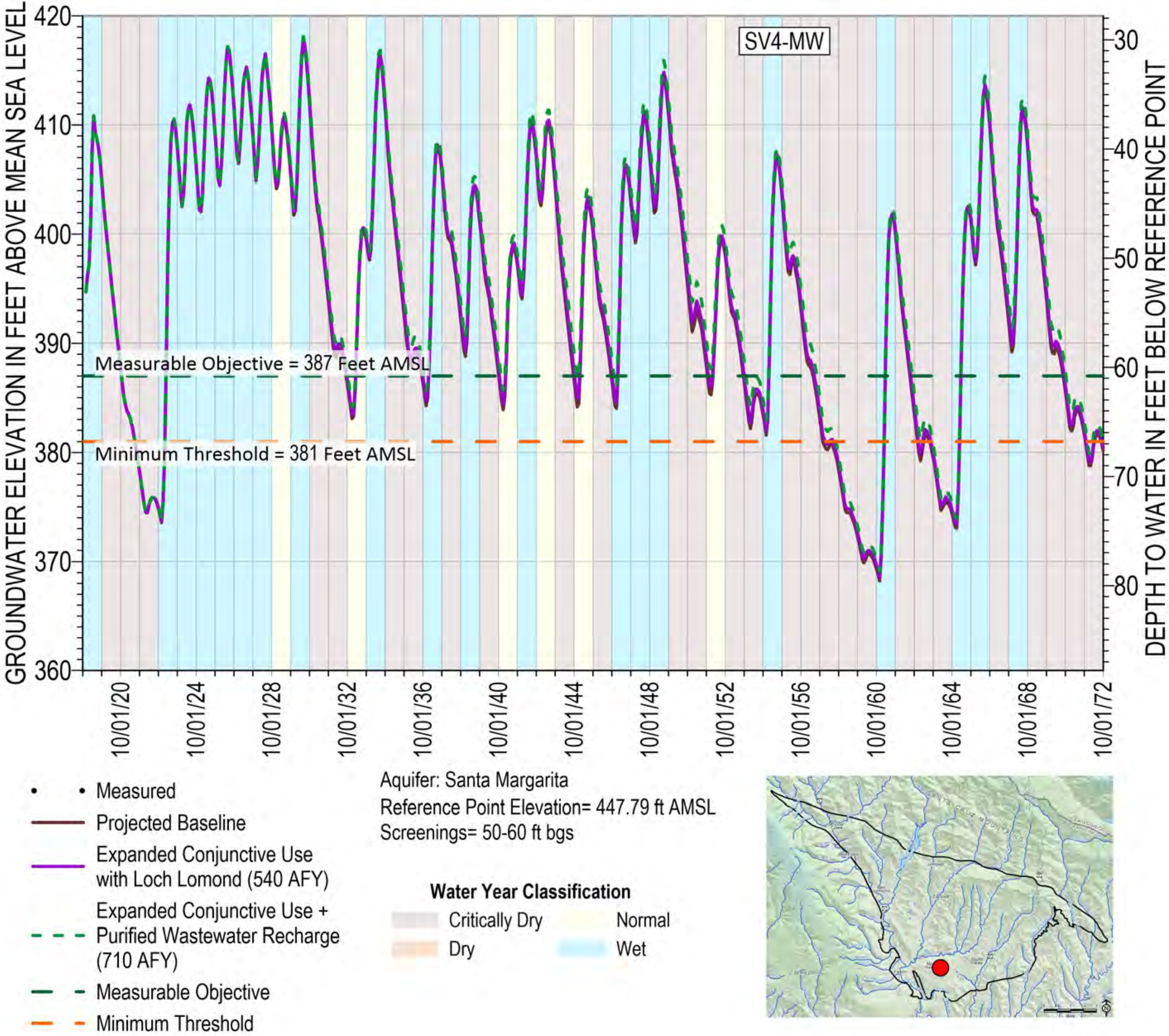
Water Year Classification

Critically Dry | Normal
Dry | Wet

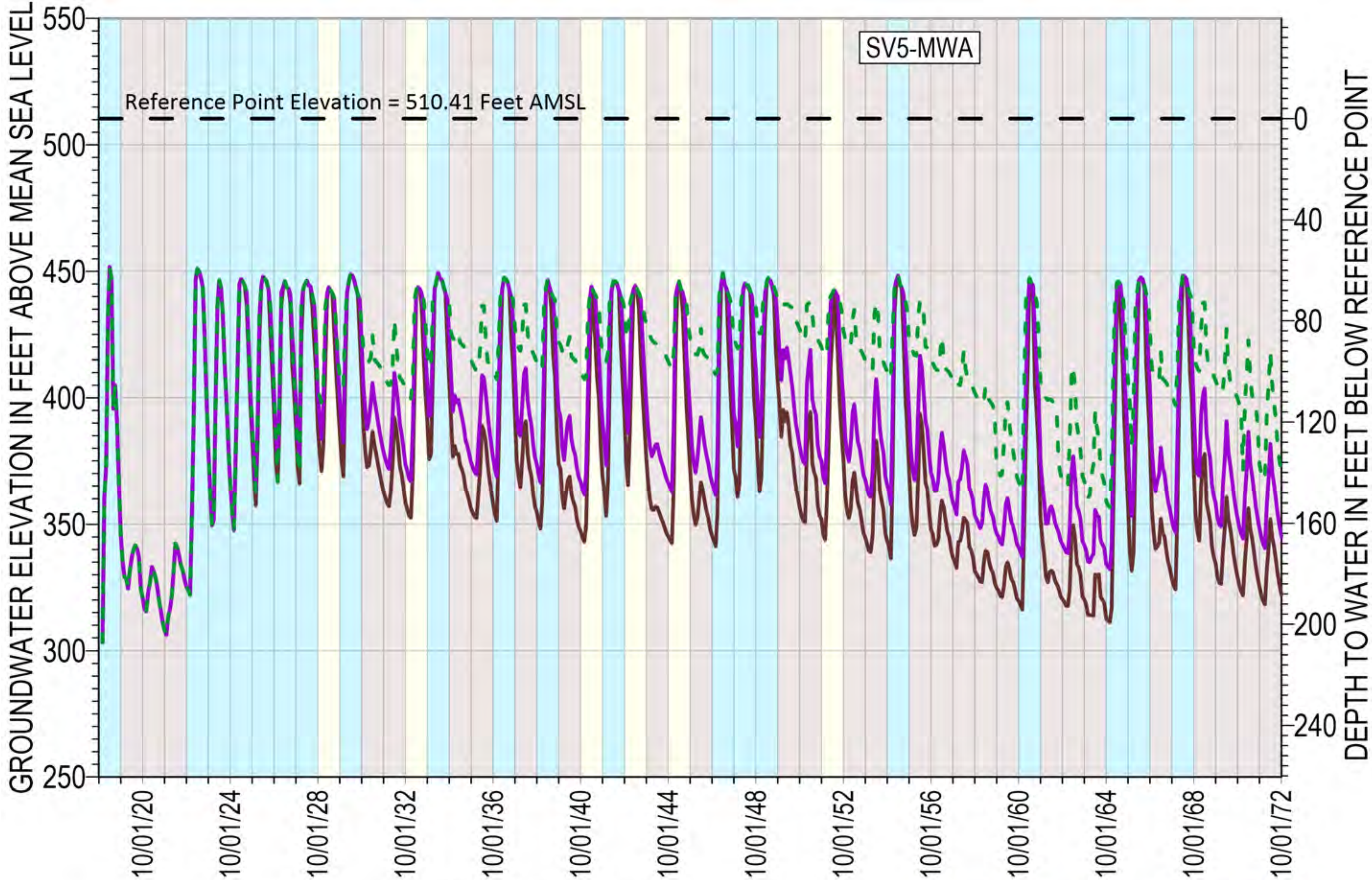

SV3-MWB
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Santa Margarita
Reference Point Elevation= 584.65 ft AMSL
Screenings= 100-110 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



Reference Point Elevation = 584.65 Feet AMSL
SV3-MWC
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
550
500
450
400
350
300
250
0
40
80
120
160
200
240
280
320
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Lompico
Reference Point Elevation= 584.65 ft AMSL
Screenings= 150-160 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



SV4-MW
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
420
410
400
390
380
370
360
30
40
50
60
70
80
Measurable Objective = 387 Feet AMSL
Minimum Threshold = 381 Feet AMSL
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Santa Margarita
Reference Point Elevation= 447.79 ft AMSL
Screenings= 50-60 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 510.41 ft AMSL

