

OVERVIEW OF THE BRADLEY SUBAREA OF THE PASO ROBLES GROUNDWATER BASIN

This overview of the Paso Robles Groundwater Basin (Basin) and the Bradley Subarea are provided to establish the groundwater setting and identify groundwater issues that may be used to develop groundwater management goals, objectives, and actions as part of the Paso Robles Groundwater Basin Management Plan. The following information was summarized from existing reports and available information for the Basin and the Bradley Subarea.

Paso Robles Groundwater Basin

The basin-wide information includes the recent hydrologic conditions and the general groundwater setting of the Paso Robles Groundwater Basin.

Groundwater Setting of the Paso Robles Groundwater Basin

The Paso Robles Groundwater Basin covers about 505,000 acres in southern Monterey County and northern San Luis Obispo County. The Paso Robles Groundwater Basin is subdivided into eight subareas. The groundwater system in the Paso Robles Groundwater Basin consists of the Paso Robles Formation and the shallow alluvial aquifers associated with creeks and rivers.

The shallow alluvial aquifers are present along the Salinas River, Estrella River, Huerhuero Creek, and other tributary creeks. Groundwater stored in the alluvial aquifer system accounts for about two percent of the total groundwater storage in the entire Basin. While the amount of total storage may be small, the alluvial aquifers are a significant source of recharge to the Paso Robles Formation, particularly along the western end of the Basin where the Salinas River is located. The coarse-grained deposits of the shallow alluvium act as an unconfined aquifer.

In areas where the alluvial aquifers are not present, the Paso Robles Formation is exposed at the ground surface. The Paso Robles Formation consists of less permeable, interbedded deposits with highly variable thicknesses and permeability, but is the primary aquifer for most agricultural and municipal users. Groundwater stored in the Paso Robles Formation generally occurs under semi-confined to confined conditions. The two primary sources of recharge to the Paso Robles Formation include the infiltration of precipitation and the percolation of stream flow into the shallow alluvial aquifers that infiltrates the Paso Robles Formation.

The alluvium and Paso Robles Formation rest on older consolidated sediments. Faults have created a conduit to allow water trapped in these older sediments to come to the surface as geothermal water.

There are currently about 150 wells located within the limits of the Paso Robles Groundwater Basin that are monitored by the San Luis Obispo County Department of Public Works and the Monterey County Water Resources Agency (Figure 1). These wells are used to track the changes in groundwater level trends through time at a specific location (presented in well hydrographs), or across an area for a specific date (presented as water level maps).

