Draft

Groundwater Sustainability Plan
Chapter 5 –Groundwater Conditions

for the

Arroyo Grande Groundwater Subbasin Groundwater Sustainability Agency

Prepared by

11/5/2021

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LIST OF TERMS USED

Abbreviation	**Definition**
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
AG Subbasin	Arroyo Grande Groundwater Subbasin
Basin Plan	Water Quality Control Plan for the Central Coast Subbasin
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of Arroyo Grande
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ET_0	Evapotranspiration
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter

Abbreviation	**Definition**
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCCAG	Natural Communities Commonly Associated with Groundwater
NCDC	National Climate Data Center
NCMA	Northern Cities Management Area
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SMCL	Secondary Maximum Contaminant Level
SMRVGB	Santa Maria River Valley Groundwater Basin
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SSURGO	Soil Survey Geographic Database
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USDA-NRCS	United States Department of Agriculture – Natural Resources Conservation Service
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

5 GROUNDWATER CONDITIONS (§ 354.16)

This section describes the current and historical groundwater conditions in the Alluvial Aquifer in the Arroyo Grande Subbasin of the SMRVGB. In accordance with the SGMA Emergency Regulations §354.16, current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. This Chapter focuses on information required by the GSP regulations and information that is important for developing an effective understanding of current and historical groundwater conditions in the Subbasin, and ultimately to develop a plan to achieve sustainability. The six sustainability indicators specified in the GSP regulations are as follows:

1. Chronic lowering of groundwater elevations;
2. Groundwater storage reductions;
3. Seawater intrusion;
4. Land subsidence;
5. Depletion of interconnected surface waters, and;
6. Degradation of groundwater quality.

The Arroyo Grande Subbasin is hydraulically connected to the Santa Maria Subbasin and, by association, the Pacific Ocean. However, the base of alluvial sediments in the Arroyo Grande Subbasin is above sea level (Figure 4-4), therefore seawater intrusion is not an issue and will not be discussed further in this GSP.

5.1 GROUNDWATER ELEVATIONS AND INTERPRETATION

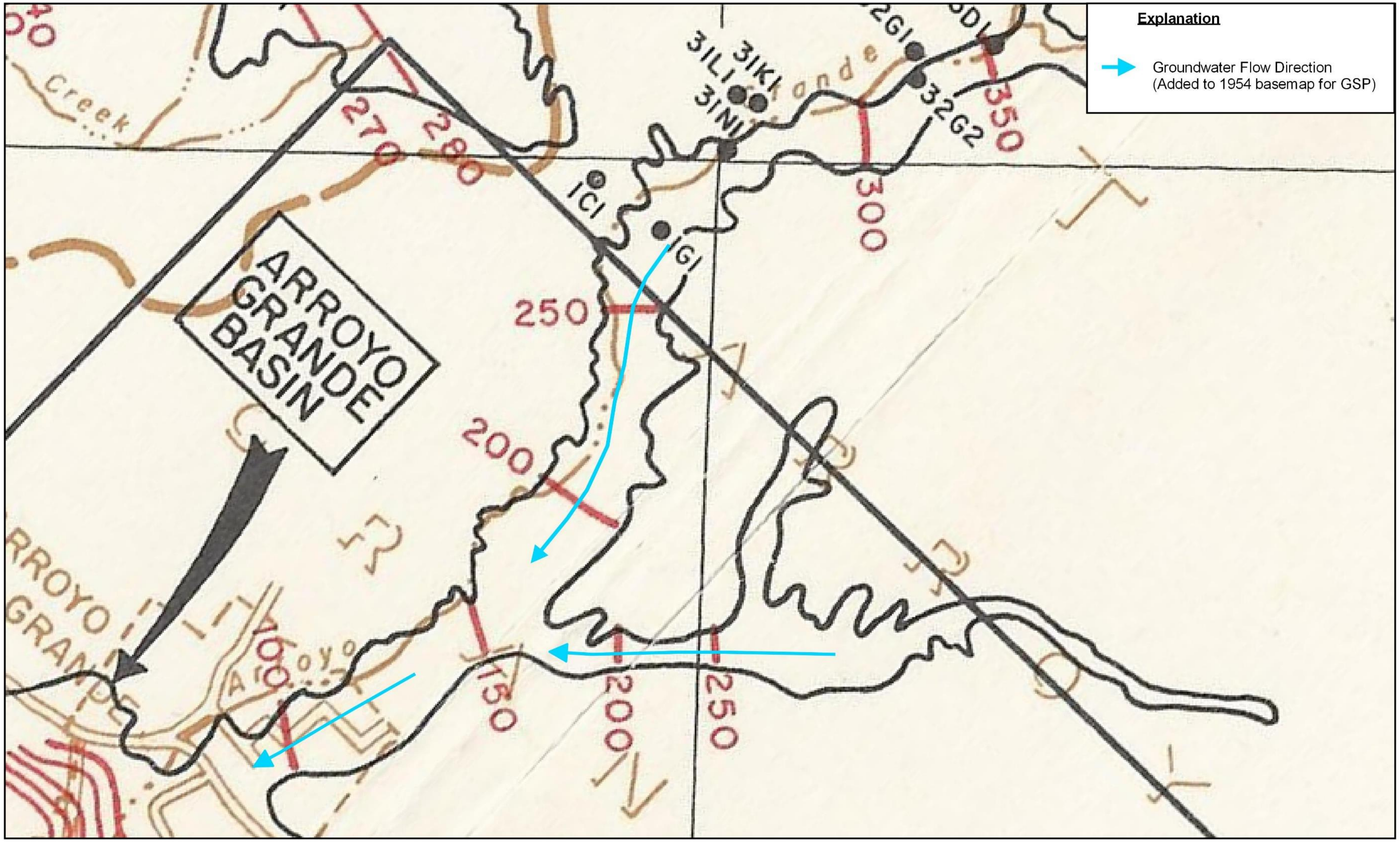
As discussed in Chapter 4, the Subbasin is comprised of a single alluvial aquifer. The groundwater elevation data is combined and presented as a single groundwater elevation map for each time period presented. As discussed in Chapter 3, Lopez Reservoir is a major public works project operating at the upstream boundary of the Subbasin. The reservoir has a storage capacity of 49,388 acre-feet and a safe yield of 8,730 acre-feet that is distributed as municipal diversions (4,530 acre-feet) and downstream releases (4,200 acre-feet). (Water Systems Consulting, Inc., 2021)

In general, the primary direction of groundwater flow in the Subbasin is from the areas of highest groundwater elevations (Lopez Dam on the northern Subbasin boundary and Tar Spring Creek at the eastern boundary) to where the flow leaves the Subbasin near Highway 101. Groundwater in the Arroyo Grande Creek Valley flows south-southwest and parallel to the valley axis, while groundwater in the Tar Spring Creek valley flows west along the tributary valley and into the Arroyo Grande Creek valley. Groundwater Elevation maps for various recent and historical time periods are presented and discussed in the following sections.

5.1.1 Fall 1954 Groundwater Elevations

DWR published a series of maps (DWR, 1958) depicting groundwater elevations for various basins in the County, including groundwater elevations in the Arroyo Grande Subbasin for fall 1954 (Figure 5-1). Groundwater flow direction arrows were added to Figure 5-1 for this GSP to illustrate the primary direction of flow in the Basin. This is the oldest Subbasin-wide groundwater elevation map available, and pre-dates construction of Lopez Reservoir. The hydraulic gradient (the ratio of horizontal distance along the groundwater flow path to the change in elevation) in the main valley in fall 1954, based on the elevation contours, was approximately 0.007 feet/foot (ft/ft). In the Tar Spring Creek valley portion of the Subbasin, the dominant groundwater flow direction is westward from the higher groundwater elevations at the east Subbasin boundary to lower elevations at the confluence with the Arroyo Grande Creek Valley. The gradient in lower Tar Spring Creek valley was estimated to be double that in the Arroyo Grande Creek

Valley, approximately 0.015 ft/ft. The discharge point for both surface water and groundwater are coincident with the area where Arroyo Grande Creek leaves the Subbasin.



Prepared For:

Author: TK
Date: 11/03/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: San Luis Obispo County Investigation
State Water Resources Bulletin No. 18, Plate 9B, May 1958

Notes:
1.
2.
3.

**Groundwater Elevation Surface
Fall 1954**

Figure 5-1

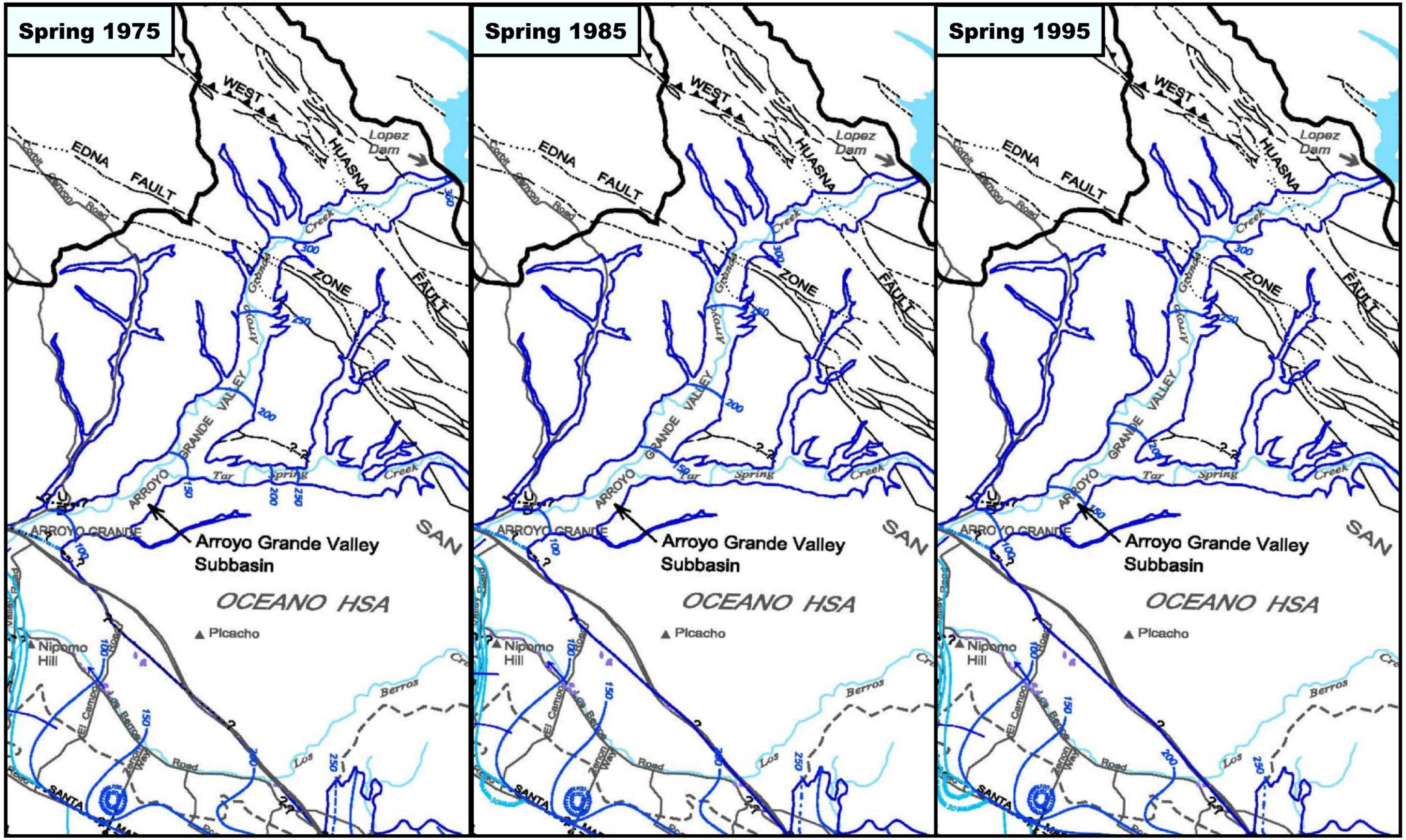
5.1.2 Spring 1975, 1985, and 1995 Groundwater Elevations

As part of their 2002 Report of *Water Resources of the Arroyo Grande - Nipomo Mesa Area* (DWR, 2002), DWR mapped water level elevations in the Arroyo Grande Creek Valley Subbasin in Spring of 1975, 1985 and 1995. A digitized recreation of the DWR groundwater elevation contours for these three years is presented in Figure 5-2**Error! Reference source not found.** and displays patterns of groundwater flow direction in the Basin similar to those exhibited in the DWR 1954 map. Groundwater elevation data was compiled from San Luis Obispo County, Santa Barbara County, USGS and DWR records as well as from drillers and local well owners. These years represented average (19.38 inches of rainfall), dry (14.87 inches of rainfall) and wet (38.34 inches of rainfall) years, respectively. Average rainfall at the Lopez Dam rain gage from 1969-2020 is 21.07 inches (Figure 3-1; Chapter 3).

In 1975 and 1985, groundwater elevations were similar through the main Arroyo Grande Creek valley, with a hydraulic gradient of approximately 0.007 ft/ft. In 1995, water levels appear up to 30-35 feet higher in the middle of the Subbasin, where the Tar Spring Creek valley enters the main valley, although the overall hydraulic gradient from the dam to the Highway 101 remains approximately 0.007 ft/ft (Figure 5-2). Although 1995 was a wet year, releases through the dam into the Subbasin from Lopez Reservoir between April 1994 through March 1995 (2,600 acre-feet) were only 200 acre-feet more than 1985, and 60 acre-feet less than 1975. Therefore, the higher groundwater elevations through the middle of the Subbasin in 1995 are interpreted to be due to greater inflow from the Tar Spring Creek valley.

The Arroyo Grande Creek valley was recognized in the 2002 DWR report (DWR, 2002) as a subbasin bounded on the south by the Wilmar Avenue fault, which is consistent with the current southern boundary interpretation. The hydraulic gradient for outflow into the main SMRVGB across the southern Subbasin boundary was estimated from water levels contours to range from approximately 0.008 to 0.010 ft/ft, with the higher gradient in spring 1995 (a wet year).

The DWR only shows water level elevation contours in the lower Tar Spring Creek valley for 1975, with a hydraulic gradient of 0.014 ft/ft. Overall, the water level elevations and hydraulic gradients are similar to the pre-dam 1954 values.



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Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: Water Resources of the Arroyo Grande - Nipomo Mesa Area Southern District Report, 2002 (Plate 12,13,14)

Notes:
1.
2.
3.