Screenings= Unknown ft bgs

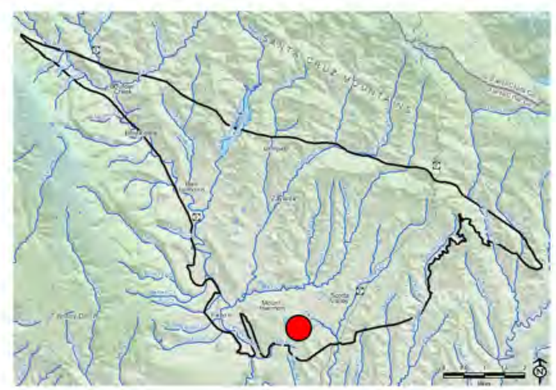
Water Year Classification

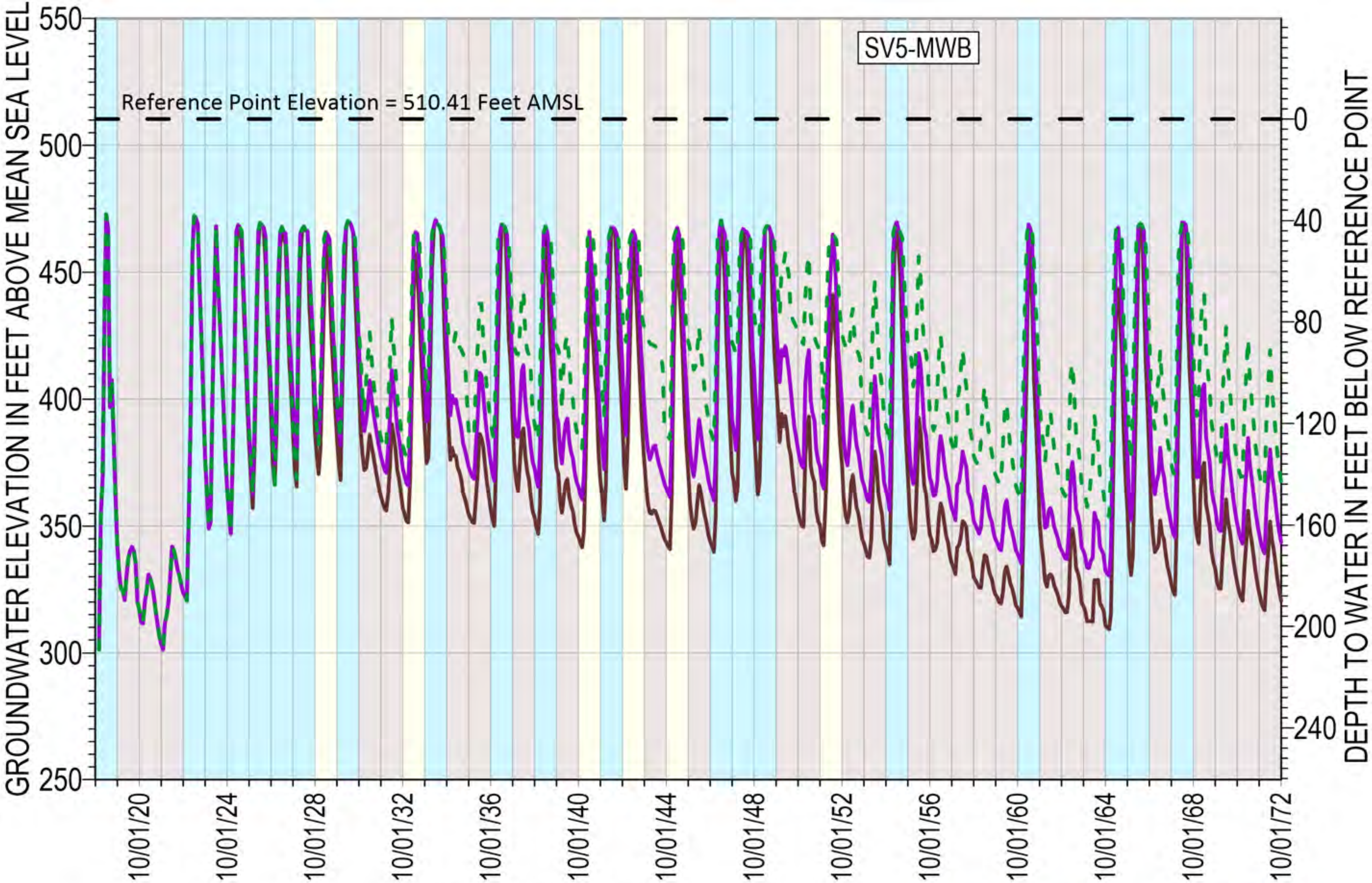
Critically Dry

Normal

Dry

Wet





Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 510.41 ft AMSL

Screenings= 20-40, 60-80 ft bgs

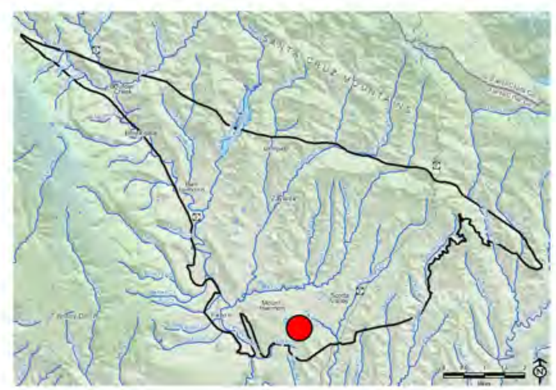
Water Year Classification

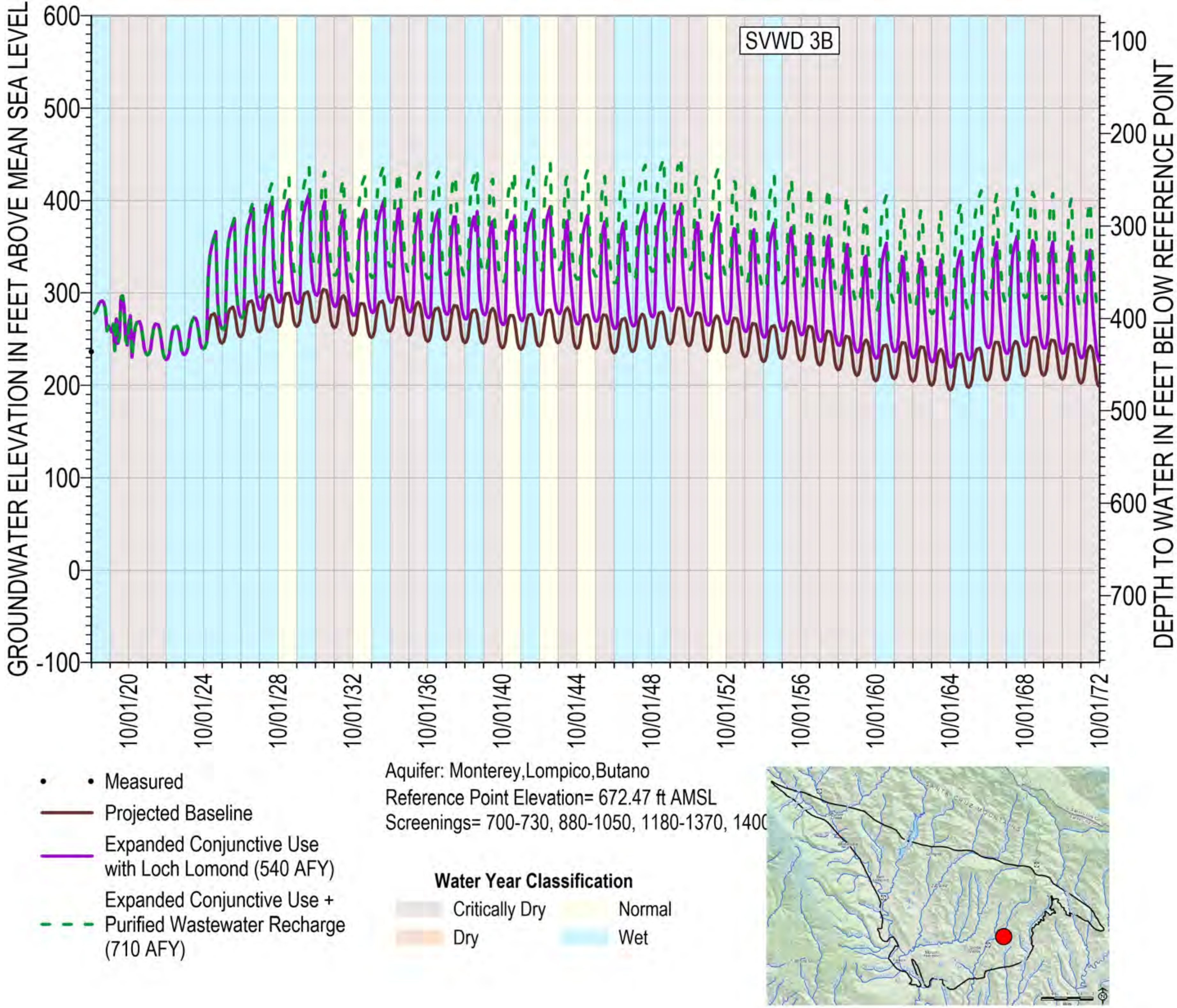
Critically Dry

Normal

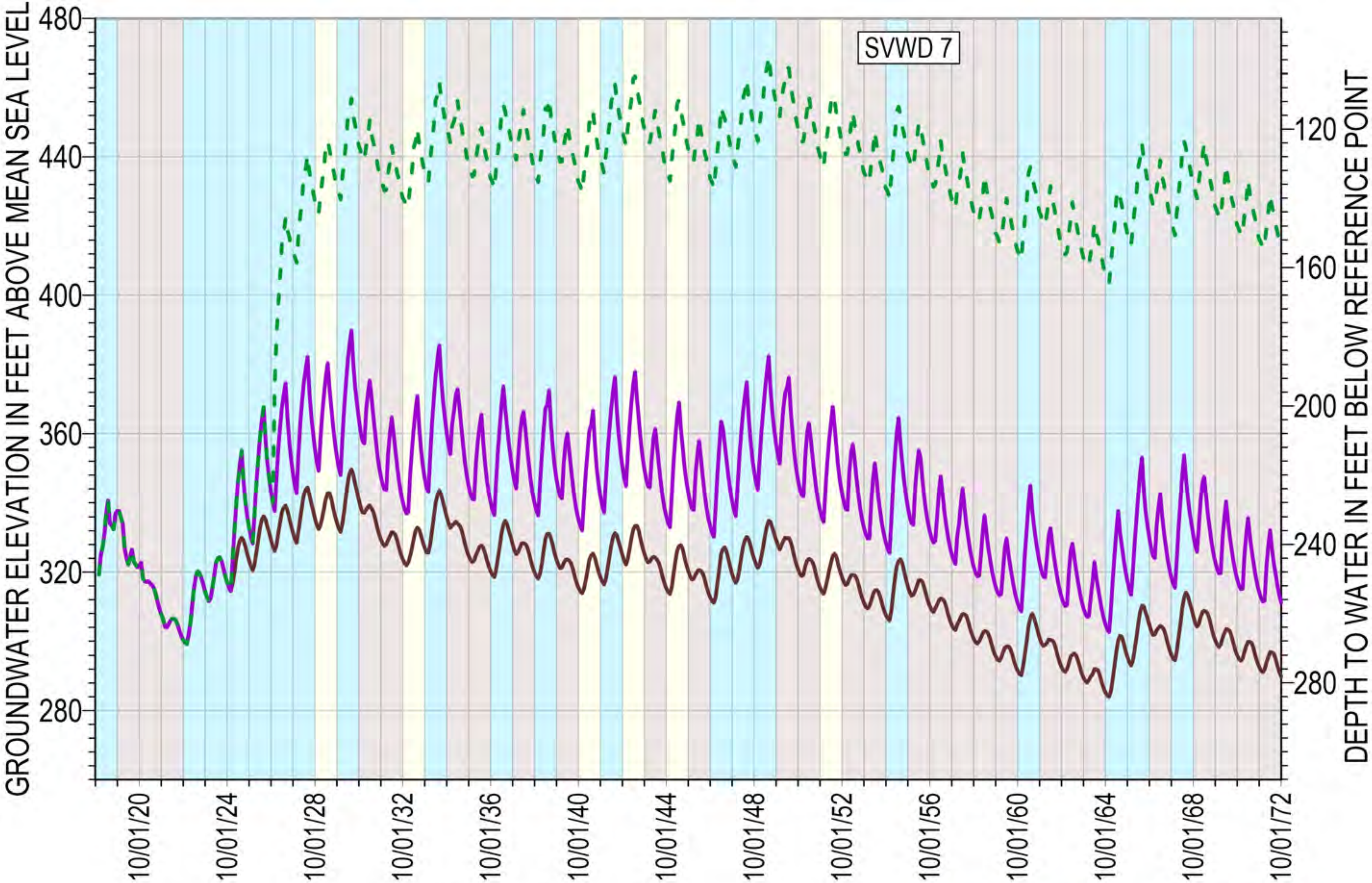
Dry

Wet





SVWD 3B
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
600
500
400
300