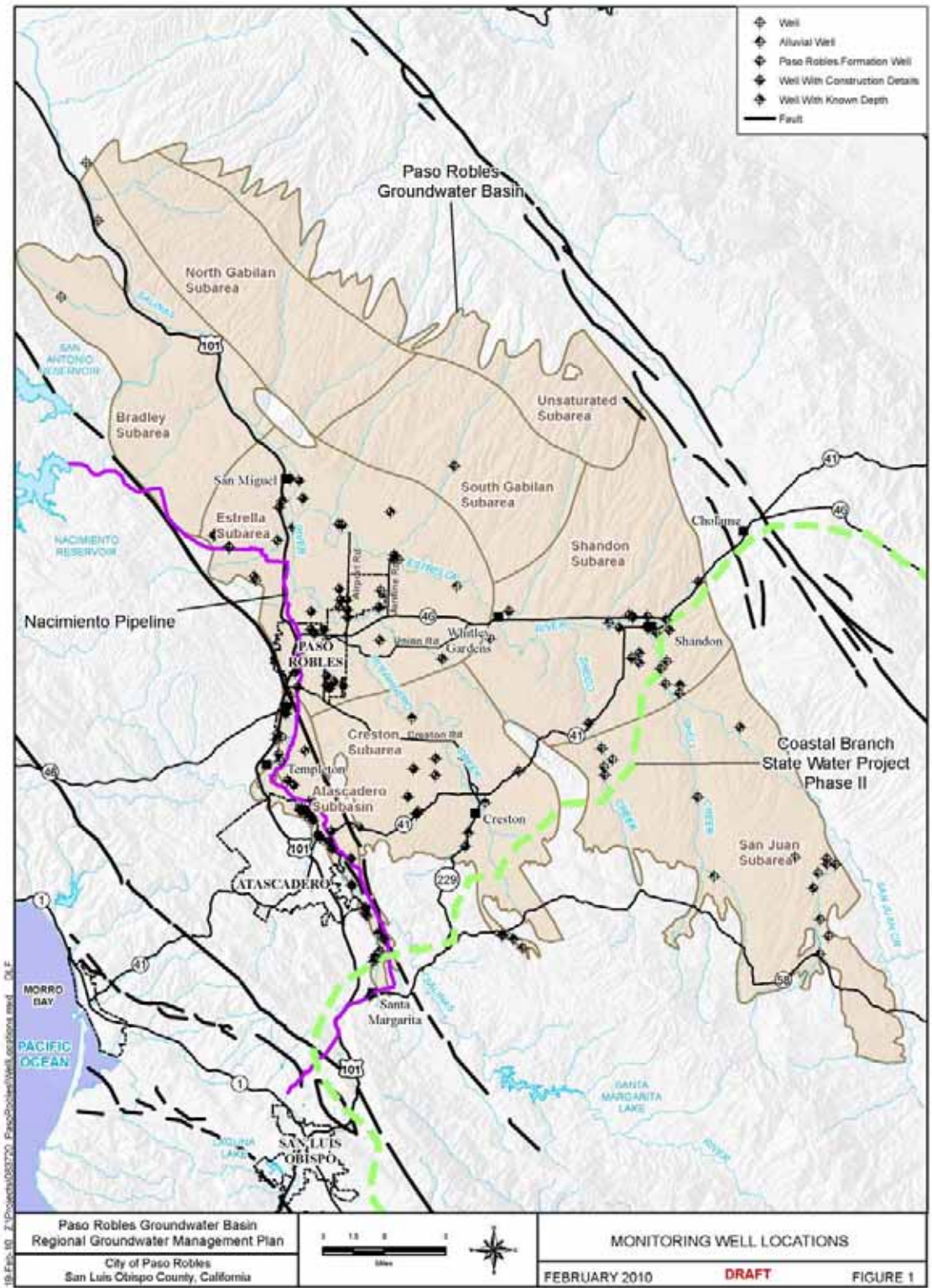


Figure 1. Location of Groundwater Monitoring Wells in the Paso Robles Groundwater Basin

Recent Hydrologic Conditions

This section summarizes the recent hydrologic conditions for the areas tributary to the Paso Robles Groundwater Basin. The annual precipitation is measured at seven rainfall gauge stations located throughout the Basin to record the geographic variation in rainfall. One of the gauges with a long, continuous period of record is the Atascadero MWC Station No. 34. The long-term average annual precipitation at this gauge for the 1916 to 2009 period is 17.6 inches per year.

During the 1998 to 2009 period, the Atascadero MWC Station No. 34 averaged 16.7 inches per year. Based on this comparison, the average annual precipitation for the 1998 to 2009 period is somewhat drier than the long-term average.

While the 12-year average for the 1998 to 2009 period may not differ greatly from the long-term average, there is considerable annual variation in precipitation. During the 1998 to 2009 period, the annual precipitation at the Atascadero MWC Station No. 34 ranged from a minimum of 7.6 inches in 2007 to a maximum of 34.6 inches in 2005. Additionally, the last three years (2007 to 2009) received below average rainfall.

Bradley Subarea

The following information for the Bradley Subarea includes the recent land and water conditions and local groundwater conditions.

Land and Water Use

The Bradley Subarea is located along the northwestern portion of the Paso Robles Groundwater Basin and has an area of approximately 55,500 acres, which makes up about 11 percent of the area of the Basin. Much of the subarea is located in Monterey County. The Salinas River flows northwest through the subarea. The Nacimiento River and the San Antonio River drain the western portion of the Basin. Several creeks draining the North Gabilan Subarea flow into the Salinas River within the subarea. Highway 1 parallels the Salinas River through the subarea. Much of the subarea south of San Antonio Creek is within the limits of Camp Roberts.

The water use in 2006 totaled about 7,226 acre-feet representing about eight percent of the water use in the Basin. The water users in the Bradley Subarea and their uses are shown in Table 1. In 2006, the entire demand was met with groundwater.

Table 1. Total Estimated Pumping in the Bradley Subarea in 2006 (AF)

Agriculture	Municipal	Small Community	Small Commercial	Rural	Total
6,932	0	0	184	189	7,226
(96%)	(0%)	(2%)	(2%)	(2%)	(100%)

(Todd, 2009)

Local Groundwater Conditions

The Bradley Subarea is further subdivided into the Hames Valley, Southern Bradley Region, and the Northern Salinas Valley.

The Paso Robles Formation in the Hames Valley area has a high percentage (up to 50 percent) of gravel and sand layers and consequently is highly permeable. Wells produce as much as 4,000 gallons per minute (gpm), where the Paso Robles Formation reaches a thickness of more than 1,100 feet. In areas where the aquifer is thinner, wells produce several hundred gallons per minute. In this area, the Paso Robles Formation includes semi-confined to confined aquifer conditions.