Groundwater Elevation Surface
Spring 1975, 1985, 1995

Figure 5-2

5.1.3 Groundwater Elevation Contouring Methodology

More recent groundwater level data were obtained and used to generate groundwater elevation maps to evaluate more recent and current conditions. The following assessment of groundwater elevation conditions is based primarily on data from the San Luis Obispo County Flood Control and Water Conservation District's (SLOFCWCD) groundwater monitoring program, supplemented by field data collected for this GSP by consultant team staff in Tar Spring Creek valley in spring 2021. No water level records were available for Tar Spring Creek valley since 1989, therefore, water level monitoring was conducted in April 2021 to assist in representing both current and historical water levels.

Groundwater levels are measured by SLOFCWCD through a network of private wells in the Subbasin. Figure 5-3, Figure 5-4, Figure 5-5, Figure 5-6, and Figure 5-7 presents the contours generated from the data for the Spring 1996, Spring 2015, and Spring 2020 monitoring events. Control points are not displayed to maintain confidentiality agreements negotiated with well owners. Water year 1996 recorded above average rainfall during an overall wet period (23.29 inches of rainfall at Lopez Dam), 2015 was a dry year during extended drought (10.76 inches or rainfall), and 2020 was below average (15.25 of rainfall) and represents current conditions.

Historical water level monitoring data are available for approximately 60 wells in the Subbasin. The set of wells and data points used in the groundwater elevation assessment were selected based on the following criteria:

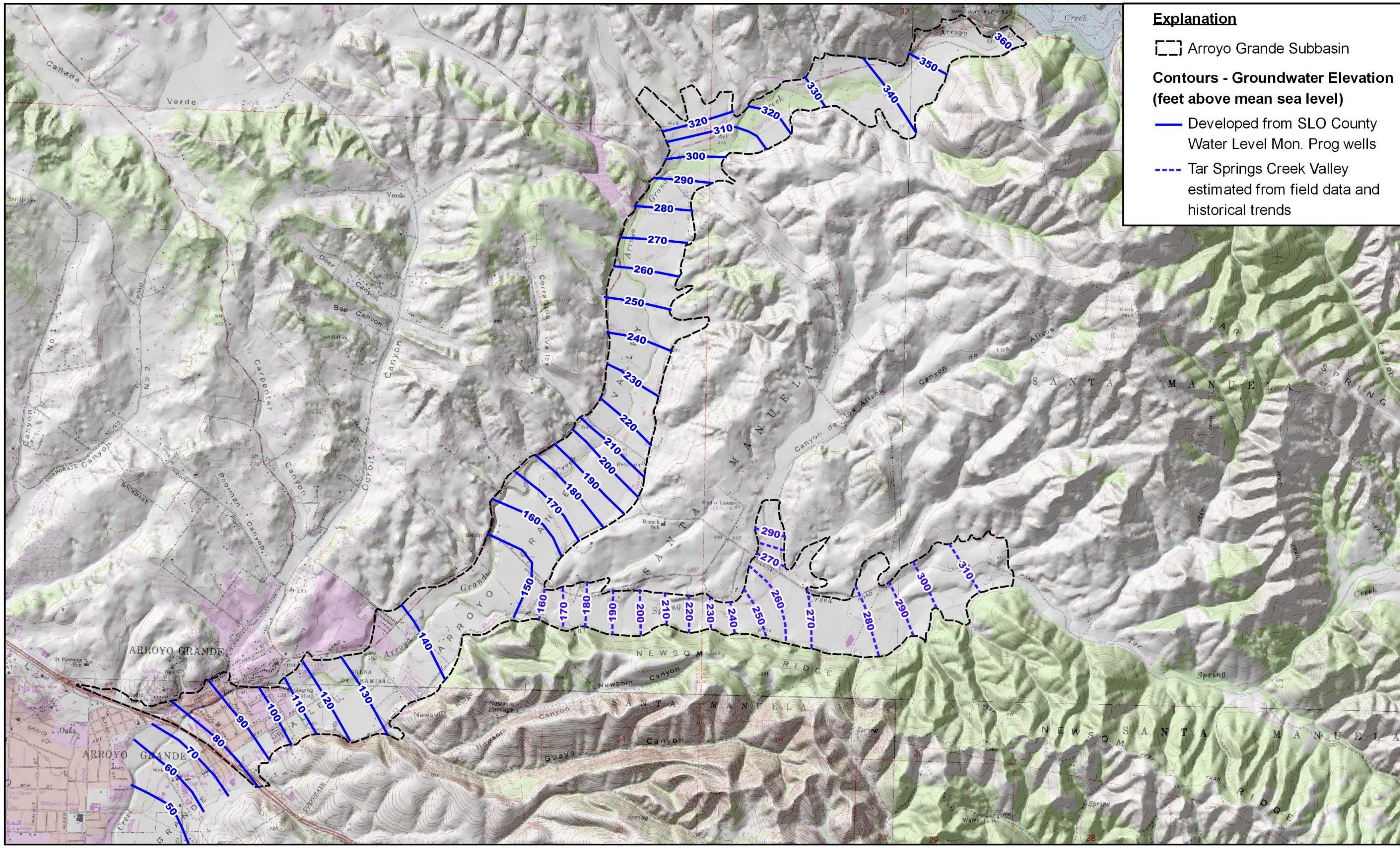
- The wells have groundwater elevation data for the periods of record of interest;
- Groundwater elevation data were deemed representative of static conditions.
- In areas where a data gap exists, water levels were estimated from a combination of (a) water level data from Well Completion Reports for the general period of interest; (b) correlation with general water level trends; (c) correlation with general hydraulic gradients.

Based on available data and above criteria, approximately 20 wells were used for contouring groundwater elevations in the main alluvial valley for selected years. Water level data collected for the GSP from an additional 11 wells were used for contouring Spring 2021 groundwater elevations in the Tar Spring Creek tributary valley and adjusted to represent prior years based on water level trend and hydraulic gradient correlations. The following information is presented in subsequent subsections.

- Groundwater elevation contour maps for spring 1996, 2015, and 2020;
- A map depicting the change in groundwater elevation between 1996 and 2015;
- A map depicting the change in groundwater elevation between 2015 and 2020;
- A map depicting the change in groundwater elevation between 1996 and 2020;
- Hydrographs for select representative wells.

Spring 1996 Groundwater Elevations (Figure 5-3) presents a groundwater surface map for Spring 1996 based primarily on field data collected by the SLOFCWCD. As mentioned above, the 1996 water year was above average for precipitation. The 1996 water year also included elevated surface water releases to Arroyo Grande Creek from Lopez Reservoir, totaling 11,462 acre-feet through March 1996. Spring 1996 represents a full Subbasin condition, although not the maximum storage condition.

As mentioned above, the Tar Spring Creek valley had a data gap with respect to water level records after 1989, with no wells monitored in 1996. Elevation contours in the tributary valley were estimated based on applying the spring 2021 hydraulic gradient to the 1996 water levels at the confluence with the main valley. No adjustments to the spring 2021 water levels were needed in order to achieve a reasonable transition between the tributary valley and spring 1996 water levels in the main Arroyo Grande Creek Valley.



Prepared For:

Author: TK
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ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:
1.
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Groundwater Elevation Surface
Spring 1996

Figure 5-3

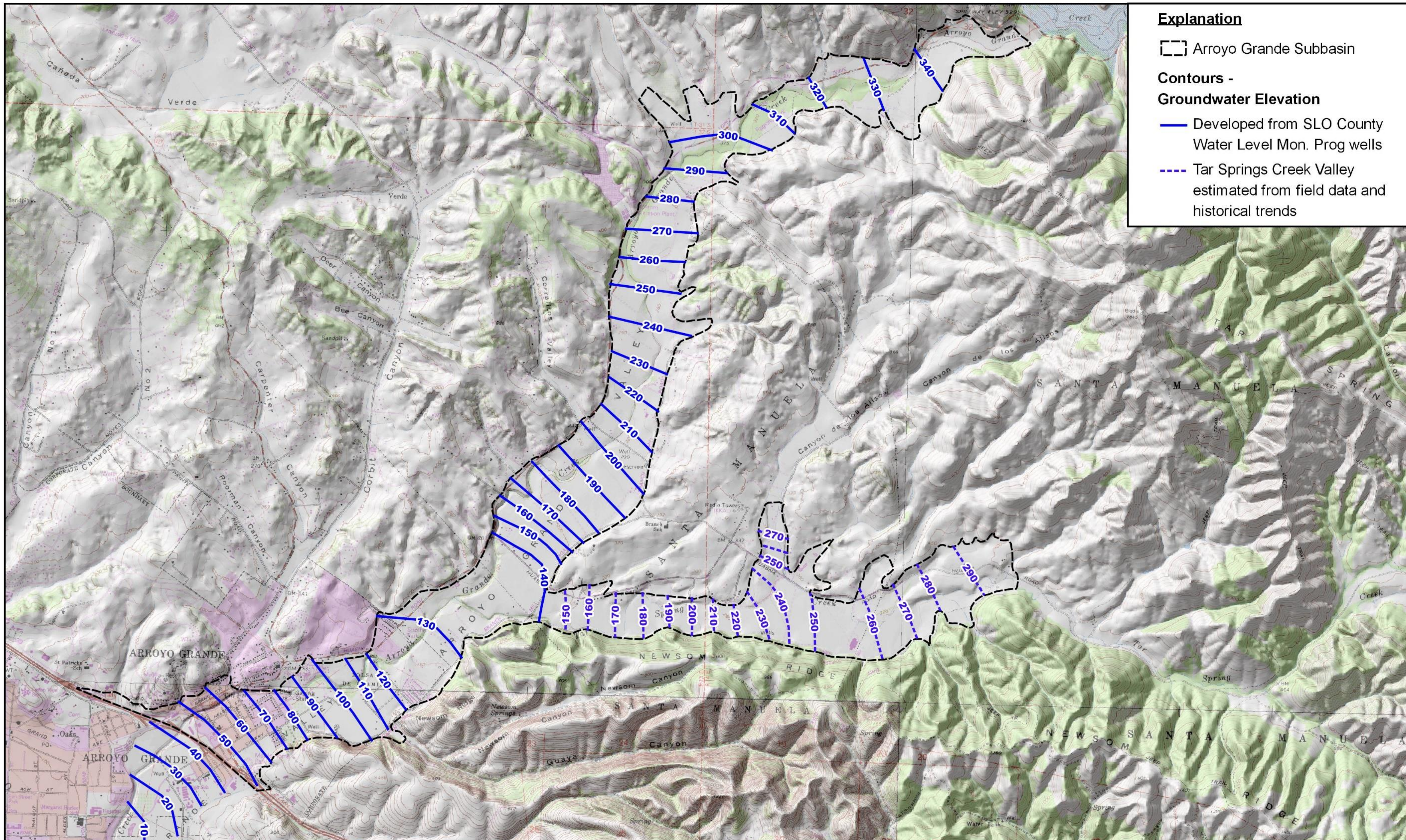
There are a few features of interest in Figure 5-3. The hydraulic gradient is uniform across the southern Subbasin boundary into the main SMRVGB, indicating the Wilmar Avenue Fault does not appear to significantly restrict alluvial water levels or underflow out of the Subbasin. The overall hydraulic gradient from below the dam to the highway is estimated at 0.007 ft/ft, which has remained relatively constant since before dam construction.

There is also a distinct flattening of the hydraulic gradient in the middle of the Subbasin, where Tar Spring Creek valley enters the Arroyo Grande Creek Valley. This flattening is interpreted to be due primarily to the contribution of flow from the tributary valley, which results in a greater volume of water in storage at the confluence. The added storage raises local water levels, which flattens the hydraulic gradient. Once sufficient saturated thickness has been reached within the alluvial aquifer to accommodate the storage increase, the hydraulic gradient returns to the steeper profile, albeit at a higher elevation than it would have been without the tributary valley groundwater contributions.

5.1.4 Spring 2015 Groundwater Elevations

Spring 2015 represents a critical drought year, with only 10.76 inches of rainfall at Lopez Reservoir, and was the fourth drought year in the 2012-2016 extreme drought period. Lopez Reservoir releases to Arroyo Grande Creek were maintained at an average of 3,690 AFY through the drought.

Figure 5-4 displays groundwater elevation contours for Spring 2015. The overall hydraulic gradient from the dam to the southern Subbasin boundary was estimated to be 0.008 ft/ft, which is similar to prior year estimates.
As with spring 1996, water levels in Tar Spring Creek valley are not available for spring 2015. In order to estimate the 2015 groundwater elevations, water levels for Tar Spring Creek valley wells from drought years 1977 and 1989 were reviewed. Available water levels for three wells averaged approximately 20 feet lower during prior drought years as compared to spring 2021 conditions, therefore, the water levels for spring 2015 are also estimated to be 20 feet lower than recently measured in Tar Spring Creek wells.



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Author: TK
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ARROYO GRANDE SUBBASIN GSP

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0 0.5 1 km

References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:
1.
2.
3.