200
100
0
-100
100
200
300
400
500
600
700
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Monterey,Lompico,Butano
Reference Point Elevation= 672.47 ft AMSL
Screenings= 700-730, 880-1050, 1180-1370, 1400
Water Year Classification
Critically Dry
Normal
Dry
Wet

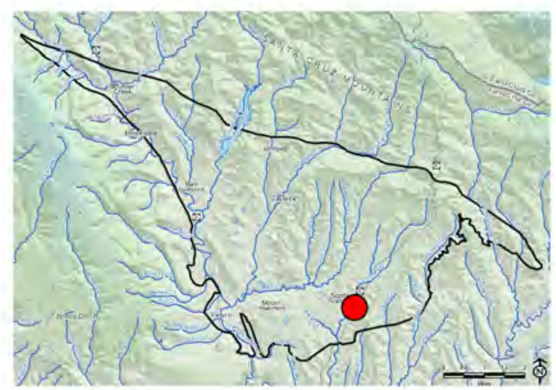


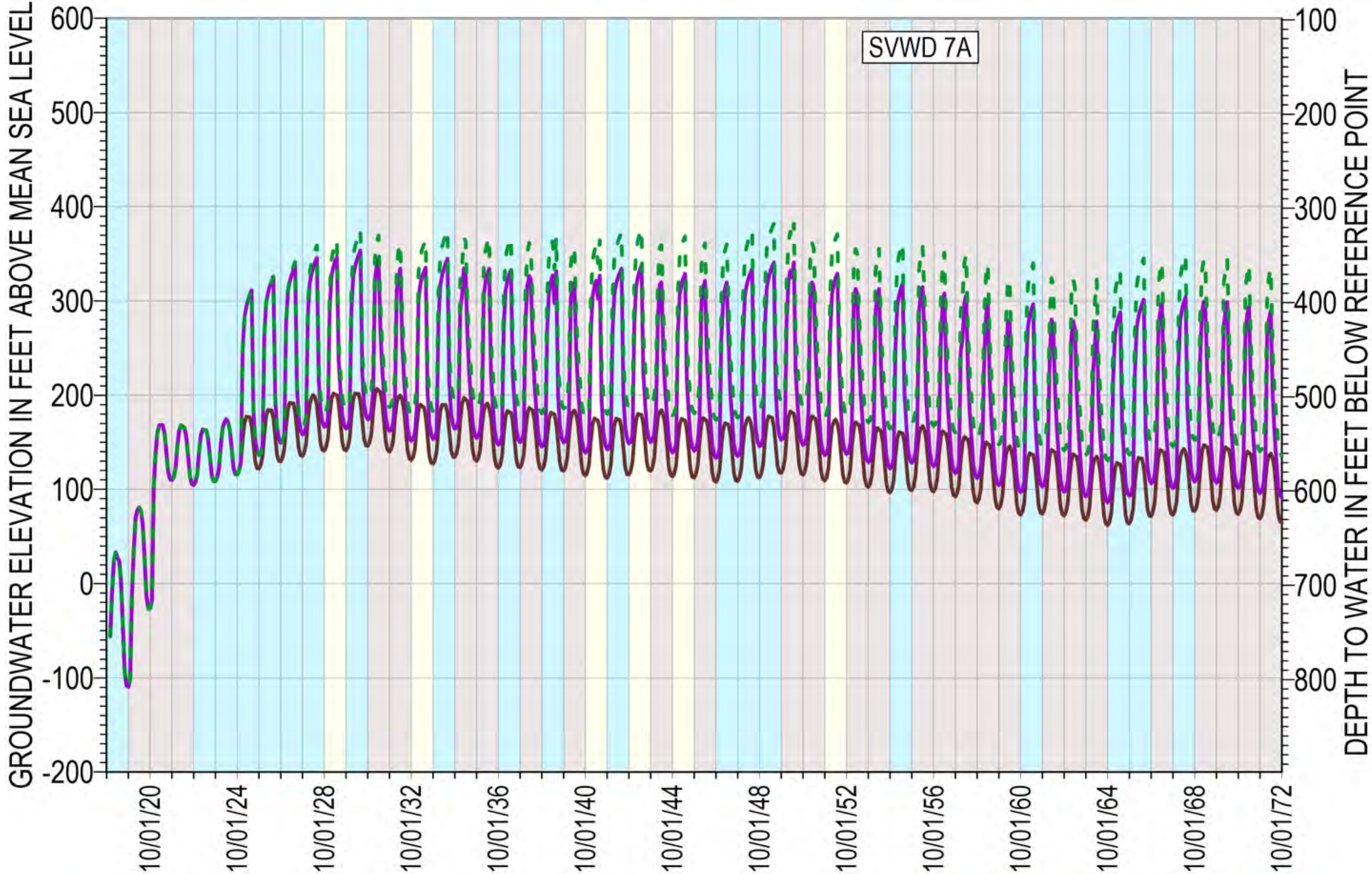
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico
Reference Point Elevation= 568.05 ft AMSL
Screenings= 200-240, 250-270, 292-332 ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet





• • Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Lompico,Butano

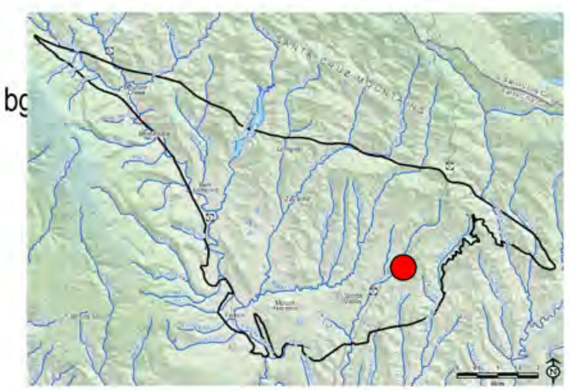
Reference Point Elevation= 698.25 ft AMSL

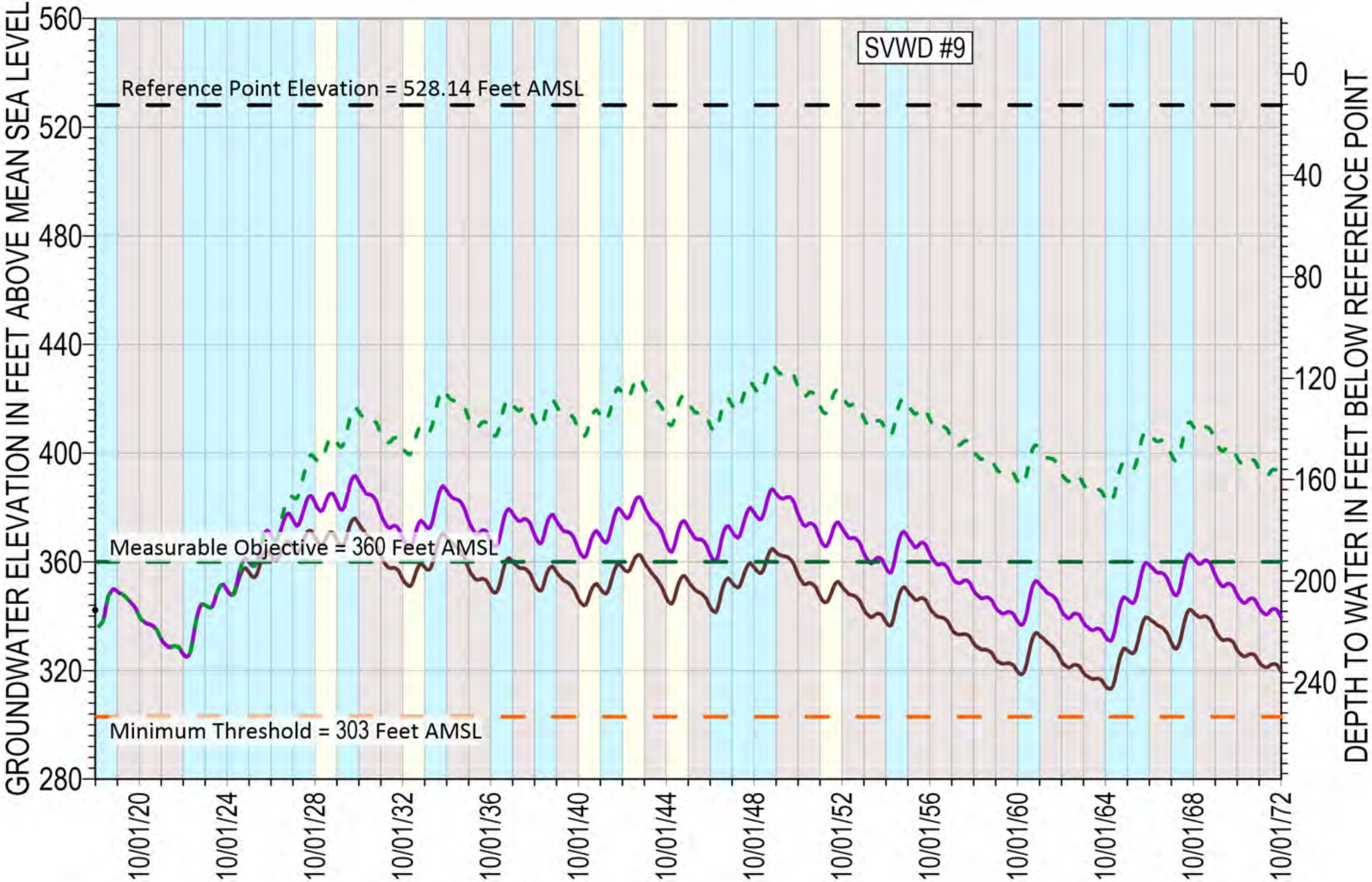
Screenings= 700-900, 1000-1150, 1250-1450 ft bg

Water Year Classification

Critically Dry | Normal

Dry | Wet



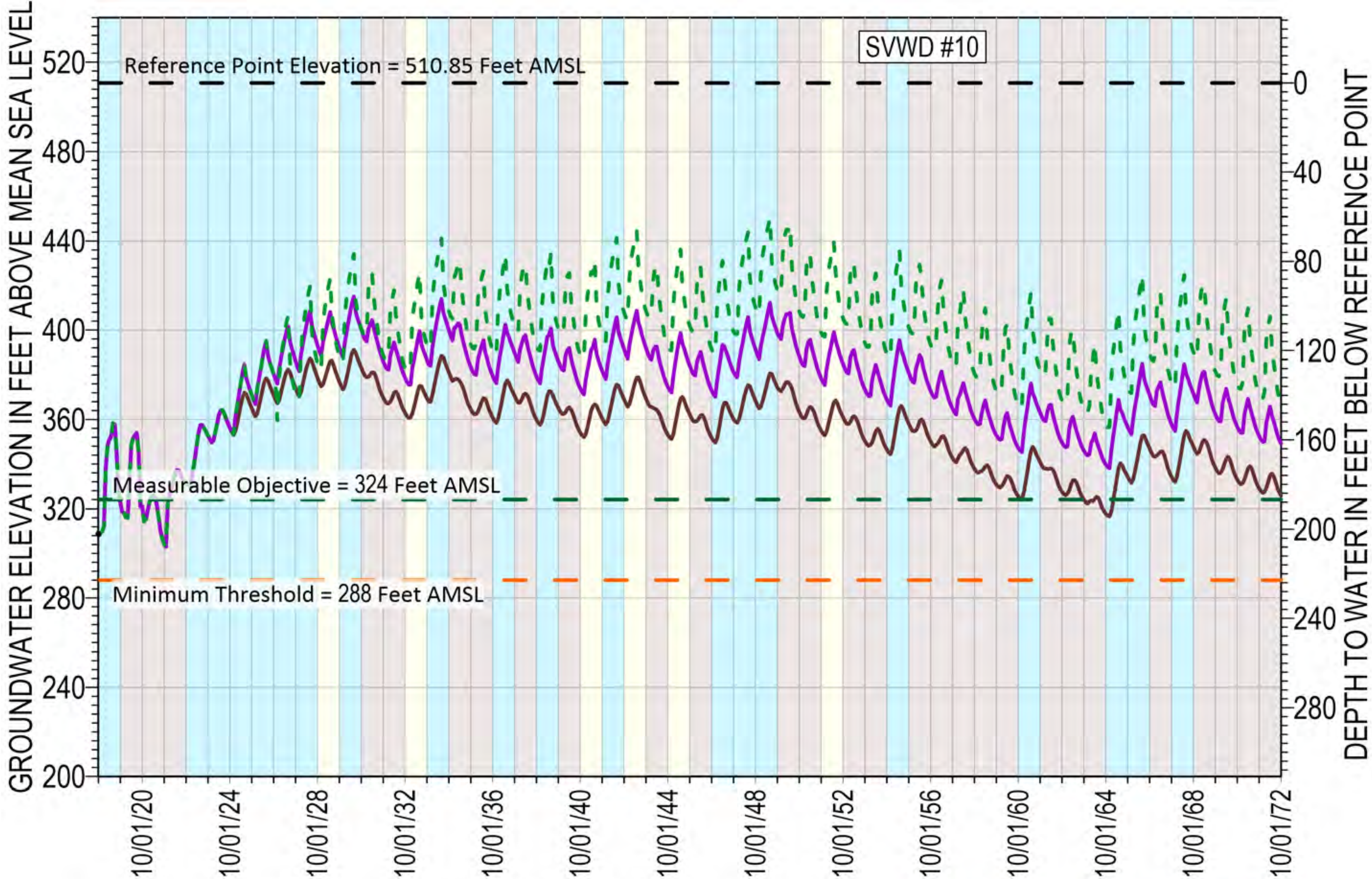


Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Monterey
Reference Point Elevation= 528.14 ft AMSL
Screenings= Unknown ft bgs