The southern Bradley area, south of the San Antonio River, is largely within the limits of Camp Roberts. Most of the wells in this area are located along the Nacimiento River valley, although several are also drilled in the San Antonio River valley. Wells in these areas produce about 300 to 1,000 gpm.

The Salinas River Valley comprises the eastern part of the Bradley area. Underlying the valley are Salinas River alluvial deposits and the lower portion of the Paso Robles Formation. Along the Salinas River Valley, the alluvium is generally less than 60 feet thick. However, it typically consists of highly permeable sand and gravel capable of yielding more than 1,000 gpm to wells.

Groundwater Flow

Groundwater flows from areas with higher elevations to lower elevations. Figure 2 shows the groundwater elevations and general flow directions for Spring 2009. Groundwater generally flows to the west, towards the Estrella Subarea, and then north paralleling the Salinas River to the Basin outlet into the Salinas Valley Groundwater Basin. There is a groundwater low (pumping depression) in the Estrella Subarea beneath the City of Paso Robles. There is a single monitoring well located near the center of the Bradley Subarea.

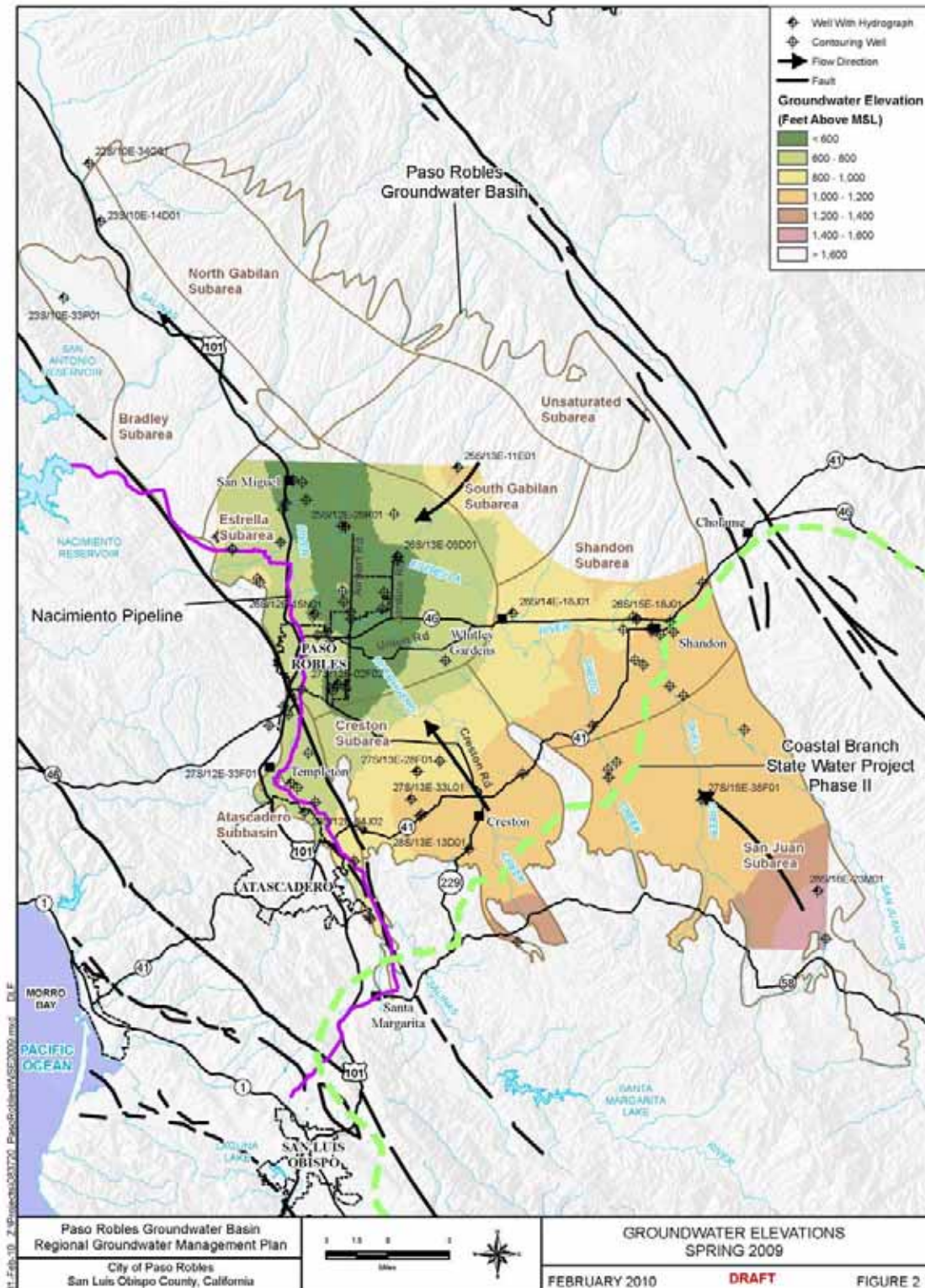


Figure 2. Spring 2009 Groundwater Levels in Paso Robles Groundwater Basin

Groundwater Levels

The available monitoring well in the Bradley Subarea is used to demonstrate how groundwater levels have changed through time (well hydrographs) at this location in the subarea. Figure 3 shows the groundwater level trend for the well. The location of the well is shown on Figure 2. A brief discussion is provided for the well.