Groundwater Elevation Surface
Spring 2015

Figure 5-4

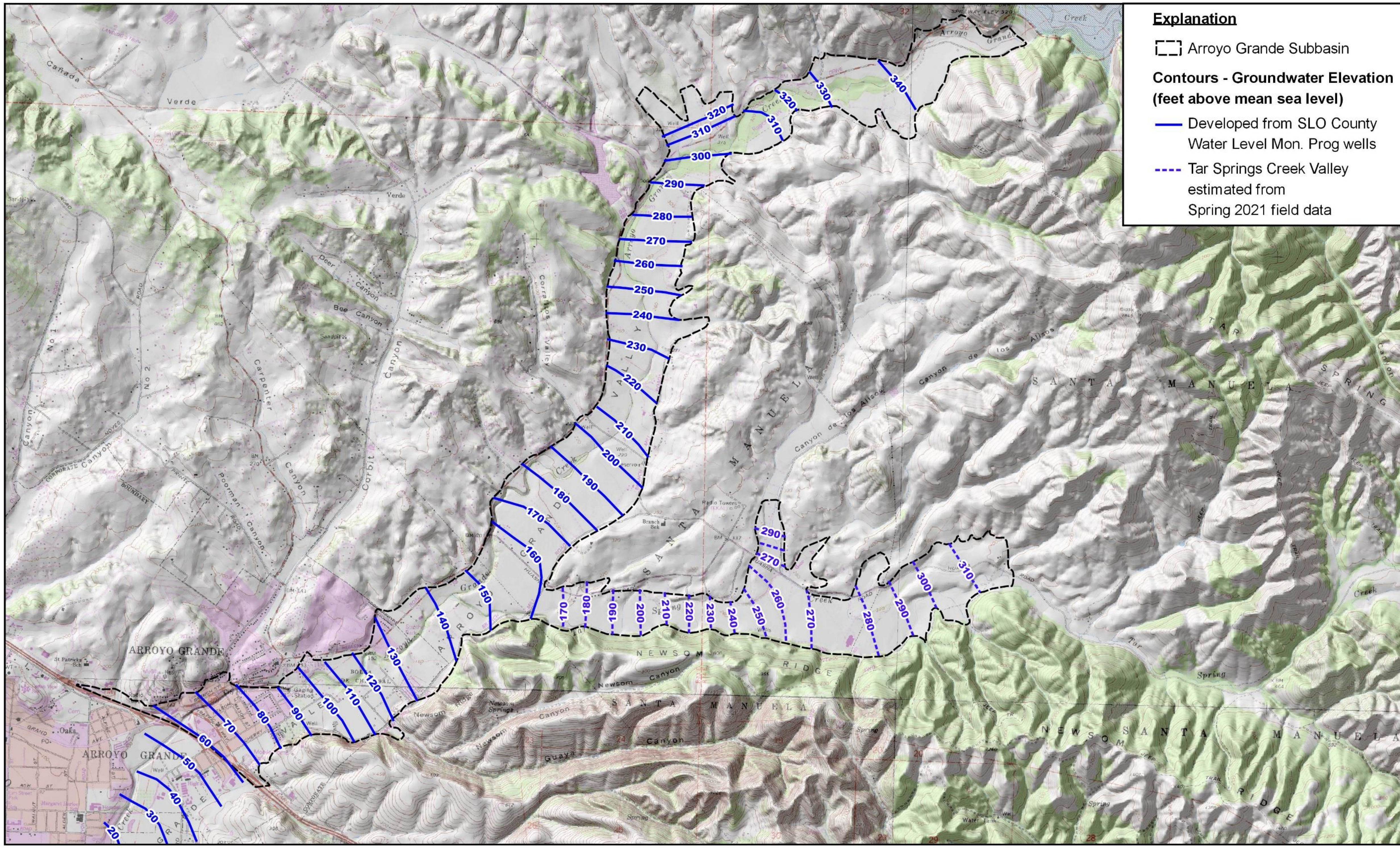
5.1.5 Spring 2020 Groundwater Elevations

Figure 5-5 presents a groundwater surface elevation map for Spring 2020 and represents the current condition. The 2020 water year (October 2019 to September 2020) had below average rainfall, with 15.25 inches recorded at the Lopez Dam gage. Releases from Lopez Reservoir into Arroyo Grande Creek were 2,672 acre-feet.

The overall hydraulic gradient between Lopez Dam and the southern Subbasin boundary for Spring 2020 is estimated to be 0.007 ft/ft, which is consistent with the historical gradient for all years reviewed except for 2015 (estimated at 0.008 ft/ft), which was during extreme drought. As with prior years, the hydraulic gradient is uniform across the southern Subbasin boundary into the Santa Maria Area Subbasin, indicating the Wilmar Avenue Fault does not appear to significantly restrict alluvial water levels or underflow out of the Subbasin. The hydraulic gradient also flattens at the confluence with Tar Spring Creek, with is attributed to the tributary inflow.

As previously mentioned, a water level survey was conducted in the Tar Spring Creek valley (tributary to Arroyo Grande Creek valley) in April 2021 to address the historical data gap in groundwater monitoring records. A total of 11 wells were sounded and the resulting static water levels used to develop the water level contours in Figure 5-4. Although Figure 5-5 is for spring 2020, there was no basis for making significant adjustments to the 2021 water levels, and the spring 2021 groundwater elevations are used for spring 2020. The overall hydraulic gradient in the tributary valley from the eastern Subbasin boundary to the confluence with Arroyo Grande Creek valley is approximately 0.010 ft/ft.

The direction of groundwater flow is westerly from Tar Spring Creek valley into the Arroyo Grande Creek Valley. This is a normal condition for a tributary valley (flow from the tributary into the main valley) and precludes the operation of Lopez Reservoir and associated releases to Arroyo Grande creek from having a significant influence on groundwater conditions in the Tar Spring Creek valley.



Prepared For:

Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

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Groundwater Elevation Surface
Spring 2020

Figure 5-5

5.1.6 Changes in Groundwater Elevation

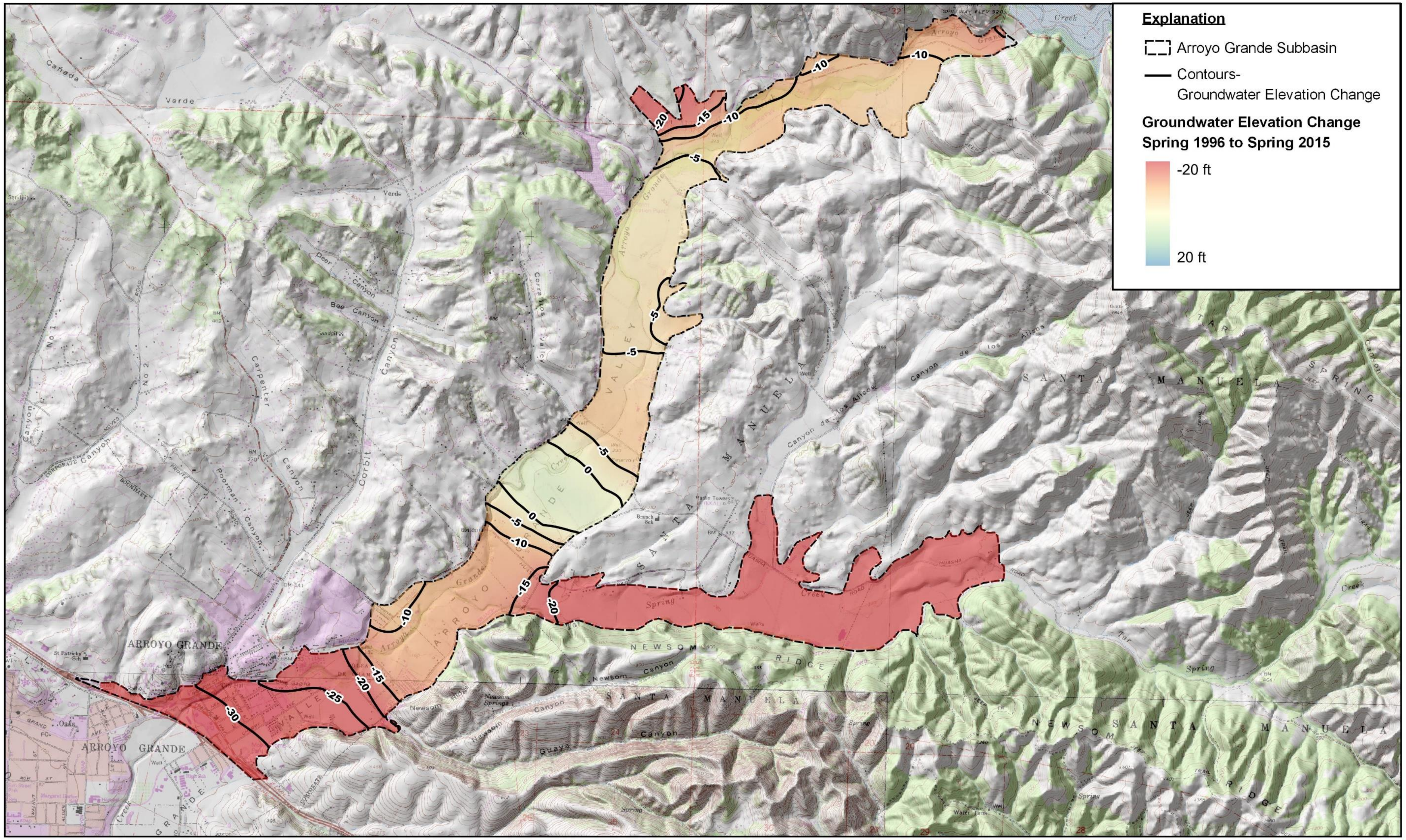
Changes in groundwater elevations are a proxy for changes in groundwater storage. Both chronic lowering of groundwater elevations and reductions in Subbasin storage are used as sustainability indicators in this GSP. A quantification of groundwater in storage and changes over time will be presented in Chapter 6 (Water Budget).

In order to demonstrate how groundwater elevations have varied over the recent history of the Subbasin, three maps were generated that display changes in groundwater elevation. These maps were developed by comparing contoured groundwater elevation surfaces from one year to the next and calculating the differences in elevation between the surfaces over the specified time period. It should be noted that the results of this analysis are largely dependent on the density of data points and should be viewed as indicative of general trends.

The first time period compares changes in groundwater elevation from spring 1996 to spring 2015, which depicts changes from a relatively full basin condition to a drought condition. Calculated changes in groundwater elevation over this 19-year period are presented in Figure 5-6. This figure indicates a groundwater decline of 5 to 10 feet over most of the Subbasin, with maximum declines in groundwater elevation of 30 feet approaching the southern Subbasin boundary, and a decline of 20 feet in the Tar Spring Creek valley. No significant increases in groundwater elevation are noted, although there is a relatively small area of the Subbasin, above the tributary valley confluence, which does not show a decline in water levels.

The next time period selected compares changes in groundwater elevation from spring 2015 to spring 2020. This time period was selected to capture the potential recovery of the Subbasin between extreme drought and current conditions, which between 2016 and 2020 were average (discussed in Chapter 6). Water years 2020 and 2021 have been dry overall but followed a wet year (2017) and an above average rainfall year (2019) that marked the end of the prior extreme drought. Calculated changes in groundwater elevation over the 5-year period from 2015 to 2020 are presented in Figure 5-7. This figure indicates groundwater elevations have rebounded across the Subbasin, with maximum increases in groundwater elevation of 20 feet in the Tar Spring Creek valley, and most areas recording a 5- to 15-foot gain in groundwater elevation.

The third time period compares changes in groundwater elevation from spring 1996 to spring 2020. This time period is the summation of the prior two periods and was selected to compare the overall change in groundwater elevation from a relatively full condition in 1996 to current conditions (average). Calculated changes in groundwater elevation over this 24-year period are presented in Figure 5-8. Groundwater elevations have generally declined by 5 feet or less, with a maximum decline of up to 20 feet near the southern Subbasin boundary and a maximum increase of approximately 5 feet near the confluence of Tar Spring Creek valley with the Subbasin.



Prepared For:

Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

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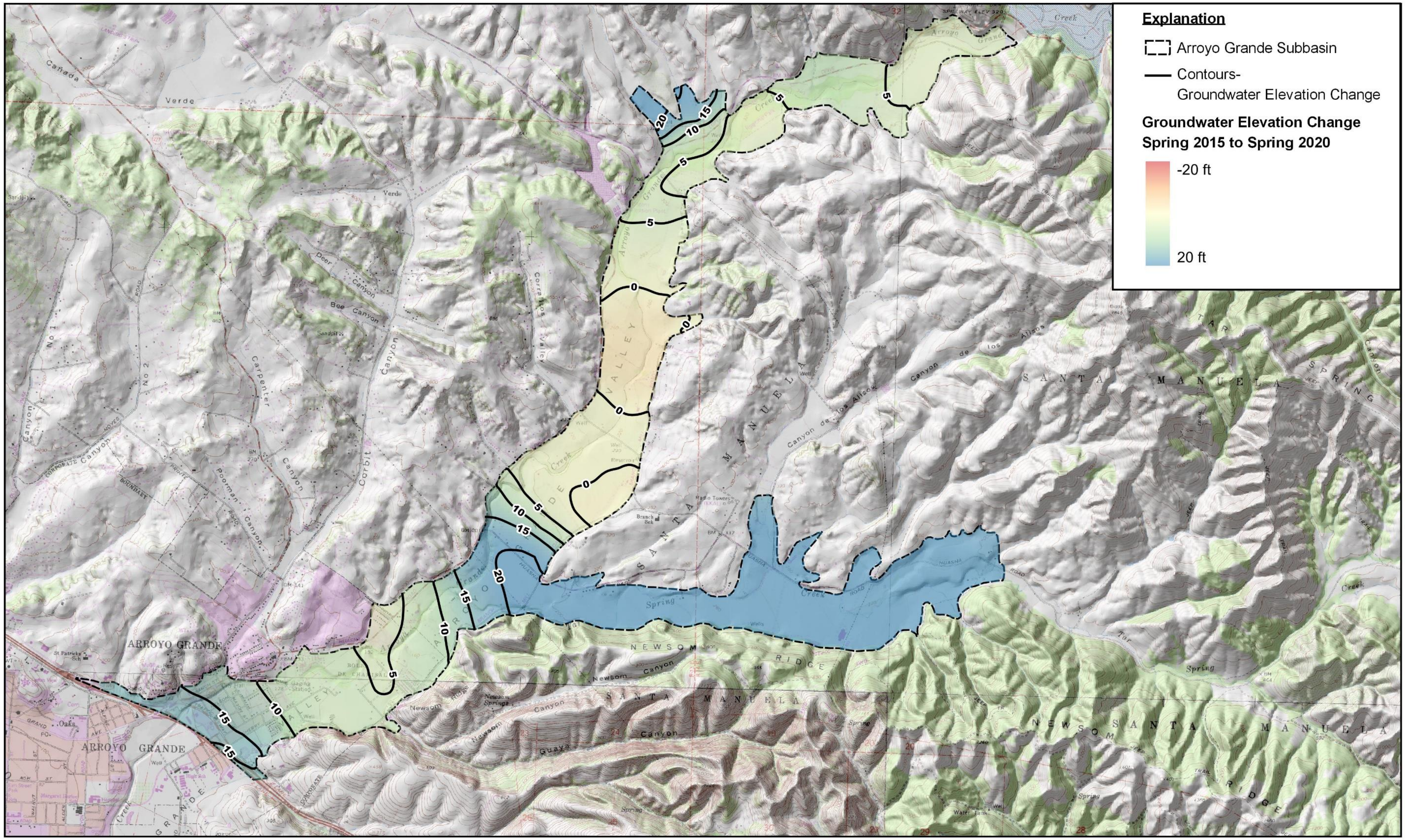
Groundwater Elevation Change
Spring 1996 to Spring 2015

Figure 5-6



Prepared For:

Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

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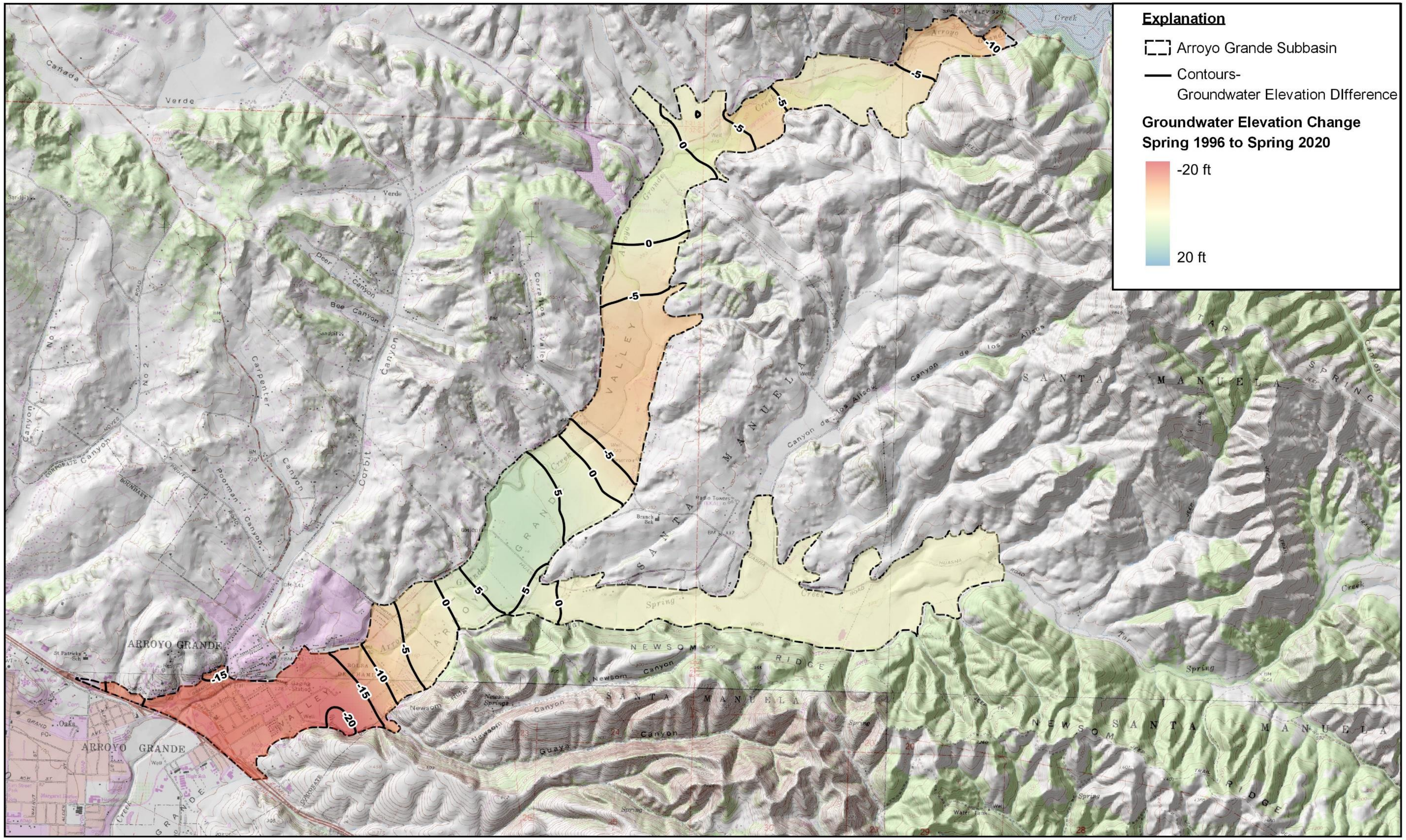
Groundwater Elevation Change
Spring 2015 to Spring 2020

Figure 5-7



Prepared For:

Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

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Groundwater Elevation Change
Spring 1996 to Spring 2020

Figure 5-8

5.1.7 Vertical Groundwater Gradients

Vertical hydraulic gradients are calculated by measuring the difference in groundwater elevation at a single location between specific and distinct strata or aquifers. The characterization of vertical gradients may have implications with respect to characterization of flow between aquifers, migration of contaminant plumes, and other technical details describing groundwater flow in specific areas. In order to accurately characterize vertical groundwater gradient, it is necessary to have two (or more) piezometers sited at the same location, with each piezometer screened across a unique interval that does not overlap with the screened interval of the other piezometers(s). If groundwater elevations at one such piezometer are higher than the other(s), the vertical flow direction can be established since groundwater flows from areas of higher pressure to areas of lower pressure. However, because such a “well cluster” must be specifically designed and installed as part of a broader investigation, limited data exists to assess vertical groundwater gradients.

The Arroyo Grande Subbasin is effectively composed of a single, unconfined, alluvial aquifer, but vertical hydraulic gradients may exist both within the alluvium and between the alluvium and bedrock formations. Alluvial groundwater supply wells are typically screened through the base of the alluvial deposits, and may also continue into underlying bedrock, where other water-bearing strata may occur, but which are not part of the Subbasin. Vertical hydraulic gradients between the alluvial aquifer and any underlying bedrock aquifers that may be present would generally be expected to be upward, since the bedrock formations extend laterally to form hills surrounding the alluvial valley where groundwater elevations are above the valley floor.

Relatively extensive clay aquitards occur within the alluvium (Figure 4-9, Figure 4-10, and Figure 4-11) that result in local vertical gradients between alluvial deposits above and below these clays. Given that the basal alluvial gravels are the main water supply aquifer in the Subbasin, groundwater pumping would generally result in downward vertical gradients. In the vicinity of Arroyo Grande Creek and Tar Spring Creek, return flows from irrigation that perch on these shallow clays may result in gaining reaches of stream flow, even though downward vertical hydraulic gradients are present within the alluvium.

There are no paired wells that provide specific data comparing water levels in wells screening the bedrock and the Subbasin sediments, or between shallow saturated strata and the underlying alluvial supply aquifer. However, from a conceptual standpoint, the Pismo, Monterey, and Obispo Formations are assumed to receive rainfall recharge in the surrounding mountains at higher elevations than the Basin sediments. As indicated above, it is assumed that an upward vertical flow gradient exists between the bedrock and the overlying Basin sediments. The rate of this flux will be considered in Chapter 6 (Water Budget). The lack of nested or clustered piezometers to assess vertical gradients in the Basin is a data gap that will be discussed further in Chapter 8.

5.2 GROUNDWATER ELEVATION HYDROGRAPHS

The Arroyo Grande Subbasin is primarily agricultural land use (Figure 3-2; Chapter 3), with historical estimates of agricultural acreage ranging from 1,620 acres in 1975 to 1,920 acres in 1995 (DWR, 2002), although in 2002 the DWR Subbasin encompassed 3,860 acres, compared to the currently defined Subbasin area of 2,899 acres (per the 2019 basin boundary modification). Other historical estimates for agricultural acreage in the Arroyo Grande Creek valley range from 1,770 acres in 2009 to 1,867 acres in 2013 (Cleath-Harris Geologists, 2015), but also include acreages outside of the currently defined Subbasin. A 2016 estimate of agricultural land use of 1,440 acres within the formal Subbasin boundary is provided in Table 3-1 (Chapter 3; total acreage minus native vegetation and urban land use). The main crop type for all years is vegetable crops.

Available water level data was reviewed to evaluate historical trends at individual wells and throughout the Subbasin. Data from selected wells are presented in Figure 5-9 and discussed in this section. All of the data was obtained from the County's groundwater monitoring network database.

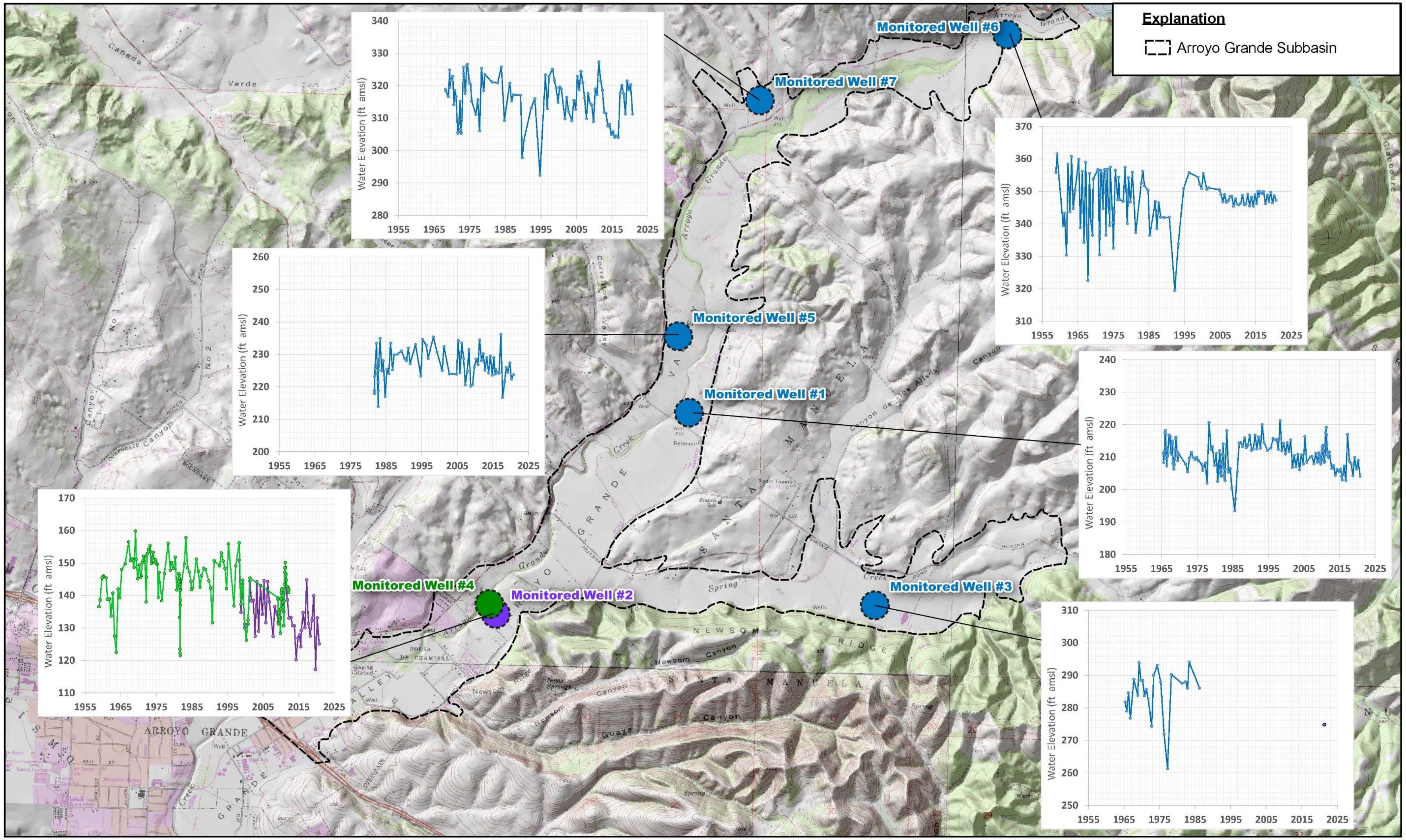
Figure 5-9 presents groundwater elevation hydrographs for six wells throughout the Subbasin and one well located within the Subbasin along Tar Springs Creek. Seasonal variations on the order of 30 feet are apparent in some of the hydrographs, although some of that may be due to the influence of nearby pumping wells when the data was collected. The most important feature of these hydrographs is that they show no long-term trends of chronic lowering of water levels over time, although differences between wet and dry periods are evident. All the wells display elevations under current conditions that are within the historical range of water levels in the 1960's and 1970's. State well identification numbers are not displayed for reasons of owner confidentiality.

The well below the dam (Monitored Well #6) displays seasonal fluctuations within a range of 20-30 feet over from the late 1950s to the mid-1990s, followed by a shift to seasonal fluctuations of approximately 5 feet through 2020. This change in fluctuation is interpreted to be associated with a change in well use (such as discontinued pumping). The spring static elevations at Monitored Well #6 have declined by close to 10 feet overall since the late 1950's, with a few feet of decline appearing to coincide with dam construction in the late 1960's, and the remaining several feet of decline following the last reservoir spill event in 1999. Water levels have been stable for the last 15 years.

Another well with a long and continuous history of record is Monitored Well #1, located near the center of the main valley (Figure 5-9). Seasonal fluctuations at this well are generally close to 5 feet, with occasional greater fluctuations due to high spring peaks. There has been a decline of several feet in the average water level since the wet period during the mid to late-1990's, but levels are similar to earlier records from the 1907's and 1980's, and the last high spring peak in 2017 was also similar to prior high spring peaks.

In the lower Subbasin, below the confluence with the Tar Spring Creek valley, are two adjacent wells, Monitored Well #2 and Monitored Well #4 (Figure 5-9). Monitored Well #2 has a period of record beginning in 1958 and ending in 2012, while Monitored Well #2 begins in 1998 and is actively monitored. The general pattern of fluctuations in Monitored Well #2 is variable and may be affected by pumping. When the records are combined, there appears to have been a decline of close 10 feet in water levels since the mid to late-1990's wet period, although the last high spring peak in 2017 was similar to spring high water levels recorded in the early 1960's. In addition, the overlapping higher peaks in spring 1998 And 2011 are approximately 5 feet higher in Monitored Well #2, compared to Monitored Well #4, suggesting there may be an elevation adjustment needed when merging the datasets for trend analysis.

Monitored Well #3 is one of the wells in Tar Spring Creek valley where historical data was available ending in 1989. A recent spring 2021 water level has been added to update the record. The water levels show close to 10 feet of decline since 1986, although there is only one recent measurement for comparison. The two other wells for which updated water levels are available show little to no decline.



Prepared For:

Author: TK
Date: 06/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Horizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

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Groundwater Hydrographs

Figure 5-9

Figure 5-10 shows groundwater elevation hydrographs for selected monitoring wells along with a time series of Lopez Reservoir releases and spills into Arroyo Grande Creek. Spill years occur when the reservoir fills beyond its storage capacity. As shown in the figure, there have been releases into Arroyo Grande Creek every year since 1969, with multiple spill years between 1970 and 1987, after which there have been only three other spill years (1997, 1998, and 1999).
The hydrographs shown in Figure 5-10 illustrate that seasonal water level fluctuations dominate the water level trends. In Monitored Well #1, seasonal fluctuations are typically 5-10 feet, both prior to and during Lopez Reservoir operation, and the long-term trend in water levels is flat. At Monitored Well #2 seasonal water level fluctuations are more variable, possibly associated with pumping, both prior to and during Lopez Reservoir operations. The long-term trend is flat for Monitored Well #2 but appears to show a slightly declining water level trend after the last reservoir spill in 1999, when combined with adjacent Monitored Well #4 data as shown in the figure. As previously mentioned, there may be an elevation adjustment needed when merging the datasets for trend analysis, but even without the adjustment, spring water level recovery outside of drought are comparable to levels recorded in the 1960's.