Water Year Classification

Critically Dry
Normal
Dry
Wet

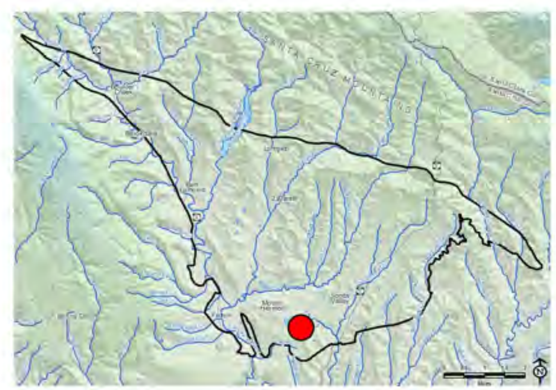


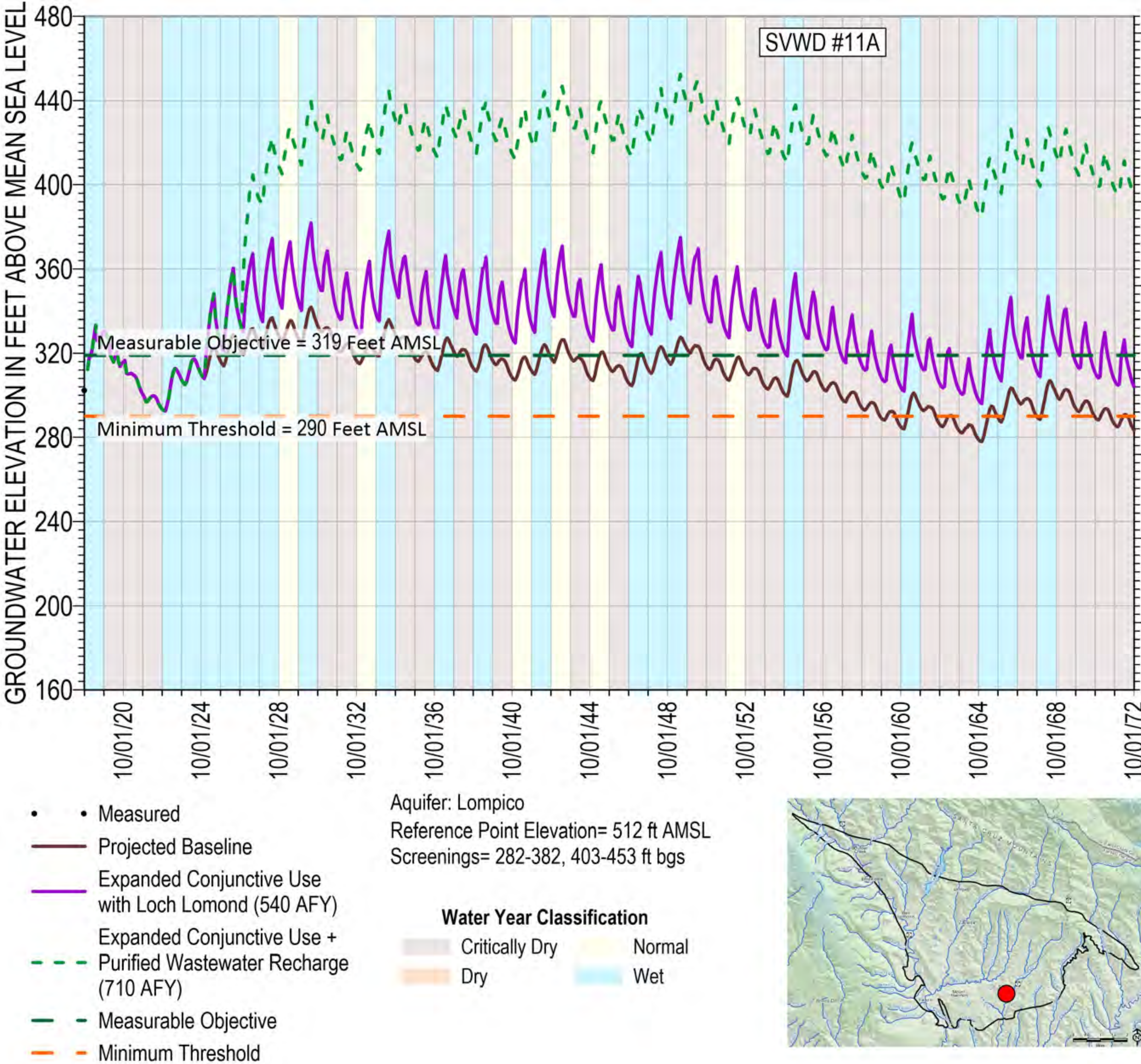
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold

Aquifer: Santa Margarita,Lompico
Reference Point Elevation= 510.85 ft AMSL
Screenings= 190-220, 240-270, 325-355 ft bgs

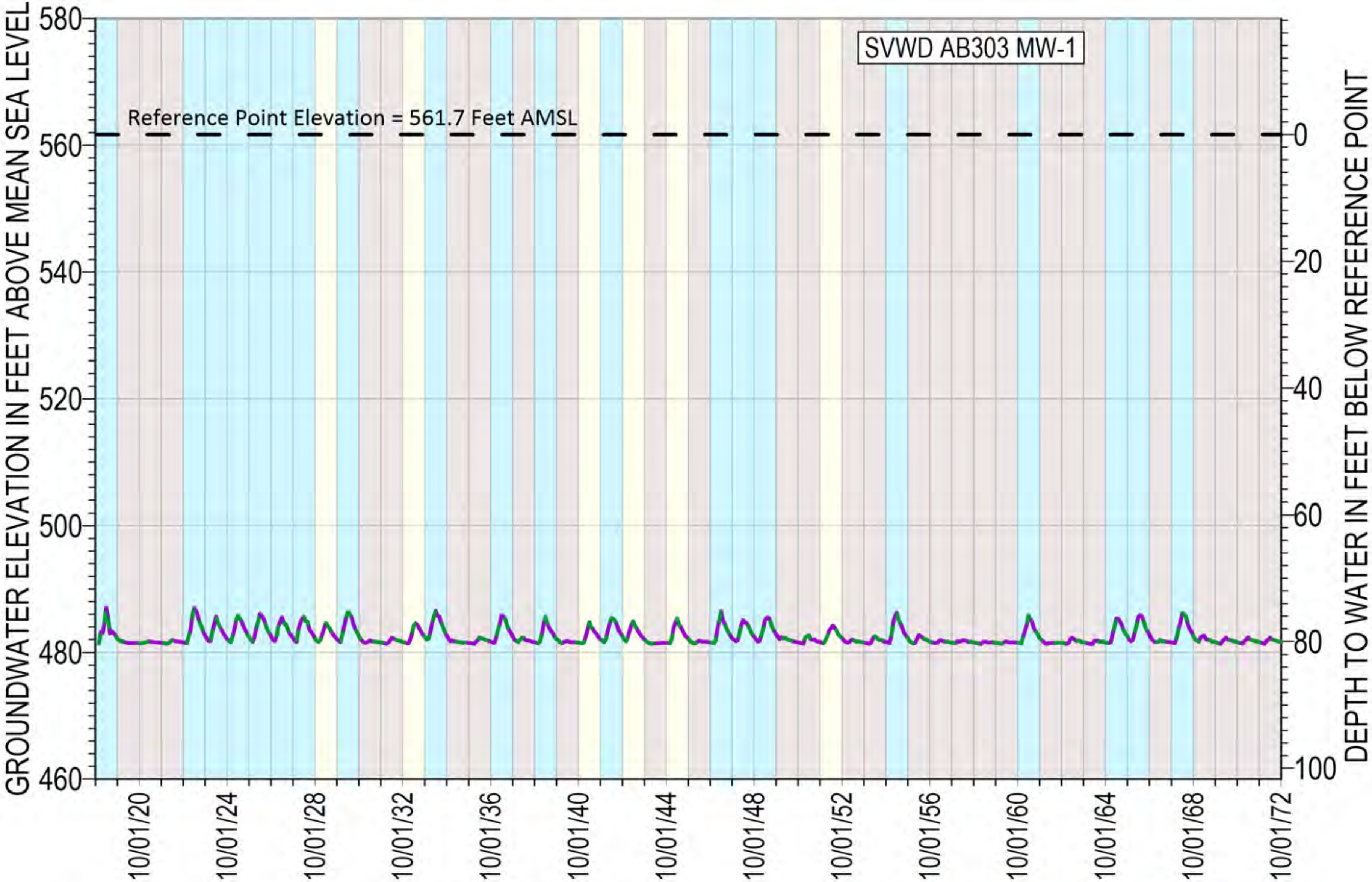
Water Year Classification

Critically Dry
Dry
Normal
Wet





SVWD #11A
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
480
440
400
360
320
280
240
200
160
40
80
120
160
200
240
280
320
Measurable Objective = 319 Feet AMSL
Minimum Threshold = 290 Feet AMSL
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Lompico
Reference Point Elevation= 512 ft AMSL
Screenings= 282-382, 403-453 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



Reference Point Elevation

Measured

Projected Baseline

Expanded Conjunctive Use with Loch Lomond (540 AFY)

Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita

Reference Point Elevation= 561.7 ft AMSL

Screenings= 114-124 ft bgs

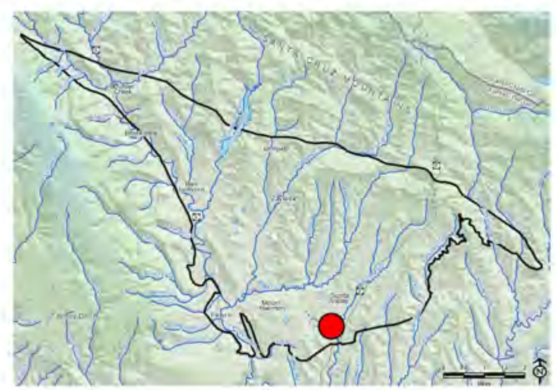
Water Year Classification

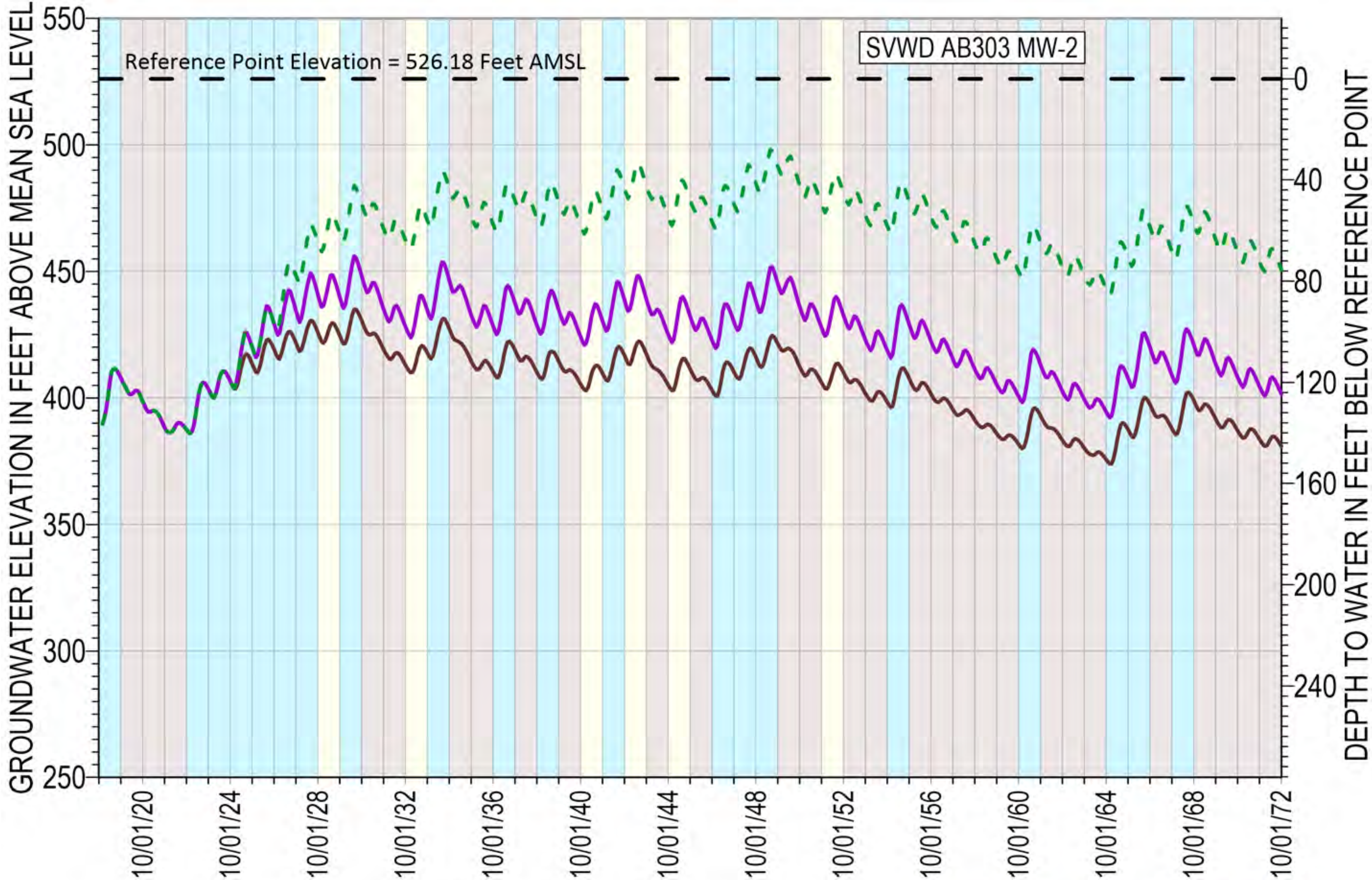
Critically Dry

Normal

Dry

Wet



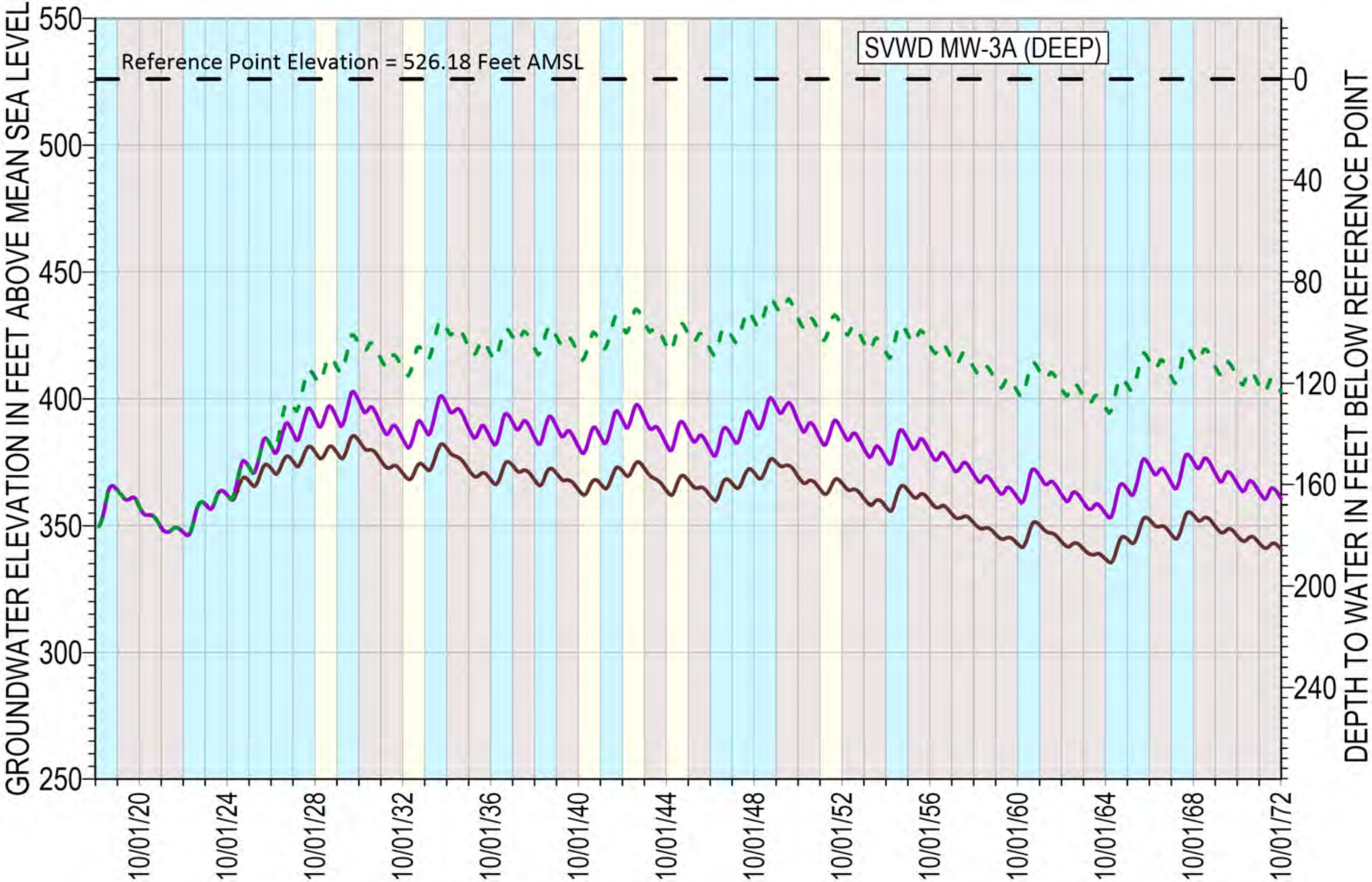


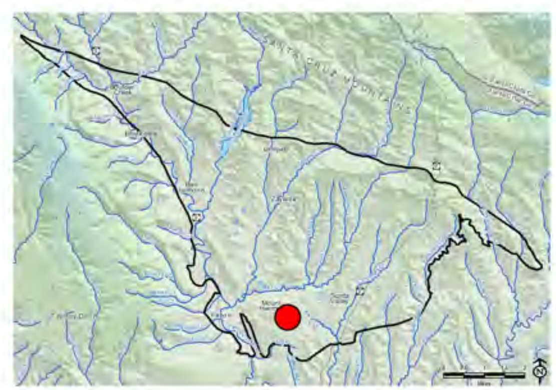
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