Well 22S/10E-34G01 - This well is located at the northern end of the subarea near the Salinas River as shown on Figure 2. Over the 50-year period of record, groundwater levels in this well have generally ranged between very stable, reflecting the relationship between the Salinas River and the alluvial aquifer and the inflow from the Nacimiento River recharge as shown on Figure 3. This hydrograph shows there is no change in groundwater levels at this location. This hydrograph may not be representative of the groundwater system in the subarea.

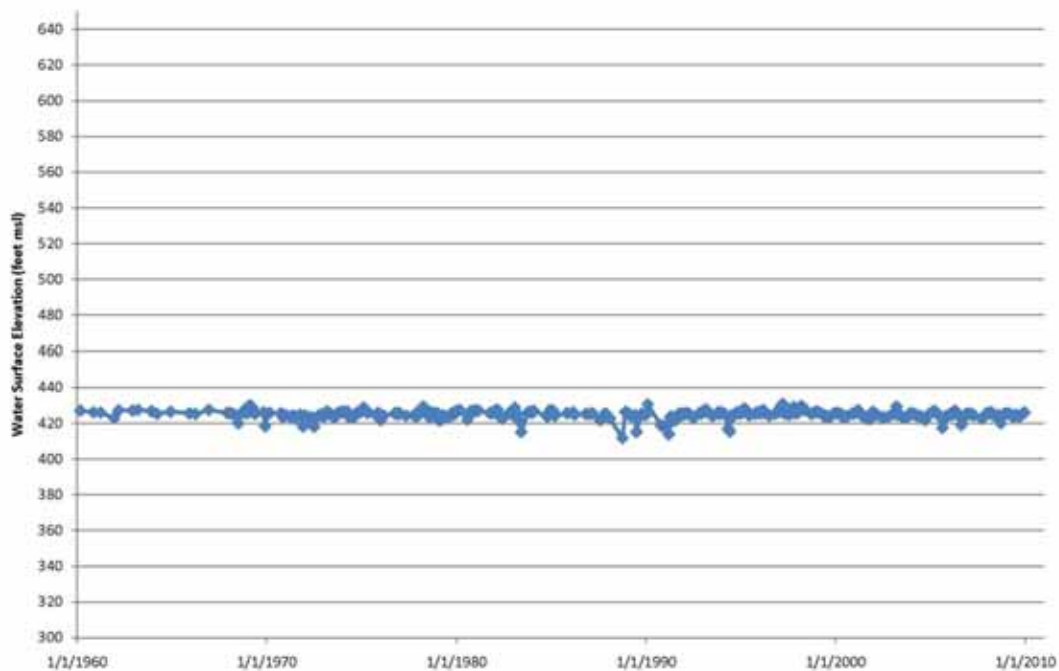


Figure 3. Hydrograph for 22S/10E-34G01

Groundwater Quality

Groundwater quality in the area is variable, with no dominant general mineral type. Only one of the six groundwater samples from the 2002 water quality survey matched a surface water type. Water quality in the Bradley Subarea, despite having a relatively large amount of low salinity surface water inflow, is controlled by the geologic structure. Older, less permeable deposits are uplifted closer to the surface, providing sources of dissolved sodium, chloride, and sulfate ions in the groundwater. TDS concentrations in groundwater from the 2002 survey ranged from 400

mg/l in a well sample from the town of Bradley, to a high of 1,280 mg/l in a well southeast of the town. The average TDS concentration in samples collected from the six wells was 900 mg/l.

Groundwater samples reviewed in the subarea have no irrigation restrictions in the town of Bradley and the Hames Valley, a moderate restriction on irrigating trees and vines due to potential sodium ion toxicity east of the Salinas River near the Nacimiento River confluence, and a severe restriction due to potential sodium and chloride ion toxicity along the Nacimiento River Valley (Fugro and Cleath, 2002).

References

Fugro and Cleath, 2002. *Paso Robles Groundwater Basin Study*, August 2002

Fugro, 2010. *Paso Robles Groundwater Basin Balance Review and Update*. February 2010

Todd, 2009. *Evaluation of Paso Robles Groundwater Basin Pumping, Water Year 2006*. May 2009