Overall, the hydrographs indicate the Subbasin is in approximate equilibrium, and that, despite occasional and intermittent drought periods, the alluvial aquifer in the Subbasin has not reached a state of overdraft because of the managed releases from Lopez Reservoir. Further discussion of sustainable yield indicators related to changes to groundwater in storage will be covered in Chapter 6 (Water Budget).

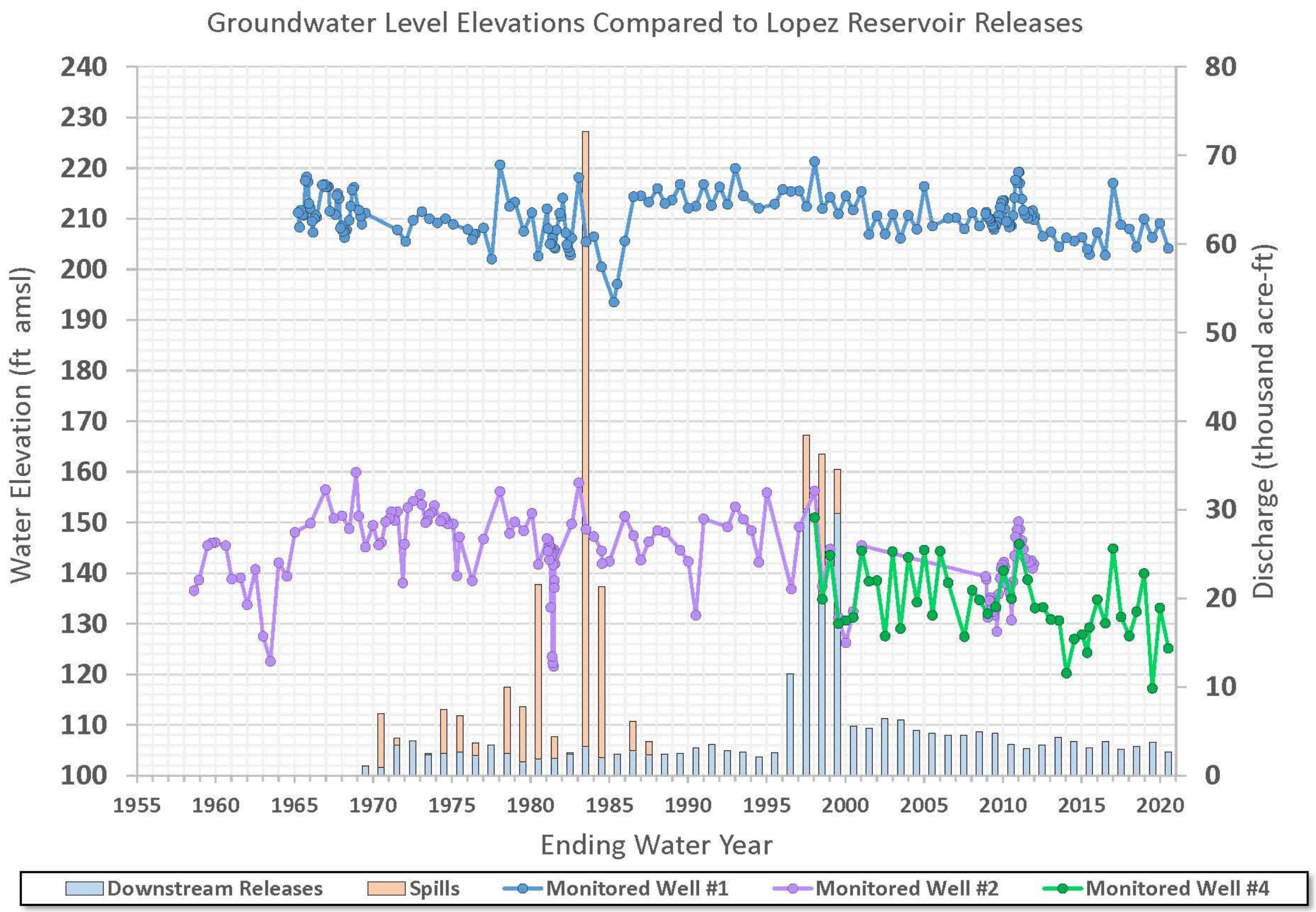


Figure 5-10: Groundwater level Elevations Compared to Lopez Reservoir Releases

5.3 GROUNDWATER RECHARGE AND DISCHARGE AREAS

The primary source of recharge for the Subbasin is stream infiltration. Arroyo Grande Creek, which flows through the valley, flows year-round due to regular release of surface water from Lake Lopez. This stream flow infiltrates into and recharges the alluvium in the valley. Additionally, based on the observation that the potentiometric surface of groundwater in wells screened in the underlying bedrock rises to elevations within the alluvium, there is likely a component of recharge from the underlying bedrock into the overlying alluvium. Other sources of recharge include direct percolation of rainfall on the alluvium surface, irrigation return flow, and mountain-front recharge from runoff along the steep slopes on both sides of the valley.

Areas of significant areal recharge and discharge within the Subbasin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge components is provided in Chapter 6: Water Budgets.

5.3.1 Groundwater Recharge Areas

In general, natural areal recharge occurs via the following processes:

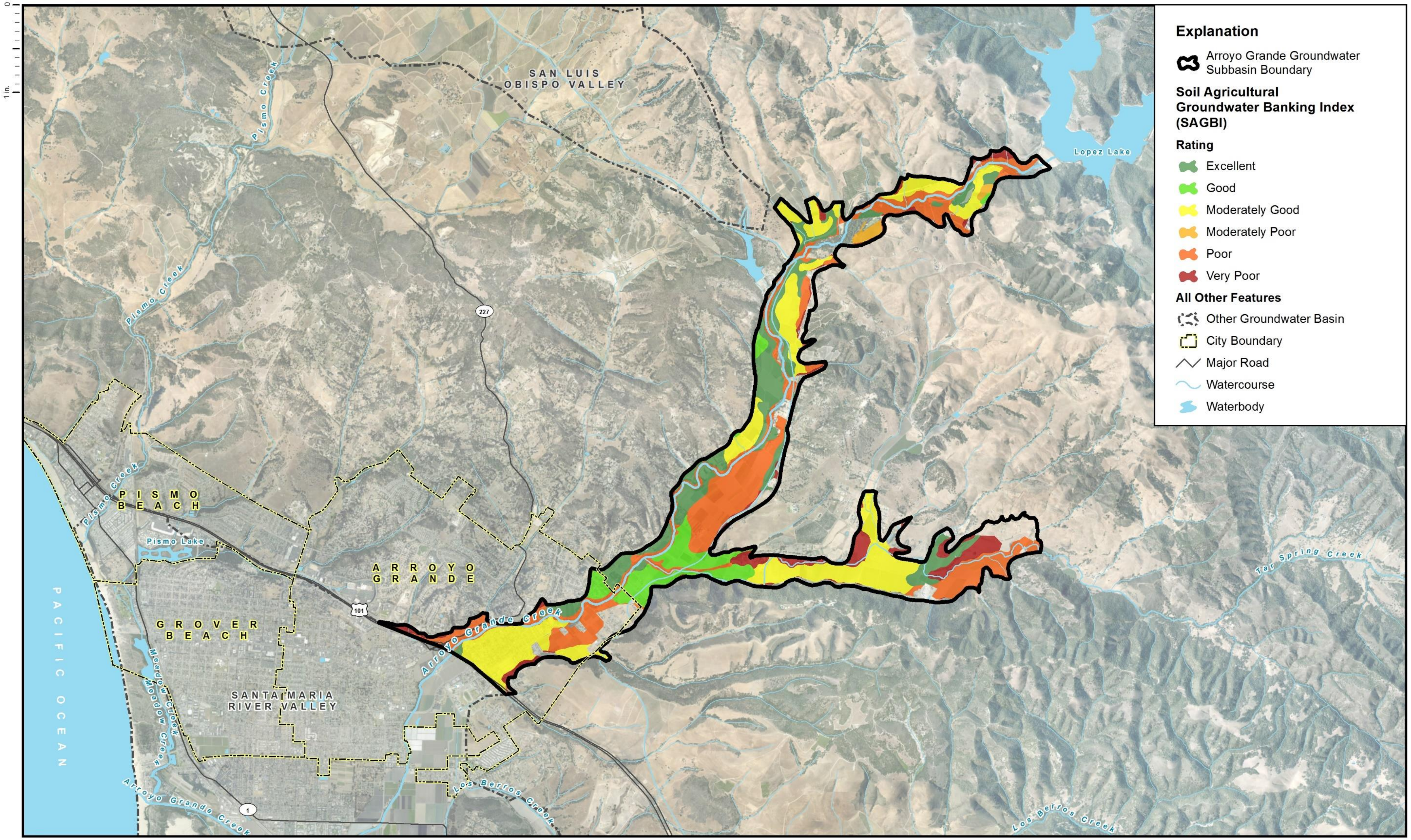
1. Distributed areal infiltration of precipitation,
2. Subsurface inflow from adjacent “non-water bearing bedrock”, and
3. Percolation of surface water from streams and creeks.
4. Anthropogenic recharge

The following sections discuss each of these components.

5.3.1.1 Percolation of Precipitation

Areal infiltration of precipitation is a significant component of recharge in the Subbasin. Water that does not run off to stream or get taken up via evapotranspiration migrates vertically downward through the unsaturated zone until it reaches the water table. By leveraging available GIS data that defines key factors such as topography and soil type, locations with higher likelihood of recharge from precipitation have been identified. These examinations are desktop studies and therefore are conceptual in nature. Still, the results of these studies provide an initial effort at identifying areas that may have the intrinsic physical characteristics to allow greater amounts of precipitation-based recharge in the Subbasin.

The University of California (UC) at Davis and the UC Cooperative Extension published a study in 2015 that uses existing GIS data to identify areas potentially favorable for enhanced groundwater recharge projects (UC Davis Extension, 2015). The UC study is statewide in scope includes more than 17.5 million acres, is scientifically peer reviewed, and focuses on the possibilities of using fallow agricultural land as temporary percolation basins during periods when excess surface water is available. The UC study developed a methodology to determine a Soil Agricultural Groundwater Banking Index (SAGBI) to assign an index value to agricultural lands through the state. The SAGBI analysis incorporates deep percolation, root zone residence time, topography, chemical limitations (salinity), and soil surface conditions into its analysis. The results of the SAGBI analysis in the Subbasin are presented in Figure 5-11. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, this map provides guidance on where natural recharge likely occurs.



Prepared for:

Author: AB
Date: 6/10/2021

ARROYO GRANDE SUBBASIN GSP

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Soil Agricultural Groundwater Banking Index (SAGBI)

Figure 5-11

5.3.1.2 Subsurface Inflow

Subsurface inflow is the flow of groundwater from the surrounding bedrock into the Subbasin sediments. This process is sometimes referred to as mountain front recharge. Groundwater flows from areas of high head to areas of lower head, and water levels in the mountains are at a higher elevation than the Subbasin. Flow across the Subbasin boundary is predominantly via highly conductive, but random and discontinuous fracture systems. The rate of subsurface inflow to the Subbasin from the surrounding hill and mountain area varies considerably from year to year depending upon precipitation (intensity, frequency and duration, seasonal totals, etc.) and groundwater level gradients. There are no available published or unpublished inflow data for the hill and mountain areas surrounding the Subbasin. An estimate of this component of recharge is presented in Chapter 6 (Water Budget).

5.3.1.3 Percolation of Streamflow

Percolation of streamflow is a significant source of recharge in the Subbasin. Groundwater recharge from percolation of streamflow is thought to occur in the Arroyo Grande Creek Valley. Because releases from Lopez Dam maintain flow in the creek year-round, water levels are assumed to be maintained at elevations at or near the creek bed elevation. In Tar Spring Creek, the natural streamflow regime is unaffected by Lopez operations, and during the dry season, water levels decrease to below land surface. Therefore, the periodic streamflow appears to recharge the underlying Alluvium in this area. Specific isolated monitoring of alluvial wells compared to the underlying aquifers' water levels could clarify this recharge component.

[INCORPORATE DISCUSSION OF THE RESULTS OF THE ARROYO GRANDE CREEK FIELD SERVICES INVESTIGATION PRIOR TO COMPLETION OF THE GSP].

5.3.1.4 Anthropogenic Recharge

Significant anthropogenic recharge occurs via the two processes discussed below:

1. Percolation of return flow from agricultural irrigation, and
2. Percolation of return flow from domestic septic fields.

Irrigated agriculture is prevalent in the Subbasin. Return flows from irrigated agriculture occur when water is supplied to the irrigated crops in excess of the crop's water demand. This is done to avoid excess build-up of salts in the soil and overcome non-uniformity in the irrigation distribution system. These are all standard practices. In addition, there are a small number of residences in the Subbasin that rely on septic fields for their wastewater disposal, and these systems regularly have an element of return flow to the underlying aquifer. An estimate of this component of recharge is presented in Chapter 6 (Water Budget).

5.3.2 Groundwater Discharge Areas

The primary source of discharge for the Subbasin is pumping of irrigation wells screened in the alluvium. As discussed previously, much of the valley is cultivated in various crops. Other sources of discharge include evapotranspiration from the root zone of plants along the stream channel, and underflow of groundwater out of the Fringe Area, discussed previously.

Groundwater elevation hydrographs of wells in the Subbasin indicate that water levels in the valley have remained essentially stable over the past 50 years (Figure 5-10), indicating that recharge and discharge in the valley are in approximate equilibrium, and the alluvium has demonstrated sustainability over this time period. The regular recharge of the alluvial aquifer from the Lake Lopez releases is a significant factor in this observed stability of groundwater levels.

Natural groundwater discharge occurs as discharge to springs, seeps and wetlands, subsurface outflows, and evapotranspiration (ET) by phreatophytes. There are no significant mapped springs or seeps located within the Subbasin boundaries; most springs in the vicinity are located at higher elevations in the surrounding mountain areas.

Natural groundwater discharge can also occur as discharge from the aquifer directly to streams. Groundwater discharge to streams and potential groundwater dependent ecosystems (GDEs) are discussed in Section 5.5. In contrast to mapped springs and seeps, whose source water generally comes from bedrock formations in the mountains, groundwater discharge to streams is derived from the alluvium. Discharge to springs or streams can vary seasonally as precipitation and stream conditions change throughout the year. Subsurface outflow and ET by phreatophytes are discussed in Chapter 6 (Water Budget).