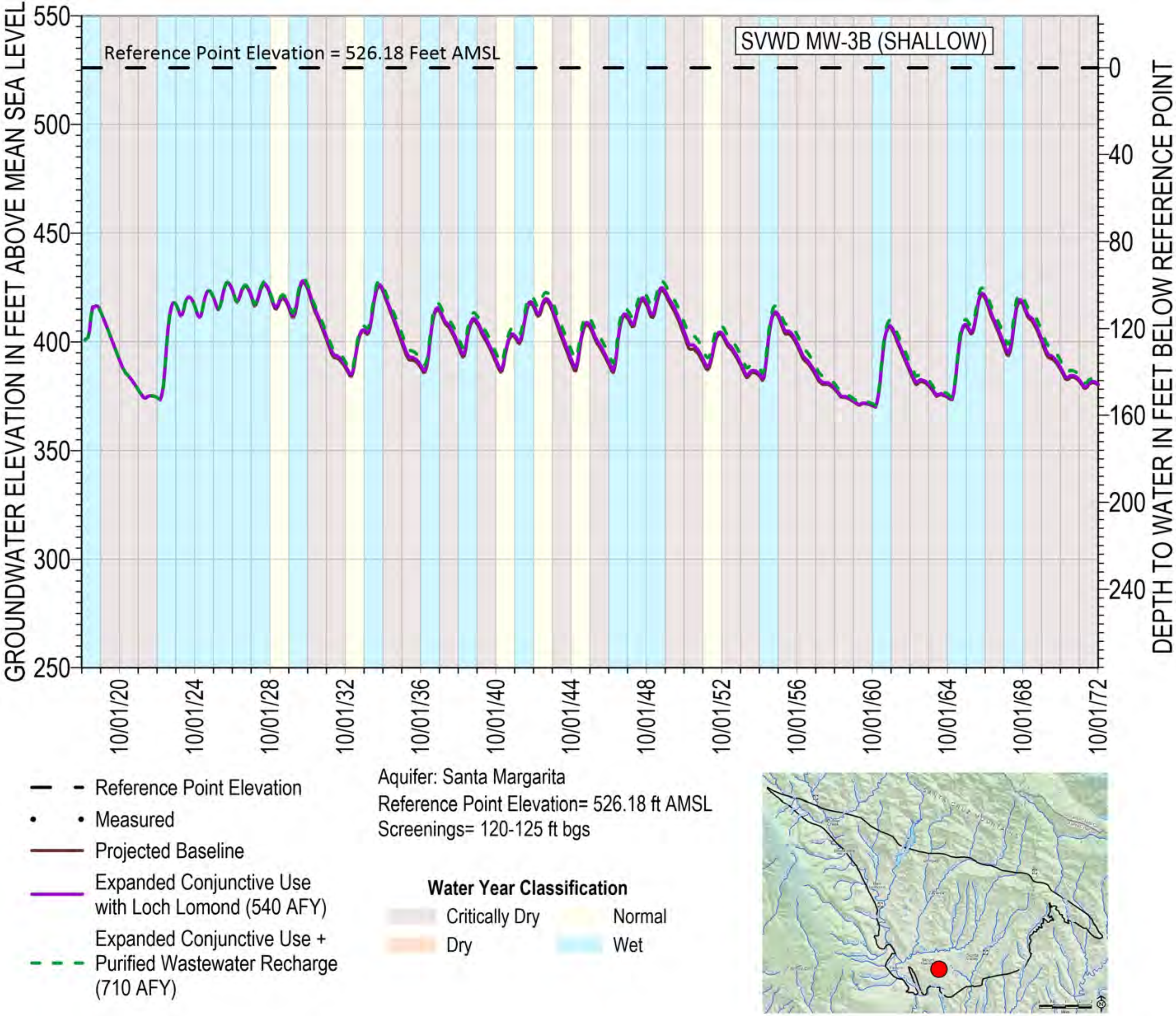
Aquifer: Lompico
Reference Point Elevation= 526.18 ft AMSL
Screenings= 705-715, 810-850 ft bgs