5.4 INTERCONNECTED SURFACE WATER

Surface water/groundwater interactions may represent a significant portion of the water budget of an aquifer system. Where the water table is at a higher elevation than the streambed and slopes toward the stream, the stream receives groundwater from the aquifer; that is called a gaining reach (i.e., it gains flow as it moves through the reach). Where the water table is beneath the streambed and slopes away from the stream, the stream loses water to the aquifer; that is called a losing reach. In addition, a stream may be disconnected from the regional aquifer system if the elevation of streamflow and alluvium is significantly higher than the elevation of the water table in the underlying aquifer.

[INCORPORATE DISCUSSION OF THE RESULTS OF THE ARROYO GRANDE CREEK FIELD SERVICES INVESTIGATION PRIOR TO COMPLETION OF THE GSP].

5.4.1 Depletion of Interconnected Surface Water

Groundwater withdrawals are balanced by a combination of reductions in groundwater storage and changes in the rate of exchange across hydrologic boundaries. In the case of surface water depletion, this rate change could be due to reductions in rates of groundwater discharge to surface water, and increased rates of surface water percolation to groundwater. High-capacity wells located immediately adjacent to a stream could locally affect aquifer discharge to the stream. Seasonal variation in rates of groundwater discharge to surface water or surface water percolation to groundwater occur naturally throughout any given year, as driven by the natural hydrologic cycle. However, they can also be affected by anthropogenic actions. Since, as presented in the discussion of hydrographs in the Subbasin in Section 5.2, there has been no long-term water level declines in this area, there is no evidence of long-term depletion of interconnected surface water in the subbasin.

5.5 POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS

The SGMA Regulations §354.8(a)(5) require identification of groundwater dependent ecosystems within the Subbasin. Several datasets were utilized to identify the spatial extent of potential groundwater dependent ecosystems (GDEs) in the Subbasin, as discussed in the following sections. As defined in SGMA Regulations §351 (m), "groundwater dependent ecosystems refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". In areas where the water table is sufficiently high, groundwater discharge may occur as evapotranspiration (ET) from phreatophyte vegetation within these GDEs.

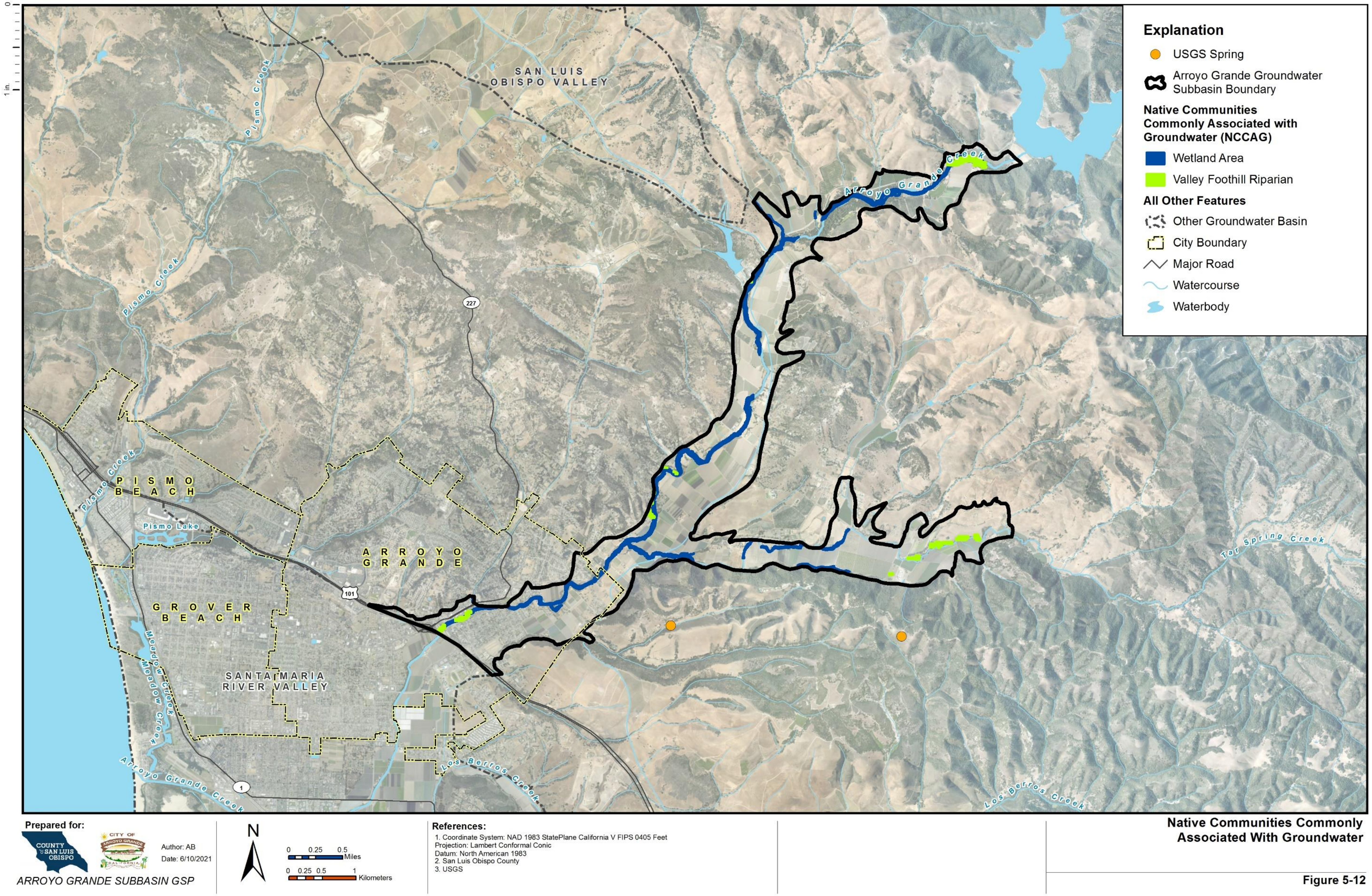
The overall distribution of potential GDEs within the Subbasin has been initially estimated in the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (DWR, 2018). The Natural Communities data set is a compilation of 48 publicly available state and federal agency data sets that map vegetation, wetlands, Spring, and seeps in California. A working group that includes DWR, CDFW, and The Nature Conservancy (TNC) reviewed the compiled data set and conducted a screening process to exclude vegetation and wetland types less likely to be associated with groundwater and to retain types commonly associated with groundwater as described in (Klausmeyer, 2018). Two habitat classes are included in the Natural Communities data set statewide:

- Wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions.
- Vegetation types commonly associated with the subsurface presence of groundwater (phreatophytes).

This dataset was reviewed and the resulting distribution of potential GDEs is shown in Figure 5-12. The data included in the Natural Communities data set do not represent the determination of a GDE by DWR, but only the potential existence of a GDE. However, the Natural Communities data set can be used by GSAs as a starting point when approaching the task of identifying GDEs within a groundwater basin that are both classified as potential GDEs and are connected to groundwater (The Nature Conservancy, 2020).
There has been no field verification that the locations shown on this map constitute GDEs. Additional field reconnaissance is necessary to verify the existence and extent of these potential GDEs and may be considered as part of the monitoring network for future planning efforts.

In support of the State Water Resources Control Board licensing/permitting process for the Lopez Project, the District is currently preparing an HCP Studies in support of the HCP are underway.

It is anticipated that the integrated surface/groundwater model for the Arroyo Grande Creek Watershed currently being developed as part of the GSP process will inform the HCP. Specifically, the model may be a key tool allowing the District to better understand the relationship between downstream releases from the reservoir and groundwater pumping on the availability of surface water and GDEs in lower Arroyo Grande Creek. The updated downstream release program and the HCP would provide an approach for the operation of Lopez Reservoir that fulfills the contractual water supply obligations to the Zone 3 contractors and provides releases for downstream agricultural users, while also maintaining and enhancing habitat steelhead, red-legged frog, and other environmentally sensitive biota in lower Arroyo Grande Creek.



Native Communities Commonly Associated With Groundwater

Figure 5-12

5.5.1 Identification of Potential GDEs

The Nature Conservancy (TNC) developed a guidance document based on best available science to assist agencies, consultants, and stakeholders to efficiently incorporate GDEs analysis into GSPs. In the guidance, five steps were outlined to inform the GSP process (Rohde, 2018):

1. Step 1 – Identify potential GDEs;
   a. Step 1.1 - Map GDEs
   b. Step 1.2 - Characterize GDE Condition
2. Step 2 – Determine Potential Effects of Groundwater Management on GDEs;
3. Step 3 – Consider GDEs when Establishing Sustainable Management Criteria
4. Step 4 – Incorporate GDEs into the Monitoring Network; and
5. Step 5 – Identify Projects and Management Actions to Maintain or Improve GDEs.

There are two objectives within Step 1 which are to map (Step 1.1) and characterize (Step 1.2) GDEs in the Subbasin. Steps 1.1 and 1.2 are the focus of this section. The remaining steps are considered in later sections of the GSP.

Based on review of the Natural Communities data set, several wetland features and one type of vegetation community are present within the basin. The Natural Communities vegetation type is Valley Foothill Riparian.

Wetland classifications recorded in the Natural Communities data set for the Basin are: palustrine, emergent, persistent, seasonally flooded; palustrine, forested, broad-leaved- evergreen, seasonally flooded; palustrine, forested, seasonally flooded; palustrine, scrub-shrub, seasonally flooded; riverine, unknown perennial, unconsolidated bottom, semi-permanently flooded; and riverine, upper perennial, unconsolidated bottom, permanently flooded (The Nature Conservancy, 2019). Generally, wetlands were recorded along Arroyo Grande Creek and portions of Tar Spring Creek.

The Natural Communities vegetation classifications are presented as polygons on Figure 5-12 as they occur throughout the basin. The Valley Foothill Riparian vegetation classification is described in detail below. The Natural Communities wetland classifications are also presented on Figure 5-12 (lumped as one 'wetland area' category).

5.5.1.1 Potential GDE Vegetation Classification

The Natural Communities vegetation class mapped within the Subbasin is Valley Foothill Riparian. In general, NCAAG vegetation classifications are a collection of multiple vegetation species dominated by a few key species, as described below.

The Valley Foothill Riparian Natural Communities classification occurs in a few scattered stands within the Subbasin, including areas along Arroyo Grande Creek and the upper reaches of Tar Spring Creek. The Valley Foothill Riparian classification covers an area of 28 acres within the Subbasin, as shown of Figure 5-12. Valley Foothill Riparian habitats are found in valleys bordered by sloping alluvial fans, slightly dissected terraces, lower foothills, and coastal plains. They are generally associated with low velocity flows, flood plains, and gentle topography (Mayer, 1988). The dominant species within this classification are cottonwood, California sycamore, and valley oak, with a subcanopy of white alder, boxelder, and Oregon ash. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, blue elderberry, poison oak, button brush, and willows. The herbaceous layer consists of sedges, rushes, grasses, miner's lettuce, Douglas sagewort, poison-hemlock, and hoary nettle (Mayer, 1988). Rooting depths for

Valley Foothill Riparian species vary from 1 foot for willow (TNC, 2020), up to a reported maximum rooting depth of 80 feet for valley oak (Lewis, 1964).

5.5.1.2 Screening of Potential GDEs

To confirm whether the Natural Community vegetation and wetland polygons are connected to groundwater, local hydrologic information may be used to confirm a groundwater connection to the potential GDE. TNC guidance (Rohde, 2018) provides a list of questions to assess whether Natural Community polygons are connected to groundwater. These questions include the following from Worksheet 1 of the guidance:

1. Is the Natural Community polygon underlain by a shallow unconfined or perched aquifer that has been delineated as being part of a Bulletin 118 principal aquifer in the basin?
2. Is the depth to groundwater under the Natural Community polygon less than 30 feet?
3. Is the Natural Community polygon located in an area known to discharge groundwater (e.g., springs/seeps)?

If the answer is yes to any of these three questions, per TNC guidance, it is likely a GDE. As a part of the process, some Natural Community polygons are removed and other GDE polygons may be added, where appropriate. TNC recommends that Natural Community polygons with insufficient hydrologic data also be considered GDEs but should be flagged for further investigation.

Contoured groundwater elevation data for spring 2015 was used to determine areas where the Natural Communities polygons were within 30 feet depth to groundwater. Spring 2015 groundwater elevations were chosen for this analysis because this marked a period of the greatest recent data availability[1]. These data are considered representative of average spring-summer conditions within the last 5 years[2]. Areas with spring 2015 depth to groundwater of 30 feet or less are shown in purple on Figure 5-13 and the Natural Communities polygons associated with these areas are shown on Figure 5-13. Other than one small area in the Tar Spring Creek drainage, the areas with 30 feet or less depth to groundwater are concentrated along the main stem of Arroyo Grande Creek and especially within the upper reaches of the creek.

The Natural Communities polygons associated with spring 2015 depth to groundwater of 30 feet or less shown on Figure 5-14 are considered potential GDEs within the Subbasin. A brief aerial photo review indicates the potential GDEs identified in this step generally match areas of visible vegetation within the 30 foot or less depth to groundwater areas. An on-site biological survey is recommended by (The Nature Conservancy, 2019) as a final GDE verification step. Biological surveys have not been completed in preparation of the GSP. However, the presence of these potential GDEs shall be verified during GSP implementation. The vegetation and wetland GDEs (and potential GDE) within the basin are summarized in Table 5-1 and Table 5-2.

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[1] The spatial distribution and density of spring 2015 groundwater elevation data satisfies the TNC recommendation for using wells that are located within 5 kilometers (3.1 miles) of the Natural Communities polygons (TNC, 2019).

[2] Groundwater elevations are generally the highest in the spring, following recharge from winter rains. Spring-time groundwater elevations in 2015, being a relatively dry year, are considered representative of average modern conditions as measured throughout the spring-summer months, during the period of maximum annual evapotranspiration.