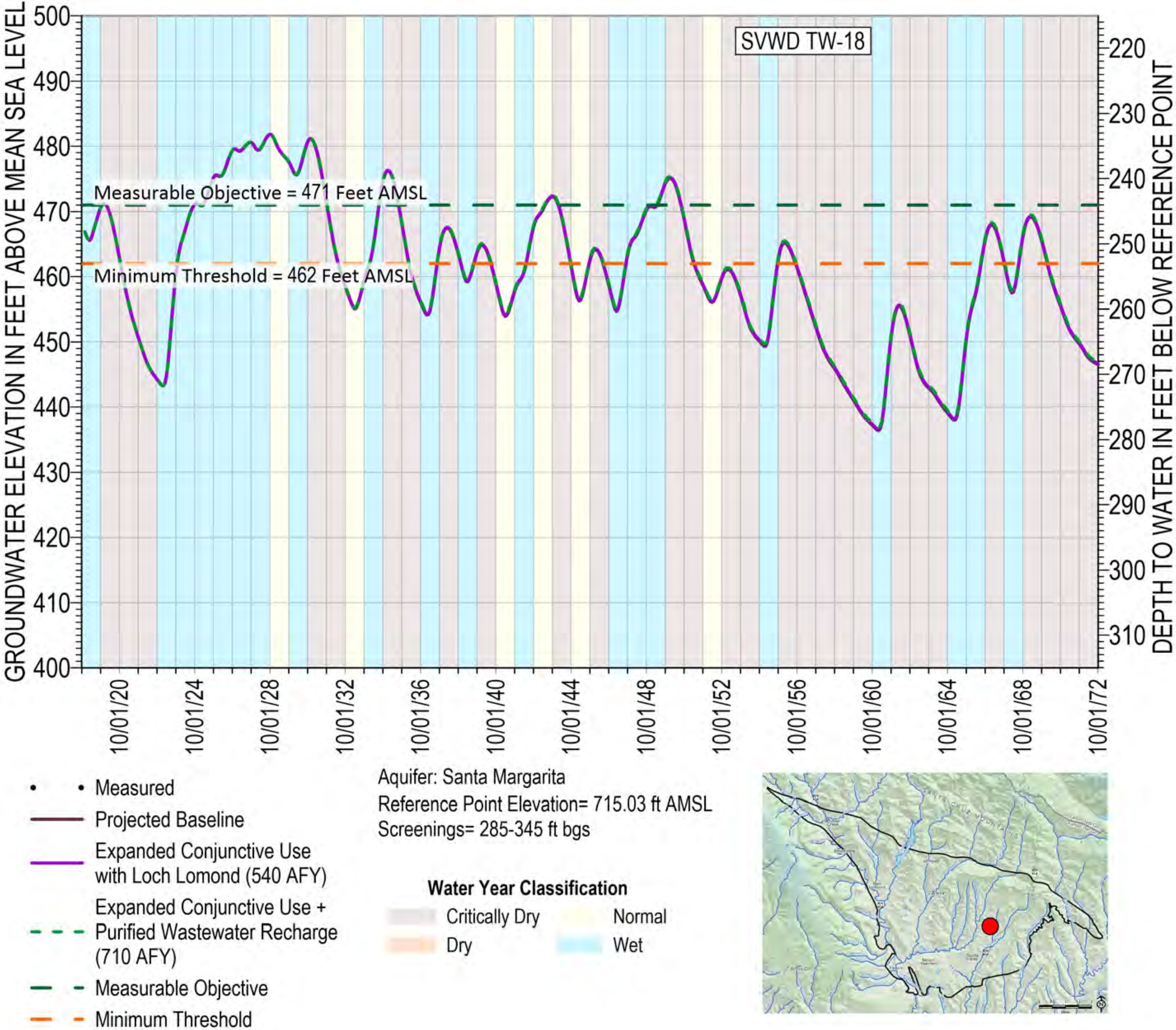
Water Year Classification

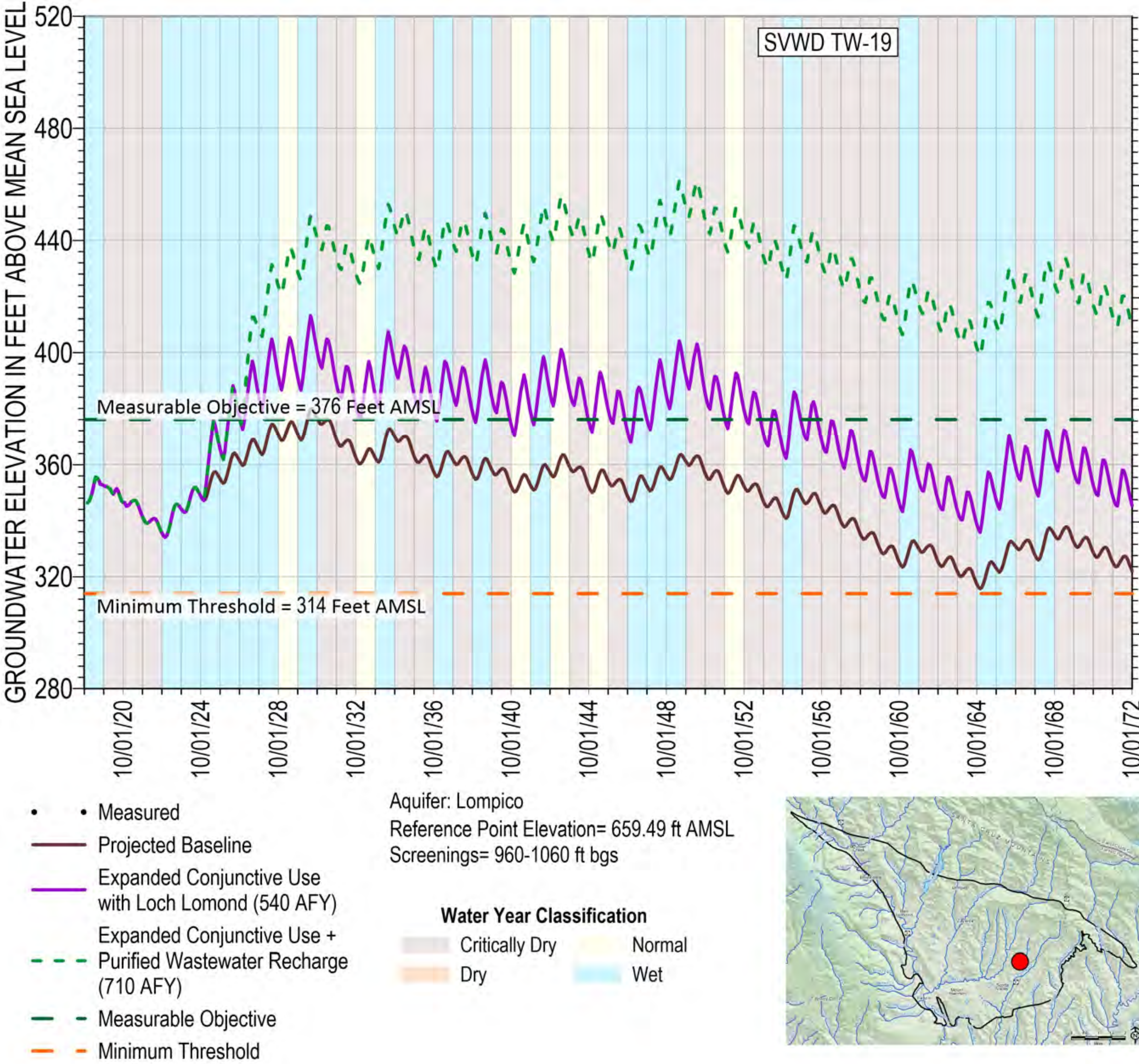
Critically Dry
Normal
Dry
Wet


SVWD MW-3A (DEEP)
Reference Point Elevation = 526.18 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
550
500
450
400
350
300
250
0
40
80
120
160
200
240
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Lompico
Reference Point Elevation= 526.18 ft AMSL
Screenings= 630-680 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet

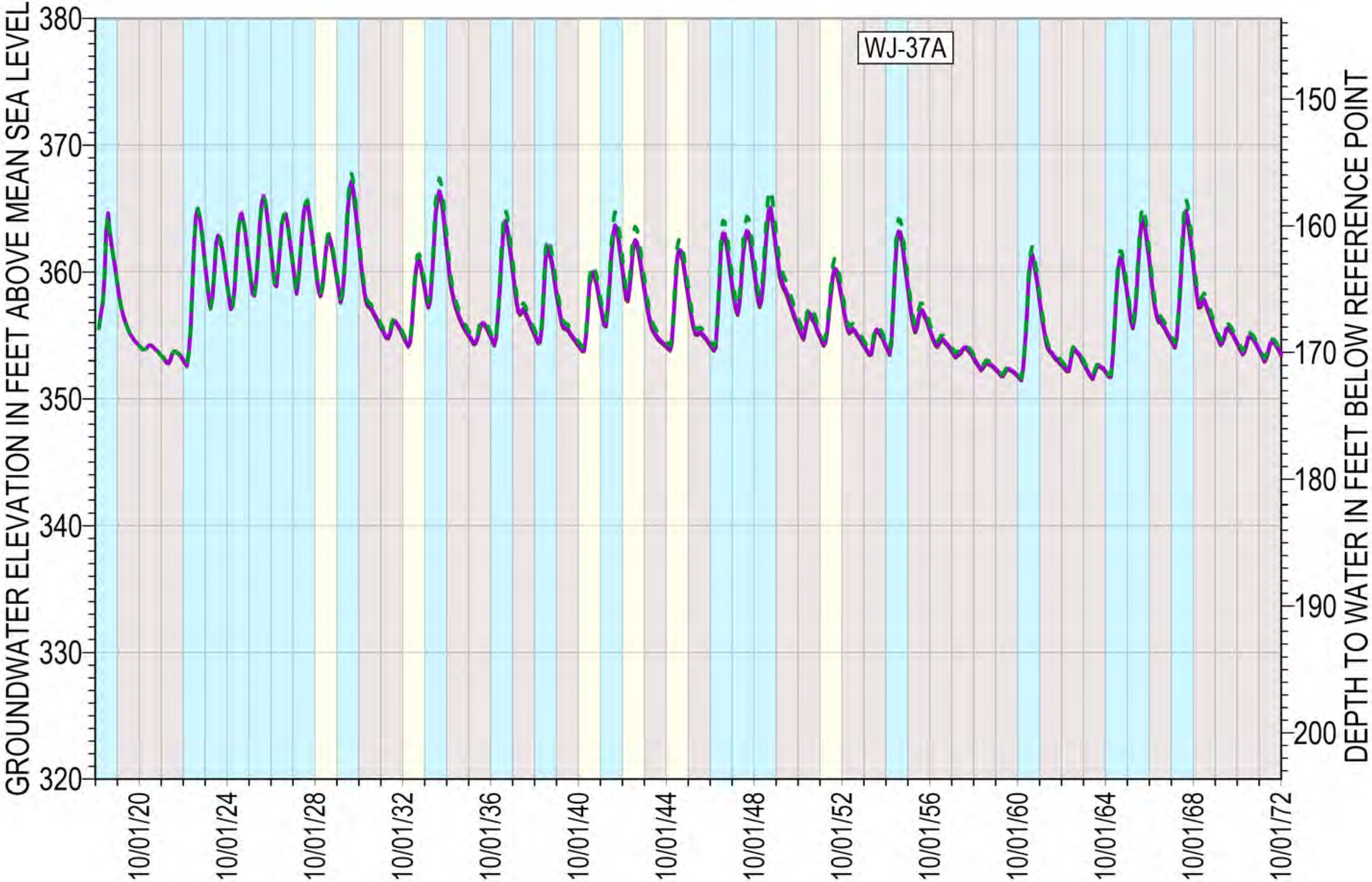



SVWD MW-3B (SHALLOW)
Reference Point Elevation = 526.18 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
550
500
450
400
350
300
250
0
40
80
120
160
200
240
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Reference Point Elevation
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Aquifer: Santa Margarita
Reference Point Elevation= 526.18 ft AMSL
Screenings= 120-125 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet


SVWD TW-18
Measurable Objective = 471 Feet AMSL
Minimum Threshold = 462 Feet AMSL
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
500
490
480
470
460
450
440
430
420
410
400
220
230
240
250
260
270
280
290
300
310
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Santa Margarita
Reference Point Elevation= 715.03 ft AMSL
Screenings= 285-345 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



SVWD TW-19
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
DEPTH TO WATER IN FEET BELOW REFERENCE POINT
Measurable Objective = 376 Feet AMSL
Minimum Threshold = 314 Feet AMSL
280
320
360
400
440
480
520
160
200
240
280
320
360
10/01/20
10/01/24
10/01/28
10/01/32
10/01/36
10/01/40
10/01/44
10/01/48
10/01/52
10/01/56
10/01/60
10/01/64
10/01/68
10/01/72
Measured
Projected Baseline
Expanded Conjunctive Use with Loch Lomond (540 AFY)
Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)
Measurable Objective
Minimum Threshold
Aquifer: Lompico
Reference Point Elevation= 659.49 ft AMSL
Screenings= 960-1060 ft bgs
Water Year Classification
Critically Dry
Normal
Dry
Wet



- Measured
- Projected Baseline
- Expanded Conjunctive Use with Loch Lomond (540 AFY)
- Expanded Conjunctive Use + Purified Wastewater Recharge (710 AFY)

Aquifer: Santa Margarita
Reference Point Elevation= 523.65 ft AMSL
Screenings= 172-202 ft bgs

Water Year Classification

Critically Dry	Normal
Dry	Wet