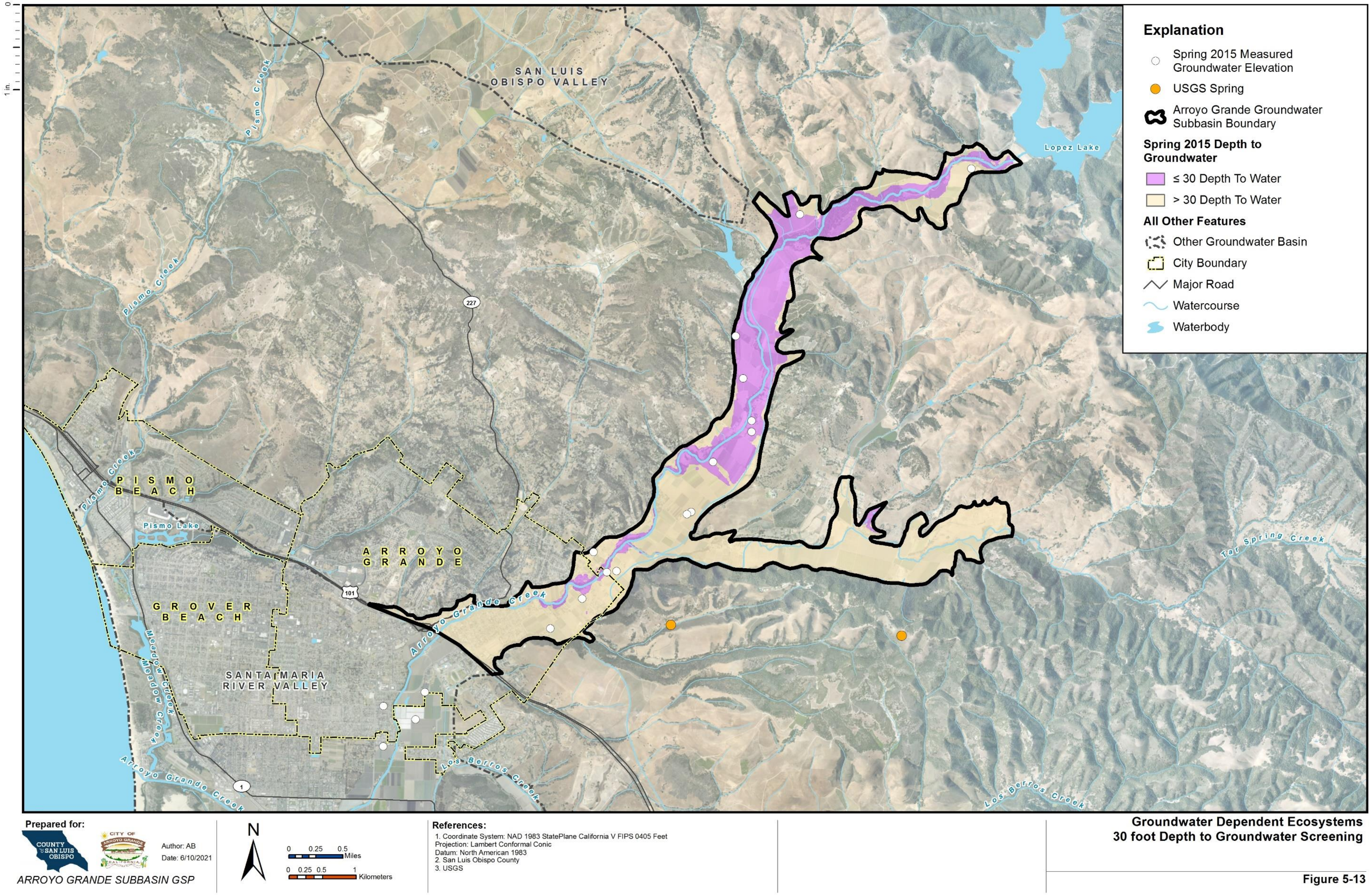
Table 5-1: Potential Vegetation GDEs.

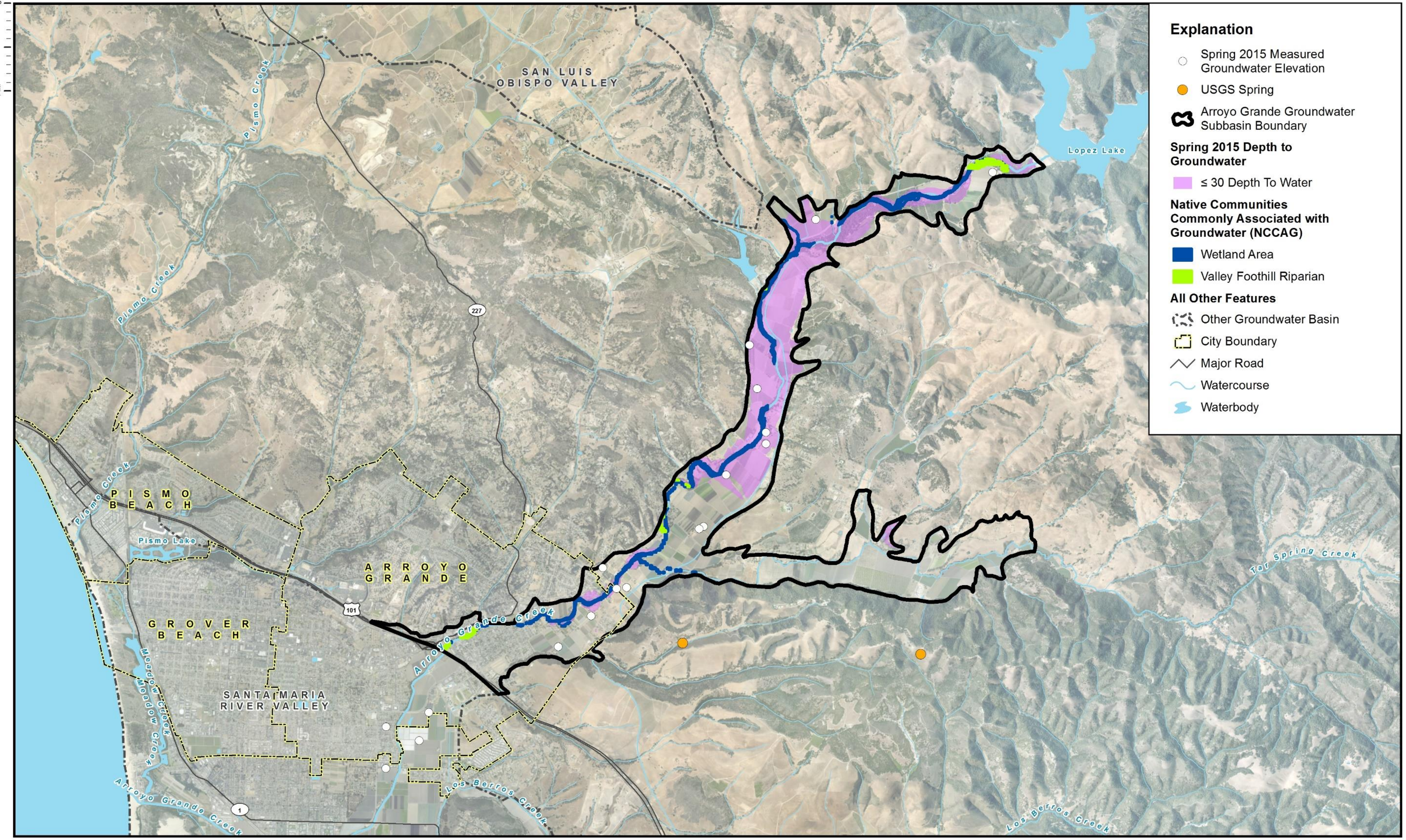
Natural Communities Vegetation Classification	Acres
Valley Foothill Riparian	19

Table 5-2: Potential Wetland GDEs.

Natural Communities Wetland Classification	Acres
Palustrine, Emergent, Persistent, Seasonally Flooded	1
Palustrine, Forested, Broad-Leaved- Evergreen, Seasonally Flooded	21
Palustrine, Forested, Seasonally Flooded	64
Palustrine, Scrub-Shrub, Seasonally Flooded	7
Riverine, Unknown Perennial, Unconsolidated Bottom, Semi permanently Flooded	1
Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded	15
Total	**109**

Note: [1] – the potential wetland GDE acres overlap in many areas with potential vegetation type GDEs. Therefore, the total potential GDE acreage in the Subbasin is less than the sum of the potential wetland GDE and the potential vegetation type GDE acres.


Explanation
Spring 2015 Measured Groundwater Elevation
USGS Spring
Arroyo Grande Groundwater Subbasin Boundary
Spring 2015 Depth to Groundwater
≤ 30 Depth To Water
> 30 Depth To Water
All Other Features
Other Groundwater Basin
City Boundary
Major Road
Watercourse
Waterbody
SAN LUIS OBISPO VALLEY
Lopez Lake
PISMO BEACH
Pismo Lake
ARROYO GRANDE
GROVER BEACH
SANTA MARIA RIVER VALLEY
Pismo Creek
Arroyo Grande Creek
Meadow Creek
Los Berros Creek
Tar Spring Creek
227
101
1
Prepared for:
Author: AB
Date: 6/10/2021
ARROYO GRANDE SUBBASIN GSP
N
0 0.25 0.5 Miles
0 0.25 0.5 1 Kilometers
References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS
Groundwater Dependent Ecosystems
30 foot Depth to Groundwater Screening
Figure 5-13



Prepared for:

Author: AB
Date: 6/10/2021

ARROYO GRANDE SUBBASIN GSP

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0 0.25 0.5 Miles
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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
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3. USGS

Potential Groundwater Dependent Ecosystems (GDEs)

Figure 5-14

5.5.2 Special Status Species Occurrence

The draft Arroyo Grande Creek Habitat Conservation Plan (HCP) (H.T. Harvey & Associates, 2015) was reviewed to determine the terrestrial and aquatic special-status species that may utilize potential GDE units overlying the basin. The US Fish and Wildlife Service (USFWS) Critical Habitat Mapper was also consulted (https://ecos.fws.gov/ecp/report/table/critical-habitat.html). No original work was done for the special status species review of the basin.

For the purposes of this GSP, special-status species are defined as those:

- listed, proposed, or under review as endangered or threatened under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA);
- designated by California Department of Fish and Wildlife (CDFW) as a Species of Special Concern;
- designated by CDFW as Fully Protected under the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515);

Table 5-3 lists the special-status species that are documented to occur within the basin or are supported by resources originating in the basin based on review of the HCP and the USFWS Critical Habitat Mapper. Wildlife species were evaluated for potential groundwater dependence using the Critical Species Lookbook (Rodhe, 2019). This potential groundwater dependence rating is indicative of the species' general documented reliance on groundwater and should not be considered a statement of specific groundwater reliance occurring within the Subbasin.

Table 5-3: Special Status Species within the Subbasin.

Common Name	Scientific Name	Status	Potential Dependence on GW[1]
California Red-legged Frog	*Rana draytonii*	Federally listed (Threatened)	Direct
Least Bell's Vireo	*Vireo bellii pusillus*	State and Federally listed (Endangered)	Indirect
South-Central California Coast Steelhead DPS	*Oncorhynchus mykiss*	Federally listed (Threatened)	Direct
Tidewater Goby[2]	*Eucyclogobius newberryi*	Federally listed (Endangered)	Direct

Notes:
DPS - distinct population segment
[1] - General Reliance on groundwater (GW) is determined from the Critical Species Lookbook (Rohde et at., 2019) and is not an indication of specific GW reliance within the Subbasin
[2] – Tidewater goby do not occur within the subbasin, however, potential reductions in streamflow of Arroyo Grande Creek leaving the subbasin could adversely affect critical habitat downstream.

5.5.3 Ecological Condition of Potential GDEs

Once potential GDEs are mapped, they are then characterized in Step 1.2 by their hydrologic and ecological conditions. Mapping of potential GDEs has been the focus of this GSP. Additional characterization of potential GDEs will be undertaken during finalization of the HCP, or during GSP implementation.

The TNC guidance recommends that the condition of each GDE unit be inventoried and documented by describing the species composition, habitat condition, and other relevant information reflected in Worksheet 2 of the guidance (Rohde, 2018). Then the ecological condition of the GDE unit should be characterized as having a high, moderate, or low ecological value based on criteria provided in the TNC guidance. This additional characterization can be undertaken during Final HCP development or GSP implementation.

5.6 GROUNDWATER QUALITY DISTRIBUTION AND TRENDS

Groundwater quality samples have been collected and analyzed throughout the Subbasin for various studies and are collected on a regular basis for compliance with regulatory programs. Water quality data surveyed for this GSP were collected from:

- The California State Water Resources Control Board (SWRCB) GeoTracker GAMA database,
- The California Safe Drinking Water Information System (SDWIS), a repository for public water system water quality data,
- The National Water Quality Monitoring Council water quality portal (this includes data from the recently decommissioned EPA STORET database, the USGS, and other federal and state entities [Note: in the Subbasin the agencies include USGS, California Environmental Data Exchange Network (CEDEN), and Central Coast Ambient Monitoring Program {CCAMP}].

In general, the quality of groundwater in the Subbasin is good. There is relatively little time series data on water quality. Water quality trends in the Subbasin are stable, with no significant trends of ongoing deterioration of water quality based on the Regional Water Quality Control Board's Subbasin Objectives, outlined in the Water Quality Control Plan for the Central Coast Subbasin (Basin Plan, June 2019). The Subbasin Plan takes all beneficial uses into account and establishes measurable goals to ensure healthy aquatic habitat, sustainable land management, and clean groundwater. The distribution, concentrations, and trends of some of the most commonly cited major water quality constituents are presented in the following sections.

Groundwater in the Subbasin is generally suitable for drinking water purposes. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes 352 sampling events from 129 supply wells and monitoring wells in the Subbasin, collected between November 1950 and April 2020. Primary drinking water standards referred to as Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) are established by Federal and State agencies. MCLs are legally enforceable standards, while SMCLs are guidelines established for nonhazardous aesthetic considerations such as taste, odor, and color.

5.6.1 Distribution and Concentrations of Point Sources of Groundwater Constituents

Potential point sources of groundwater quality degradation due to release of anthropogenic contaminants were identified using the State Water Resources Control Board (SWRCB) Geotracker website. Waste Discharge permits were also reviewed from on-line regional SWRCB websites. Figure 5-15 shows the locations of these documented groundwater contaminant point source cases; all of the cases displayed are completed/case closed sites. Based on available information there are no mapped ground-water contamination plumes at these sites, or in the Subbasin as a whole.

5.6.2 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

The distribution and concentration of several constituents of concern are discussed in the following subsections. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. Each of the constituents are compared to their drinking water standard, if applicable, or their Subbasin Plan Median Groundwater Quality Objective (RWQCB Objective) (RWQCB-CCR, 2017). This GSP focuses only on constituents that might be impacted by groundwater management activities. The constituents discussed below are chosen because they have either a drinking water standard, a known effect on crops, or concentrations have been observed above either the drinking water standard or the level that affects crops.

5.6.2.1 Total Dissolved Solids

TDS is defined as the total amount of mobile charged ions, including minerals, salts, or metals, dissolved in a given volume of water and is commonly expressed in terms of milligrams per liter (mg/L). Specific ions of salts such as chloride, sulfate, and sodium may be evaluated independently, but all are included in the TDS analysis, so TDS concentrations are correlated to concentrations of these specific ions. Therefore, TDS is selected as a general indicator of groundwater quality in the Subbasin. TDS is a constituent of concern in groundwater because it has been detected at concentrations greater than its RWQCB Subbasin Objective of 800 mg/l in the Subbasin. The TDS Secondary MCL has been established for color, odor, and taste, rather than human health effects. This Secondary MCL includes a recommended standard of 500 mg/L, an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/l. TDS water quality results ranged from 170 to 2,360 mg/l with an average of 1,003 mg/l and a median of 810 mg/l.

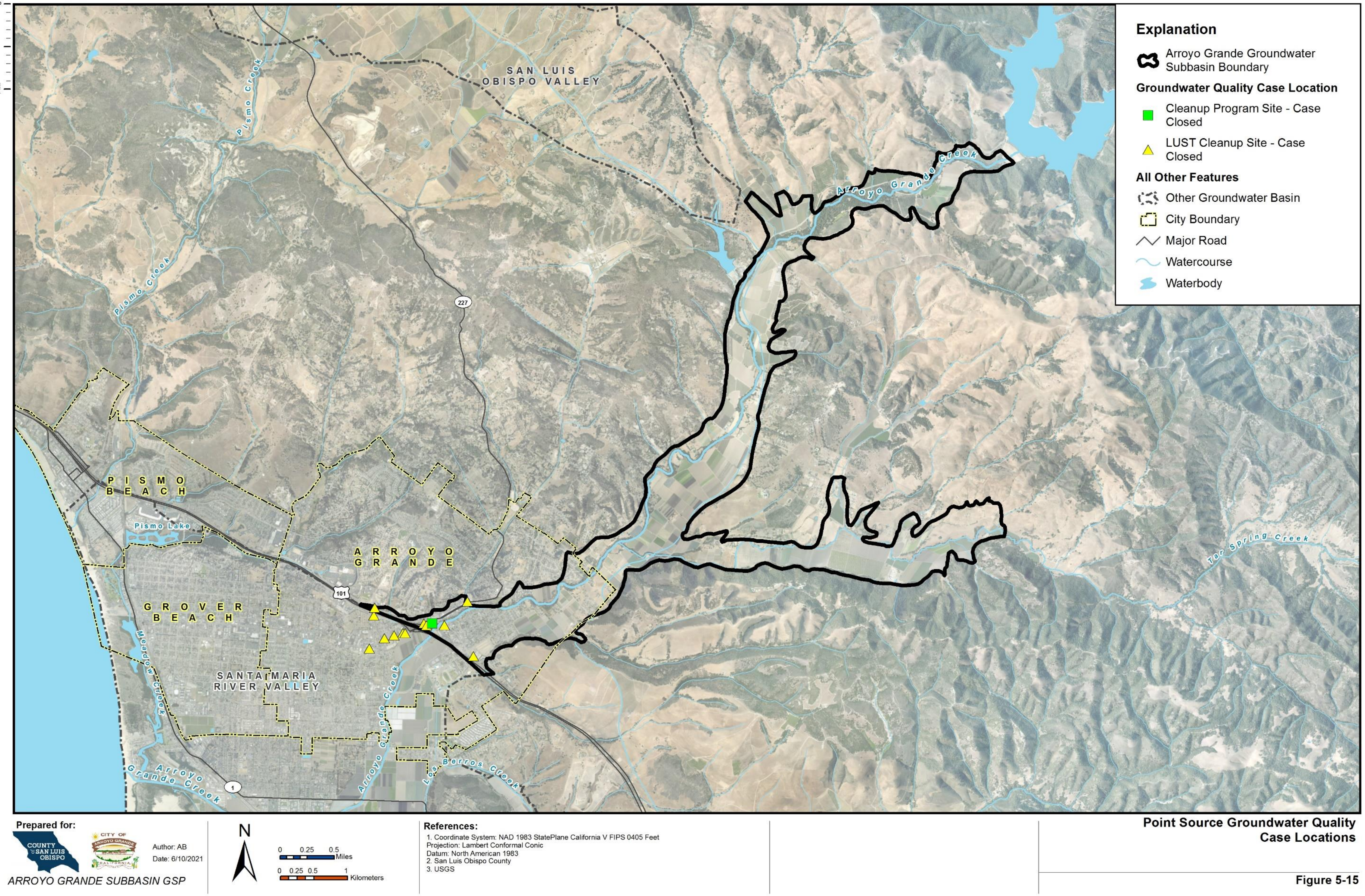
The distribution and trends of TDS concentrations in the Subbasin groundwater are presented on Figure 5-16. TDS concentrations are color coded and represent the maximum result if multiple samples are documented since 2015. It is noteworthy that TDS concentrations are higher in the lower part of the Subbasin. The reason for this is not apparent. It may be related to the presence of the shallow clay layer discussed in the cross sections in Chapter 4. Where the clay layer is not present, there may be a greater degree of percolation of fresh water released from the dam, while this mechanism may not be as significant where the clay layer is present. There is not a great amount of time series data in the Subbasin, but some graphs displaying TDS concentration with time are included on Figure 5-16. These graphs do not indicate any upward trend in TDS concentrations over the past twenty years. Potential management actions implemented as part of this GSP are not anticipated to increase groundwater TDS concentrations in wells that are currently below the SMCL.

5.6.2.2 Nitrate

Nitrate is a widespread contaminant in California groundwater. Although it does occur naturally at low concentrations, high levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilizers and wastewater treatment facilities. Nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass-through soil to the groundwater table. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface each year. It is a Primary Drinking Water Standard constituent with an MCL of 10 mg/l of nitrate as nitrogen (as N).

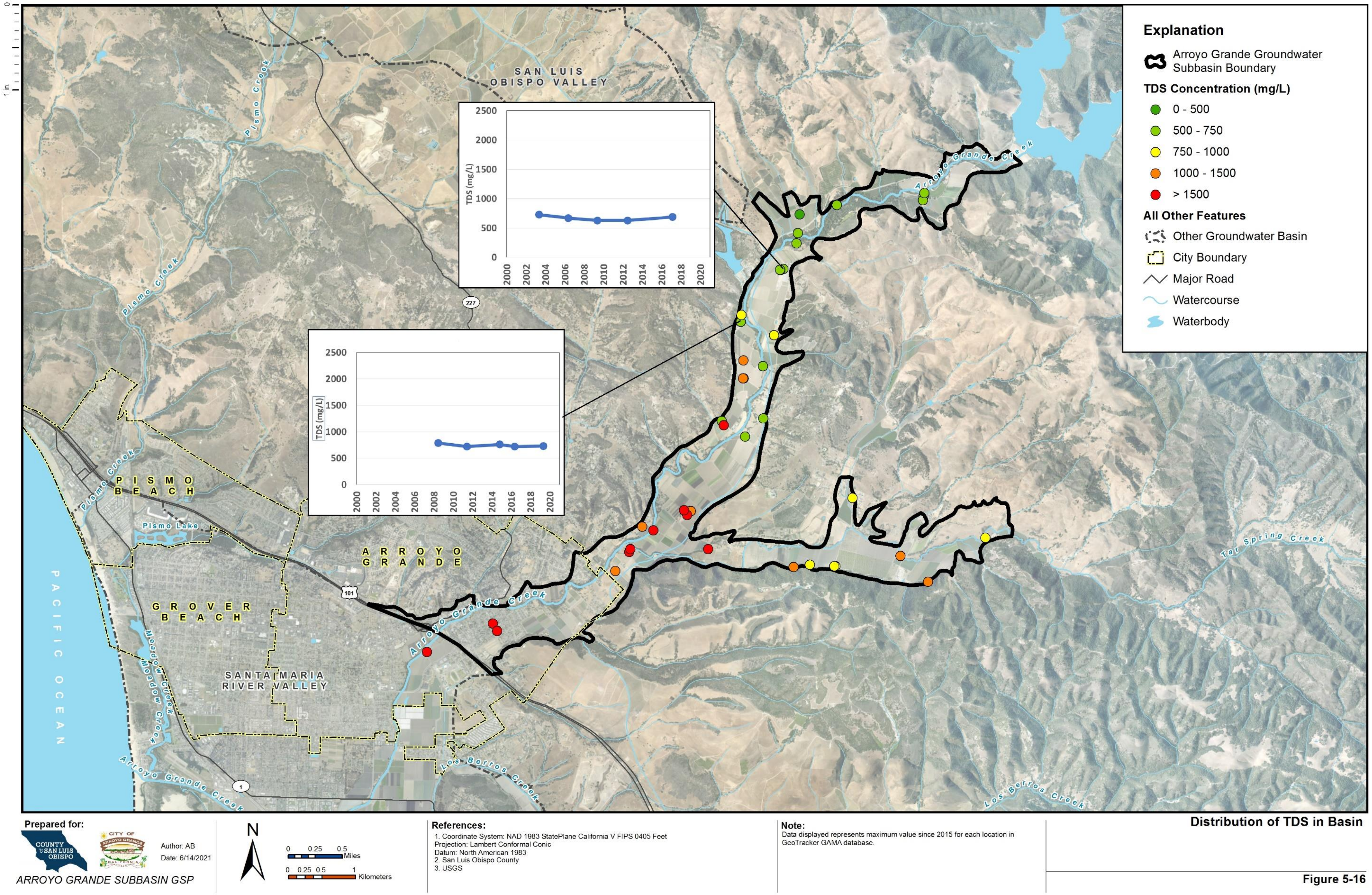
Nitrate is a constituent of concern in groundwater because it has been detected at concentrations greater than its RWQCB Subbasin Objectives of 10 mg/l (as N) in the Subbasin. The Nitrate (as N) MCL has been established at 10 mg/l. Overall, nitrate water quality results ranged from below the detection limit to 67 mg/l (as N) with an average of 2.5 mg/l (as N) and a median value of 0.4 mg/l (as N).

Figure 5-17 presents occurrences and trends for nitrate in the Subbasin groundwater. Wells with the most sampling data over time were selected for presentation. The color-coded symbols represent the maximum result if multiple samples are documented. The vast majority of results are below the MCL of 10 mg/l. There is not a great amount of time series data in the Subbasin, but some graphs displaying TDS concentration with time are included on Figure 5-17. One of the chemographs displayed on Figure 5-17 in the northern Arroyo Grande Creek valley indicates stable concentrations of nitrate below the MCL, and do not indicate trends of increasing concentrations with time. A second chemograph located in Tar Spring Creek valley indicates temporary spikes of nitrate in the 30 to 40 mg/l range in 2012 and 2018, with other occasional results above the MCL of 10 mg/l, and most of the results lower than the MCL. Potential sustainability projects and management actions implemented as part of this GSP are not anticipated to increase nitrate concentrations in groundwater in a well that would otherwise remain below the MCL to increase above the MCL.



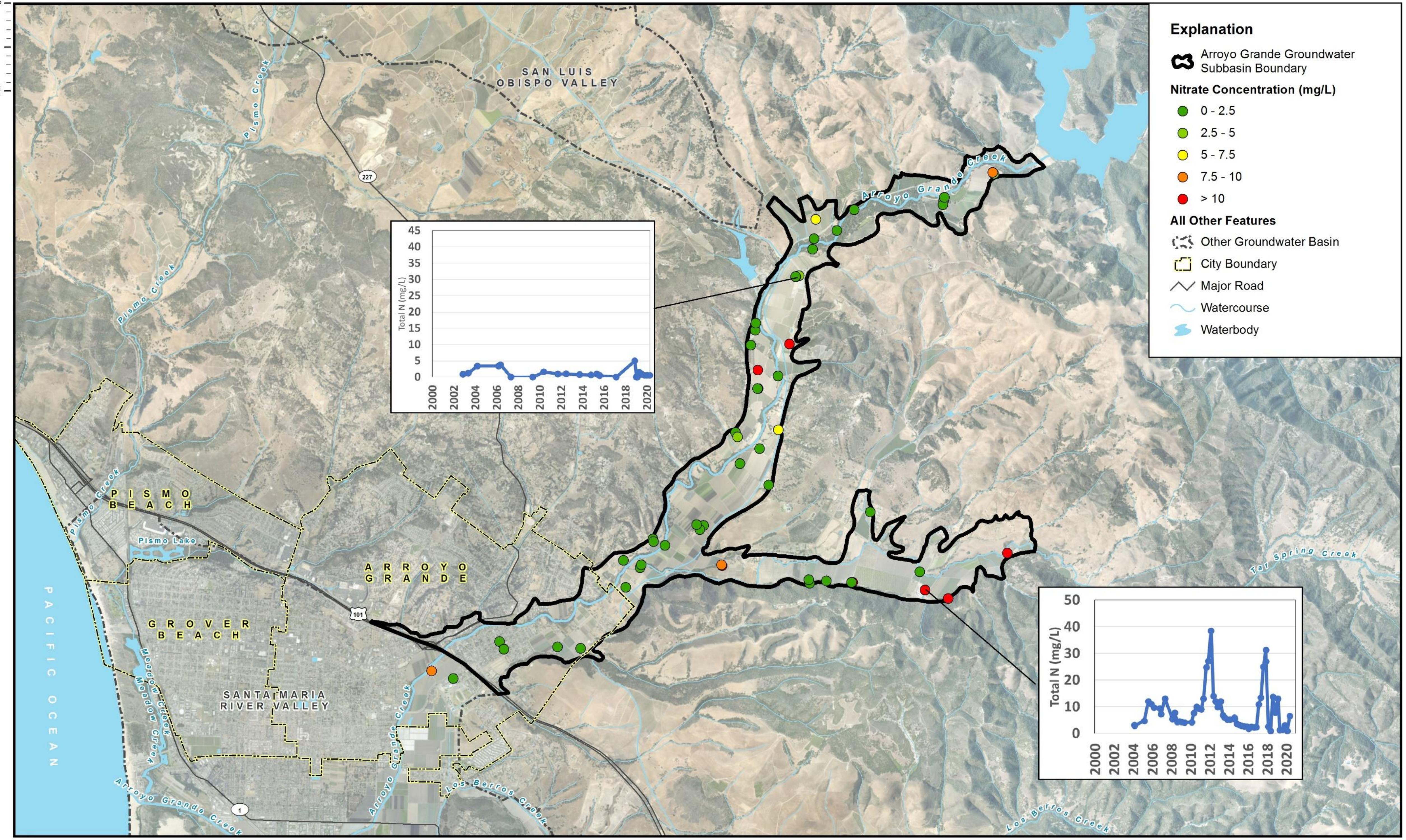
Point Source Groundwater Quality Case Locations

Figure 5-15



Distribution of TDS in Basin

Figure 5-16



Prepared for:

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Date: 6/7/2021

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Note:
Data displayed represents maximum value since 2015 for each location in GeoTracker GAMA database.

Distribution of NItrate in Basin

Figure 5-17

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